



University of Colorado
1979-1980 Catalog

General Information

ACADEMIC CALENDAR, BOULDER CAMPUS¹

Summer Session 1979

- June 8 (Fri.)*—Registration.
June 11 (Mon.)—Classes begin (7:30 a.m.).
July 4 (Wed.)—Independence Day holiday.
July 12, 13 (Thurs., Fri.)—Final examinations for first five-week term.
July 16 (Mon.)—Registration for second five-week term. Ten-week classes meet.
July 17 (Tues.)—Classes begin for second five-week term (7:30 a.m.).
Aug. 16, 17 (Thurs., Fri.)—Final examinations for ten-week and second five-week terms.
Aug. 18 (Sat.)—Commencement. Academic school year of 1978-79 ends.

Fall Semester 1979

- Aug. 31 (Fri.)*—Academic year begins. Faculty members report for departmental and academic duties. New student registration and orientation.
Sept. 3 (Mon.)—Labor Day holiday.
Sept. 4 (Tues.)—Schedule distribution.
Sept. 5 (Wed.)—Classes begin (8 a.m.).
Nov. 22, 23, 24 (Thurs., Fri., Sat.)—Thanksgiving holidays.
Nov. 26 (Mon.)—Classes resume (8 a.m.).
Dec. 15 (Sat.) through Dec. 21 (Fri.)—Final examination period of six days.
Dec. 22 (Sat.)—First day of winter vacation.

Spring Semester 1980

- Jan. 17 (Thurs.)*—New student registration and orientation.
Jan. 21 (Mon.)—Schedule distribution.
Jan. 22 (Tues.)—Classes begin (8 a.m.).
Mar. 24 (Mon.) through Mar. 29 (Sat.)—Spring vacation.
Mar. 31 (Mon.)—Classes resume (8 a.m.).
May 14 (Wed.) through May 20 (Tues.)—Final examination period of six days.
May 23 (Fri.)—Commencement.

Summer Session 1980

- June 6 (Fri.)*—Registration.
June 9 (Mon.)—Classes begin (7:30 a.m.).
July 4 (Fri.)—Independence Day holiday.

- July 10, 11 (Thurs., Fri.)*—Final examinations for first five-week term.
July 14 (Mon.)—Registration for second five-week term. Ten-week classes meet.
July 15 (Tues.)—Classes begin for second five-week term (7:30 a.m.).
Aug. 14, 15 (Thurs., Fri.)—Final examinations for ten-week and second five-week terms.
Aug. 16 (Sat.)—Commencement. Academic year of 1979-80 ends.

THE UNIVERSITY OF COLORADO

The University of Colorado includes four campuses: the main campus at Boulder, campuses at Colorado Springs and Denver, and the Medical Center in Denver where the School of Dentistry, School of Medicine, and School of Nursing are located.

To meet present needs of its students and of the world in which they live, the University offers more than 120 fields of study through its 16 schools and colleges:

- College of Arts and Sciences
- College of Business and Administration and Graduate School of Business Administration
- School of Dentistry
- School of Education
- College of Engineering and Applied Science
- College of Environmental Design
- Graduate School
- School of Journalism
- School of Law
- College of Letters, Arts and Sciences (Colorado Springs Campus)
- College of Liberal Arts and Sciences (Denver Campus)
- School of Medicine
- College of Music
- School of Nursing
- School of Pharmacy
- Graduate School of Public Affairs

Enrollment on the Boulder Campus is approximately 20,000 and on all campuses of the University is nearly 40,000.

The Boulder Campus catalog may be ordered at \$2 per copy. To request the Boulder Campus catalog and/or an application form the student should write to:

¹Calendar is tentative and subject to revision.

Communications Section
Office of Admissions
Regent Administrative Center 125
University of Colorado
Boulder, Colorado 80309

Bulletins for the School of Dentistry, School of Medicine, and School of Nursing may be ordered at \$1 per copy from the Communications Section of the Office of Admissions (address as above) or from the Medical Center in Denver at the address below.

Admissions Office
University of Colorado Medical Center
4200 E. 9th Avenue
Denver, Colorado 80220

Objectives and Stature

The basic objectives of the University of Colorado, Boulder (UCB) are to carry out the mission of education, to create knowledge through research and scholarship, and to put that knowledge at the service of the people.

Combined research and related instructional and public service programs at the University presently involve annual expenditures of approximately \$42 million.

UCB is fully accredited by the North Central Association of Colleges and Secondary Schools and is a member of the Association of American Universities.

Year-Round Operation

UCB operates a large-scale year-round program of instruction consisting of fall and spring semesters of 15 weeks each and a 10-week summer session. The program is sufficiently comprehensive so that students may make progress toward degree programs in almost all areas of study in any term.

Affirmative Action

The University of Colorado, Boulder, is an affirmative action/equal opportunity employer and does not discriminate on the basis of race, sex, creed, color, age, national origin, or individual handicap in any aspect of employment. The institution's educational programs, activities, and services offered to students and/or employees are administered on a non-discriminatory basis subject to the provisions of Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, the Vietnam Era Veterans' Readjustment Act of 1974, and Sections 503 and 504 of the Rehabilitation Act of 1974. For information about these provisions or equity, discrimination, or fairness consult the Affirmative Action Office in Willard Administrative Center, Room 175, or telephone 492-6706.

Location, Surroundings, Climate

The main campus of the University of Colorado is in Boulder, an attractive university community of approximately 80,000 population. The city is northwest

of Denver and is linked to the Colorado capital by a 30-mile Denver-Boulder turnpike.

A short drive from the 14,000-foot peaks of the Continental Divide, the Boulder Campus is within walking distance of the foothills of the Rocky Mountains.

At an altitude of over 5,000 feet, the climate is temperate, with pleasant days and cool evenings. On the average, there are 300 days of sunshine each year, making possible a variety of outdoor activities.

The teaching and research programs of the Boulder Campus are closely integrated with other facilities in the Boulder area: the National Center for Atmospheric Research (including the High Altitude Observatory), the Laboratory for Atmospheric and Space Physics, National Oceanic and Atmospheric Administration, and other Boulder institutions.

History

When Colorado was frontier land, an official territorial government was formed. At its first session in 1861, the territorial legislature passed an act providing for a university at Boulder. When Colorado became the Centennial State in 1876, the new constitution established the University under an elected board of regents.

Fifty-two acres of pasture land were donated by three Boulder residents—George A. Andrews, Anthony Arnett, and Marinus G. Smith—as a site for the University, and the cornerstone of Old Main, the first building, was laid in 1875. Today the 590-acre Boulder Campus includes 160 buildings in a setting of green lawns and trees.

UNDERGRADUATE ADMISSION REQUIREMENTS

The University of Colorado, Boulder, seeks to identify applicants who have a high probability of successful completion of their academic programs. Admission is selective and is based on evaluation of many criteria. Among the most important are the following:

1. General level of academic performance before admission to the University, as indicated by the evaluation of work taken at other educational institutions.
2. Evidence of scholarly ability and accomplishment as indicated by scores on standardized tests of scholastic aptitude.
3. Motivation and potential for academic growth and ability to work in an academic community, as indicated by trends in the student's record, by letters of recommendation from teachers and others qualified to evaluate the student, by accomplishments outside academic work, and by other relevant evidence.

All credentials presented for admission to UCB become the property of the University.

A student who is granted admission or readmission must reflect in a moral and ethical sense a personal background acceptable to the University. UCB reserves the right to deny admission to applicants whose total credentials reflect an inability to assume

the obligations of performance and behavior deemed essential and relevant to any of its lawful missions, processes, and functions as an educational institution.

Admission to a particular school or college at UCB does not guarantee eligibility for future intrauniversity transfer to another school or college within the University system. As an example, the prephysical therapy program on the Boulder Campus is designed to accommodate entering freshmen, with no assurance given for further admission to the physical therapy clinical year at the Medical Center in Denver. Nonresidents of Colorado from states *other* than Alaska, Arizona, Hawaii, Idaho, Montana, Nevada, and Wyoming (states included by special arrangement in the Western Interstate Commission on Higher Education — WICHE) may attend the University of Colorado to take their *prephysical therapy course work only*. Non-Colorado residents from states other than those listed will *not* be considered for admission to the Physical Therapy Clinical Program. The professional Physical Therapy Clinical Program is extremely limited in enrollment and is reserved for residents of Colorado and, on a very limited and highly selective basis, to residents from those WICHE states listed above.

For requirements for admission to the Graduate School, see the Graduate School section of this catalog.

Admission of Freshman Students

Freshmen may enroll in the College of Arts and Sciences, the College of Business and Administration, the College of Engineering and Applied Science, or the College of Music in the fall, spring, or summer term. Freshmen wishing to enroll in the College of Environmental Design must enter in the fall semester. The schools of the University—Dentistry, Education, Graduate, Graduate School of Business Administration, Graduate School of Public Affairs, Journalism, Law, Medicine, Nursing, and Pharmacy—require two or more years of college-level work before a student may be considered for admission.

The Board of Regents reserves the right to establish enrollment limits for all academic areas.

FRESHMAN ADMISSION CRITERIA

All applicants for freshman admission are considered by the following criteria:

1. Priority for admissions consideration is given to applicants who (a) rank in the upper half of their high school class at the end of the 6th, 7th, or final semester (upper quarter for engineering); (b) achieve a combined Scholastic Aptitude Test (SAT) score of 1000 or above or a composite American College Test (ACT) score of 23 or above (1100 SAT or 25 ACT for engineering); and (c) complete all high school course units for graduation (at least 15 academic units). Applicants who do not meet all of these requirements should refer to category number 2 below.

2. Applicants for freshman admission whose records vary in any way from the above “priority admissions” category will be *considered* on an individual

basis by evaluation of their overall academic records including (a) the quality of their high school program of study; (b) the level of their college entrance test scores (SAT or ACT); and (c) written recommendations from their high school counselor or principal. In addition, all applicants whose records reflect innovative grading systems, unusual curricula, no rank in class, or a high school equivalency through the General Educational Development (GED) test, will be considered in this category.

APPLICANTS WHO DID NOT GRADUATE FROM HIGH SCHOOL

An applicant who has not graduated from high school must submit copies of satisfactory scores on the General Educational Development Test (GED), a Certificate of High School Equivalency, a complete transcript of any high school work completed, and SAT or ACT entrance examination scores. Each applicant will be considered on an individual basis.

RECOMMENDED HIGH SCHOOL COURSES

The high school graduate is expected to present 15 units of acceptable secondary course work as *recommended* by the college in which the student plans to enroll. High school is considered as grades 9 through 12. Students whose records indicate variations from the following unit expectations *will be considered on an individual basis*.

COLLEGE OF ARTS AND SCIENCES

English (including at least one year of college preparatory composition)	3
Foreign language (high school level proficiency in the same classical or modern language)	2
History	1
Mathematics (college preparatory)	2
Natural science (laboratory)	2
Social science (including additional history)	1
Academic electives	4
Total	15

Important Notes. Foreign language is not required for admission; however, three college semesters of the same language are required for graduation with the Bachelor of Arts or the Bachelor of Fine Arts degree. If three high school units of the same foreign language have been completed satisfactorily, or other acceptable evidence of Level III proficiency is established, no further foreign language study in the college will be required.

For fall admission to the college it is *recommended* that applicants have a minimum verbal score of 400 on the SAT or an average score of 17 on the nonmathematics portion of ACT (an average of the three tests — English, social science, and natural science).

COLLEGE OF BUSINESS AND ADMINISTRATION

English (including at least one year of college preparatory composition)	3
Mathematics (college preparatory)	2
Natural sciences (laboratory science type course)	2
Social sciences (including history)	2
Electives (areas such as foreign languages, additional courses in English, mathematics, natural and social sciences. May include up to 2 credits in business areas)	6
Total	15

As there is a limitation on the number of freshmen who can be enrolled in the College of Business and Administration, applicants are urged to apply as early in their senior year as possible.

COLLEGE OF ENGINEERING AND APPLIED SCIENCE	
English (literature, composition, grammar)	4
Algebra	2
Geometry	1
Additional mathematics	1
Natural sciences (physics and chemistry recommended)	2
Social studies and humanities (foreign languages, additional English, history, and literature are included)	3
Electives	3
Total	16

Priority for admissions consideration to the College of Engineering is given to prospective students who (a) rank in the upper 25th percentile of their high school graduating class at the end of the 6th, 7th, or final semester; (b) achieve a combined Scholastic Aptitude Test (SAT) score of 1100 or above, or a composite American College Test (ACT) score of 25 or better; and (c) complete all high school course units as recommended (not required) by the College of Engineering.

A student who does not have trigonometry should expect to attend at least one extra summer session. Electives may be chosen from any of the high school subjects (except physical education) which are accepted by an accredited school for its diploma and which meet the standards as defined by the North Central Association. However, not more than two units will be considered from drawing, shop, or other vocational work. Courses that have descriptive geometry features may be considered for elective units beyond the recommended units.

COLLEGE OF ENVIRONMENTAL DESIGN (Pre-architecture)	
(Applications accepted for the fall term only)	
English (literature, composition, grammar)	3
Mathematics (college preparatory)	2
Physics	1
Biology	1
Social studies	}
Foreign language	
History	
Additional English	5
Electives	3
Total	15

Important Notes. Because of the sequentially structured curriculum in this college, freshmen must begin this field of study during the fall semester. As there is a limitation on the number of freshmen who can be enrolled in the College of Environmental Design, applicants are urged to apply as early in their senior year as possible.

Applicants to the College of Environmental Design are requested to send only required application forms and credentials, and not to include samples or photography of their design or art work. These are not used for admission and will not be returned to the applicant.

COLLEGE OF MUSIC	
English	3
Mathematics	}
Foreign language	
Social Science	
Physical science	
Theoretical music	8
Additional high school units	4
Total	15

It is expected that all students will have had previous experience in an applied music area. Two years of piano training are recommended.

Important Note. The College of Music on the Boulder Campus requires an audition of all entering undergraduate students. Personal audition dates are January 20, 1979, February 3, 1979, February 24, 1979, March 10, 1979, January 19, 1980, February 2, 1980, February 23, 1980, and March 8, 1980. Also, by contacting the associate dean for undergraduate studies in the College of Music, personal auditions may be arranged at times other than those specified. In lieu of the personal audition, applicants may substitute tape recordings

(about ten minutes in length on 7½ ips monaural). Interested students should write to the College of Music on the Boulder Campus for audition applications.

WHEN TO APPLY

All prospective new freshmen are encouraged to apply for admission *soon after their senior year begins*—as early as October—for any of the following terms.

Spring Semester

Spring enrollment is suggested for students who graduate from high school at midyear.

Enrolling in the spring semester is ideal for those who, for various reasons, delayed entering college the previous fall. Resident and nonresident freshmen may be considered for spring semester admission in the College of Arts and Sciences, College of Business and Administration, College of Engineering and Applied Science, and College of Music. A limited number of openings are available in these colleges for students wanting to start in the spring semester.

Summer Session

1. Some of the advantages for freshmen who begin in the summer term include an early campus orientation and the opportunity to accelerate and/or experiment academically.

2. Degree-seeking freshmen (residents and non-residents) who are accepted and enrolled for the summer session may continue in the fall if summer academic work is satisfactory, preregistration has been accomplished, and appropriate deposits are paid by the proper deadline. *There will be an opportunity to register for fall during the summer registration process.*

Fall Semester

The College of Arts and Sciences, College of Business and Administration, College of Engineering and Applied Science, College of Environmental Design, and College of Music accept new freshmen for the fall semester.

Because of enrollment restrictions at the University of Colorado at Boulder, applications and/or credentials for admission submitted after May 1 for the following fall semester or November 1 for the spring semester are regarded as late applications and will be considered only on an individual, space-available basis.

HOW TO APPLY

1. The student should obtain an Application for Admission Form from the Office of Admissions at the Boulder Campus. Colorado residents may obtain this form from their high school counselors. (Students from other countries who are not citizens or permanent residents of the United States must request special application materials from the UCB Office of Admissions).

2. A complete application includes:
 - a. Application for admission.
 - b. The nonrefundable \$10 application processing fee.
 - c. A transcript of high school work completed, which must also include rank in class and courses in progress for the entire year.
 - d. Required entrance test scores (SAT or ACT).
 - e. Copies of GED test scores and a Certificate of High School Equivalency if the applicant is not a high school graduate.
 - f. The required audition if the student is entering the College of Music.

Applicants who are presently attending high school should give the completed applications to their counselors. The application must include the \$10 fee, transcript, and rank-in-class information in a single mailing packet. An incomplete application packet may be returned to the high school.

3. The fact that college entrance test scores (SAT or ACT) are not available does not mean an applicant should delay sending the application and credentials. However, if final official test scores are available at the time of application, they may be posted on the official high school transcript in lieu of or in addition to being reported directly by the testing service.

4. Prospective applicants are encouraged to take the Scholastic Aptitude Test (SAT) or the American College Test (ACT) during the junior year, or as early in the senior year as possible. The student should request that the scores be sent to the University of Colorado at Boulder. Complete information on the SAT or ACT may be obtained from the high school counselor or by writing one of the following offices:

College Entrance Examination Board (SAT)
P.O. Box 1025
Berkeley, California 94704

College Entrance Examination Board (SAT)
P.O. Box 592
Princeton, New Jersey 08540

Registration Department (ACT)
American College Testing Program
P.O. Box 414
Iowa City, Iowa 52240

For high school students it is important that applications for freshman admission include a complete list of courses to be taken during the entire senior year. If accepted and confirmed to enroll at UCB, the student is responsible for having a final official transcript with grades for the senior year and statement of graduation sent to the Office of Admissions as soon as available. Failure to submit this transcript may result in a registration delay.

FRESHMAN NOTIFICATION

Six to eight weeks after the Office of Admissions receives all required credentials, students will be notified of their admission status. If eligible, students will receive notification of eligibility for admission, housing information, and materials for completing

their confirmation to enroll. Admission eligibility to the University of Colorado at Boulder *does not constitute a guarantee of enrollment*. Confirmation deposits received after enrollment limits are reached will be returned.

FRESHMAN CONFIRMATION

Students who receive notification of admission eligibility are required to confirm their intent to enroll before confirmation quotas are filled or deadlines are passed. Confirmation consists of returning the completed confirmation form, the housing application, and the designated nonrefundable deposit. If the confirmation is accepted, the student will be sent information regarding registration. Should enrollment limits be filled, the confirmation deposit will be returned.

Admission of Transfer Students

To be *considered* for admission, transfer students must be eligible to return to all collegiate institutions attended; they must report all previous college work. A student who has enrolled for any college-level course work, full time or part time, since graduation from high school is considered a transfer student. (A degree-seeking applicant who last attended the University of Colorado as a special student must apply as a transfer student.) College-level course work taken while still in high school does not qualify the applicant as a transfer student.

Generally, a resident applicant who has attained an overall grade-point average of 2.25 (2.0 equals C) or better in all college-level work attempted *will be considered* for admission on an individual basis. A non-resident applicant with a grade-point average of 2.5 or better *will be considered* on an individual basis. Applicants are selected on an individual basis in relation to the number of applications received and the overall academic quality of students applying. Therefore, applicants should understand that no assurance of admission can be given to any student, regardless of grade-point average. Work in progress at the time of application cannot be considered in computing the cumulative average.

To be considered for admission to some professional schools and colleges within the University system, applicants are required to have at least a 2.5 cumulative grade-point average regardless of residency status. The School of Education and the College of Environmental Design are examples. Also, some schools and colleges have particular program requirements and application procedures. For example, the College of Music requires an audition, and the School of Pharmacy requires the Pharmacy College Admission Test (PCAT).

SPECIFIC COLLEGE AND SCHOOL REQUIREMENTS

The School of Pharmacy has established March 1 as the application deadline date for fall admission consideration. A complete application includes the application form, the \$10 nonrefundable processing fee,

and an official transcript sent to the University Office of Admissions from each college attended. The Pharmacy College Admission Test (PACT) score results must be sent directly to the Dean's Admissions Committee, School of Pharmacy, Ekeley Chemical Laboratories, University of Colorado, Boulder, Colorado 80309.

Applicants interested in nursing who have less than the required college course work to enter the School of Nursing are considered for prenursing in the College of Arts and Sciences. Prenursing applicants apply to the Office of Admissions, University of Colorado, Boulder, Colorado 80309.

The *School of Nursing* at the University of Colorado Denver Medical Center, *not* the Office of Admissions in Boulder, considers all School of Nursing applicants who have or will have completed 60 semester (90 quarter) hours or more of appropriate prenursing college-level course work by the time they plan to enter the program. Prenursing students ready to enter the nursing program must apply directly to the School of Nursing, University of Colorado Medical Center, 4200 East 9th Avenue, Denver, Colorado 80220. An applicant who is not admitted to nursing and who wishes to be considered for another field of study on the Boulder Campus must request that the application and credentials be forwarded to the Office of Admissions in Boulder along with the proposed change of major.

For *physical therapy* information, refer to the earlier introductory section on Undergraduate Admission Requirements.

WHEN TO APPLY

Transfer applicants may submit their applications as soon as they have registered for the last term which they intend to complete at their present school. All applicants (resident and nonresident) are required to pay a \$10 processing fee. This fee, in the form of a check or money order made payable to the University of Colorado at Boulder, *must accompany the application* and is nonrefundable.

Because of enrollment restrictions at the University of Colorado at Boulder, applications and/or credentials for admission submitted after June 1 for the following fall semester or November 1 for the following spring semester are regarded as late applications and will be considered only on an individual, space-available basis.

CHECKLIST FOR TRANSFER APPLICANTS

A complete application should include the following required credentials:

1. The Transfer Application Form.
2. The nonrefundable \$10 application processing fee.
3. One official transcript from each college or university attended.
4. If a student has completed *less than 24* semester hours (or 36 quarter hours) of college work at the time he applies he must submit an official high school

transcript, or, if the student is not a high school graduate, he must submit *copies* of his certificate of high school equivalency and GED scores, plus an official transcript of any high school work completed. Furthermore, if the student has *less than 12* semester hours (18 quarter hours) of college work at the time he applies, he must also submit either SAT or ACT scores in addition to the above documents. (Important: College of Engineering and College of Environmental Design applicants must submit an official high school transcript *and* SAT or ACT test scores regardless of the number of hours of college course work.

5. If applicable, copies of Certificate of High School Equivalency and GED test scores.

6. A student who is claiming exemption from the College of Arts and Sciences foreign language graduation requirement on the basis of satisfactory completion of Level III (third-year high school level) foreign language in high school must submit an official high school transcript to the Office of the College of Arts and Sciences dean's office *within the first year of residency in the college*.

TRANSFER NOTIFICATION AND CONFIRMATION

After the Office of Admissions has received all required credentials, the applicant will be notified regarding eligibility for admission. If eligible, the applicant will receive a confirmation form and housing information and must return the confirmation form and required confirmation deposit before the enrollment limits are reached. If the confirmation is accepted, the student will be sent information regarding registration. The confirmation deposit will then be applied to the first semester's tuition and fees. Confirmation deposits received after enrollment limits are reached will be returned.

TRANSFER OF COLLEGE-LEVEL CREDIT

The Office of Admissions and the various deans' offices cannot make an evaluation of credits from another collegiate institution or give specific degree advisement until complete and official credentials are on file, the applicant has been admitted, and *has confirmed his or her intent to enroll*. In general, transfer credits from other *accredited* collegiate institutions will be accepted insofar as they meet the degree, grade, and other requirements of the student's chosen program of studies at UCB. *The Office of Admissions makes an initial evaluation of transfer credit. However, no assurance can be given regarding acceptance of credit to any specific degree program because course levels and graduation requirements vary from one school or college to another.*

College-level credit is considered for transfer to UCB using the following guidelines:

1. Provided it has been earned at a college or university of recognized standing, or from Advanced Placement Examinations, College Level Examination Program approved subject examinations, or in

military service or schooling as recommended by the Commission on Accreditation of Service Experiences of the American Council of Education. Official evidence must be submitted to the Boulder Campus Office of Admissions.

2. If a grade of C or higher has been attained.

3. UCB may accept up to 72 semester hours of junior college work or 102 semester hours of work from a four-year institution if appropriate to the degree sought at this institution.

4. No credit is allowed for vocational-technical or remedial courses.

5. A maximum of 60 semester hours of extension and correspondence work (not to include more than 30 semester hours of correspondence) may be allowed if the above conditions are met.

Readmission of Former Undergraduate Degree Students

A former degree-seeking University of Colorado undergraduate student who is in good standing and who has not attempted 12 or more semester hours (18 or more quarter hours) at another collegiate institution must complete an application form but does not need to pay the \$10 processing fee. A transcript of any course work taken elsewhere that is not presently a part of the student's record should be sent to the Boulder Campus. If the student is changing from a previous school or college, the change should be noted on the application; otherwise, it will be assumed that the student is returning to the same field of study. If a school change is requested for which the student is not eligible, the student will automatically be considered for his or her previous program.

A former student who is in good standing and who has attempted 12 or more semester hours (18 or more quarter hours) of course work at another institution since the last attendance at the University of Colorado must submit an application and a \$10 processing fee. Official transcripts from each college or university attended for which the University has no record must also be sent. The student should follow the instructions above if changing the former field of study.

After the Office of Admissions has received all required credentials, the applicant will be notified regarding eligibility for admission. If eligible, the applicant will receive a confirmation form and must return the form and designated confirmation deposit before the enrollment limits are reached or the deadline is passed. If the confirmation is accepted, the student will be sent information regarding registration and, if desired, on-campus housing. The confirmation deposit will then be applied to the first semester's tuition and fees. Confirmation deposits received after enrollment limits are reached will be refunded.

It should be noted that enrollment limits apply to returning former students and that an application or confirmation received after the enrollment limit is reached cannot be accepted.

Intrauniversity Transfer

An undergraduate student *who is enrolled on the Boulder Campus* of the University and who wishes to transfer to a different school or college on the Boulder Campus must submit a completed Intrauniversity Transfer Application to the new school or college before enrollment limits are met or deadlines are passed for the desired term and field of study. The applicant should obtain this application form from the office of the school or college in which he or she is presently enrolled and submit it to the new college or school with a Deans's Page (unofficial transcript).

An undergraduate student *who is not enrolled on the Boulder Campus* and who desires such a change must submit a Former Student Application Form to the Office of Admissions as described under Readmission of Former Undergraduate Degree Students. The school or college change may be requested on that form.

Any student who fails to enroll in the new school for the term to which accepted must reapply for future enrollment.

A graduate student wishing to change department or major must submit a new Part I and Part II of the graduate application to the new department or school and request the former department to forward recommendations and credentials.

Admission of Special Students

The special student classification has been established to meet the needs of those students who wish to take University courses but who do not presently intend to work toward a degree at the University of Colorado. Permission to register for specific courses is *contingent upon the availability of space*. Special students may have difficulty obtaining course space due to class enrollment limits. Special students are not permitted to enroll for courses in the College of Business and Administration.

The possibility exists that special students may be registered through the Division of Continuing Education in the event that Boulder Campus enrollment limits have been met. Students should contact the Office of Admissions for further information.

ADMISSION REQUIREMENTS

Special students must be 18 years of age or older in order to qualify for admission and must have a high school diploma or its equivalent.

Persons who have attended a college or university previously must be in good standing at all collegiate institutions attended.

Foreign Students

Students holding temporary visas may not apply for admission as special students for fall and spring semesters. If they wish to attend the summer session as special students, they must submit academic credentials as well as information regarding English proficiency and financial support.

SPECIAL STUDENT PROVISIONS

Special students may register for courses on a pass/fail basis. However, such courses will be counted in the hours of pass/fail permitted according to the rules of the school or college to which the student is admitted if the student changes to a degree status.

Special students may not register concurrently on more than one campus of the University of Colorado.

SPECIAL STUDENT ELIGIBILITY

Once special students have attempted 6 hours of credit, they must maintain a 2.0 cumulative grade-point average. Failure to maintain the required average will result in suspension. Students may not register summers to raise grade-point averages unless suspension is released.

TRANSFER TO AN UNDERGRADUATE DEGREE PROGRAM AT UCB

The special student may apply for admission to an *undergraduate degree* program by submitting an undergraduate admission application, complete academic credentials, and the application fee. An accepted applicant in the College of Arts and Sciences may transfer a maximum of 30 semester hours taken as a special student to an undergraduate degree program with the approval of the Arts and Sciences dean's office. Student accepted to all other colleges may transfer only 12 hours with the approval of the appropriate dean's office. (Acceptance of credit toward degrees at the University changed in fall 1970. Special students enrolled prior to that date may transfer credit in accordance with provisions in effect between January 1969 and August 1970.)

For information about changing from special to degree status at the undergraduate level, students should contact the Boulder Campus Office of Admissions.

TRANSFER TO A GRADUATE DEGREE PROGRAM AT UCB

A special student desiring to pursue a graduate degree at UCB is encouraged to submit the complete graduate application and supporting credentials as soon as possible.

The Graduate School policy on transfer of special student credit hours is as follows:

A department may recommend to the graduate dean the acceptance of 8 hours of credit toward the requirements for a master's degree for courses taken either as a student at another recognized graduate school, as a special student at this University, or both. In addition, the department may recommend to the graduate dean the acceptance of credit for courses taken as a special student at this University during the semester or summer session for which the student has applied for admission to the Graduate School.

RENEWAL OF TEACHER CERTIFICATION

A certified teacher with a baccalaureate degree who seeks only a renewal of the certificate currently held

and who does not require institutional endorsement or recommendation may qualify for the University-wide special student classification as outlined above.

INITIAL TEACHER CERTIFICATION

A person who has a baccalaureate degree and who seeks initial teacher certification must submit an application for degree status to the Boulder Campus Office of Admissions and must also apply to the School of Education for the Teacher Education Program. Interested students should consult the Office of Teacher Education in the Education Building for application and deadline information.

TRANSFER OF CREDIT TO ANOTHER INSTITUTION

Although special students enroll in regular university courses, and an official transcript of credit is available, the acceptance of special student credit at other institutions of higher education is within the jurisdiction of the receiving institution.

Members of Faculty

No member of the faculty above the rank of instructor may receive an advanced degree from this University.

Auditors

Mature persons who wish to visit classes or lectures without examination or credit may register for an auditor's ticket for either fall or spring semester. The cost of an auditor's ticket is always the minimum tuition charge. Auditors' tickets are not issued during the summer session. A person who purchases an auditor's ticket may not also register for credit in other courses. Regular degree, enrolled, graduate students may audit courses for no charge, provided they have the permission of the instructor. The course will not appear on the transcript.

Auditors do not register for specific courses, and no record is kept of the classes attended. They are entitled to listen to the lectures and class discussion but they may not enter into the class discussion or participate in any other activities of the course. Auditors may not attend laboratory courses or any courses where University equipment is used.

SENIOR AUDITOR PROGRAM

The University of Colorado, Boulder, offers a Senior Auditor Program to residents of the area who are 60 years of age or over. Senior auditors attend classes on a tuition-free, space-available basis. No record is kept of attendance, no examinations are taken for credit, and class participation is at the discretion of the instructor. Senior auditor privileges include the use of the library.

Concurrent Enrollment

Degree-seeking students who wish to attend two University of Colorado campuses concurrently must contact their home campus registrar.

Credit for Military Service and Schooling

If copies of discharge, separation papers, and a DD Form 295 (Application for the Evaluation of Educational Experience During Military Service) are submitted to the Boulder Campus Office of Admissions at the time of application, after acceptance and subsequent confirmation, an evaluation will be made and credit awarded as recommended by the Commission on Accreditation of Service Experiences of the American Council on Education to the extent that such credit is applicable to the degree sought at this university.

Credit will be allowed for college courses satisfactorily completed through the U.S. Armed Forces Institute, subject to the usual rules involving credit of this nature.

College-Level Examination Program (CLEP) Subject Examinations

By testing in University-approved Subject Examinations provided by the College-Level Examination Program (CLEP) of the College Board (CEEB), students may gain advanced standing and college-level credit to broaden their education, fulfill basic graduation requirements, and/or accelerate their program of study to graduate early.

College credit for approved CLEP examinations may be considered provided the scores are at the 67th percentile or above. Such credit will be treated as transfer credit without a grade and may be applied toward requirements at the discretion of the student's dean's office. Official test scores must be submitted to the Office of Admissions, Regent Administrative Center 125. For further information concerning University of Colorado credit by examination write to:

University of Colorado
Counseling Services
Willard Administrative Center 134
Boulder, Colorado 80309

Advanced Standing by Examination

Degree-seeking students have the opportunity to take examinations for credit. The fee for an advanced standing examination which is taken to pass a course without otherwise registering for or taking the course is assessed at the lowest resident tuition charge currently in effect for the Boulder Campus. Arrangements for the examinations are made through the Boulder Campus Office of Admissions. Interested students may contact this office for information on this program. The fees for the examinations are payable in advance and are nonrefundable.

Advanced Placement Program

The University of Colorado, Boulder, is a cooperating member of the Advanced Placement Program of the College Entrance Examination Board which provides able high school students, while still in high school, an opportunity to take work and be examined for credit on the college level.

Advanced placement and college credit may be granted on the basis of the College Entrance Examination Board's Advanced Placement Test. For students who achieve scores of 3, 4, or 5 on the CEEB Advanced Placement Examination, advanced placement as well as college credit may be granted. Official test scores must be submitted to the Office of Admissions, Regent Administrative Center 125. College credit granted will be treated as transfer credit without a grade but will count toward graduation and will meet other specific requirements for which it may be appropriate.

REGISTRATION

See Academic Calendar for time to report. There is a penalty for late registration which is explained fully under Fee Regulations.

Family Educational Rights and Privacy Act

Periodically, but not less than annually, the University of Colorado informs students of the Family Educational Rights and Privacy Act of 1974. This act, with which the institution intends to comply fully, was designed to protect the privacy of education records, to establish the right of students to inspect and review their education records, and to provide guidelines for the correction of inaccurate or misleading data through informal and formal hearings. Students also have the right to file complaints with the Family Educational Rights and Privacy Act Office (FERPA) concerning alleged failures by the institution to comply with the act.

Local policy explains in detail the procedures to be used by the institution for compliance with the provisions of the act. Copies of the policy can be found in the library on each of the campuses of the University of Colorado.

A Directory of Records which lists all education records maintained on students by this institution may be found in the Office of the Chancellor on each campus.

The following items of student information have been designated by the University of Colorado as public or directory information: name, address, telephone number, dates of attendance, registration status, class, major field of study, awards, honors, degree(s) conferred, past and present participation in officially recognized sports and activities, physical factors (height, weight) of athletes, date and place of birth. Such information may be disclosed by the institution for any purpose, at its discretion.

Currently enrolled students may withhold disclosure of directory information under the Family Educational Rights and Privacy Act of 1974. To withhold disclosure, written notification must be received each term in the Office of the Registrar on the appropriate campus prior to the 11th day of classes. Forms requesting the withholding of directory information are available in the Office of the Registrar.

The University of Colorado assumes that failure on the part of any student to specifically request the withholding of directory information indicates individual approval for disclosure.

Questions concerning the Family Educational Rights and Privacy Act may be referred to the Office of the Registrar of the student's home campus.

Boulder Campus Course Load Definitions

The following definitions classify students according to course load enrollment during the academic year.

Undergraduate. A full-time undergraduate student is one who is enrolled for 12 or more semester credit hours per semester.

Graduate. Students are considered full-time by the Graduate School if they are enrolled for 5 semester hours in course work numbered 500 or above, or at least 8 semester hours of other graduate work or thesis in a regular semester.

UNIFORM GRADING SYSTEM AND PROCEDURES

The following grading system and procedures for pass/fail registration, dropping and adding courses, and withdrawal from the University were standardized for all schools and colleges of the University effective with the 1974-75 academic year.

Grade Symbols

The instructor is responsible for whatever grade symbol (*A, B, C, D, F, IF, IW, or IP*) is to be assigned. Special symbols (*NC, W, and Y*) are indications of registration or grade status and are not assigned by the instructor. Pass/fail designations are not assigned by the instructor but are automatically converted by the grade application system, explained under Pass/Fail Procedure.

A—superior/excellent—4 credit points per credit hour

B—good/better than average—3 credit points per credit hour

C—competent/average—2 credit points per credit hour

D—minimum passing—1 credit point per credit hour

F—failing—no credit points per credit hour

IF—incomplete—automatic conversion after one academic year to *F*

IW—incomplete—automatic conversion after one academic year to *W*

IP—in progress—thesis or project at the graduate level only

P/F—pass/fail—*P* grade is not included in the grade point average; the *F* grade is included; up to 16 hours of pass/fail course work may be credited toward a bachelor's degree; a letter grade of *D* or above is considered passing

H/P/F—honors/pass/fail—intended for honors courses; credit hours count toward the degree but are not included in the grade-point average

Special Symbols

NC—indicates registration on a no-credit basis

W—indicates withdrawal without credit

Y—indicates the final grade roster was not received by the time grades were processed

Pass/Fail Procedure

1. Any student who wishes to register for a course on a pass/fail basis should do so during regular registration procedures. (Up to 16 semester hours of regular course work may be taken on a pass/fail basis and credited toward the bachelor's degree). Changes to or from a pass/fail basis may be effected only during the regular drop/add period (first ten days of classes).

2. There are more stringent requirements in some colleges. The College of Engineering and Applied Science requires departmental approval before a student may enroll for any course on a pass/fail basis.

3. The record of pass/fail registration is maintained by the Boulder Campus Office of the Registrar.

4. Academic deans and faculty will not be informed of pass/fail registration. All students who register on a pass/fail basis appear on the regular class roster and a normal letter grade is assigned by the professor. When grades are received in the Office of the Registrar, those registrations which require a pass/fail designation are automatically converted by the grade application system. Grades of *D* and above convert to grades of *P*.

5. Only 6 hours of course work may be *P/F* in any given semester.

6. Exception to the pass/fail regulations is permitted for certain specified courses offered by the School of Education, the School of Law, the Division of Continuing Education, Study Abroad Programs, and Experimental Studies Program.

7. Graduate degree students can exercise the *P/F* option for undergraduate courses only. However, a grade of *P* will not be acceptable for graduate credit to satisfy any Graduate School requirement.

Drop/Add Procedure

1. Students will be allowed to drop and add during the first ten days of the semester with no signatures required on the Drop/Add form. Adds are not allowed after the first 12 days of classes.

2. After the 12th day of classes, the instructor must indicate either a drop "without discredit" or failing. An indication of drop "failing" results in a grade of *F* for the course. The dean's signature is not required. No refund is made for courses dropped after the 12th day of classes.

3. After the 10th week, courses may not be dropped unless there are circumstances clearly beyond the student's control (accident, illness, etc.). In addition to

the instructor's certification (as in 2 above), the student must petition his dean's office for approval to drop the course.

4. Students who are reported not attending a course for which they are registered *NC* will be administratively dropped.

Withdrawal Policy Regarding Tuition and Fees

Payment of the registration or confirmation deposit and submission of registration materials obligate the student to pay the full amount of tuition and fees for the semester. If a student withdraws from the University prior to paying full tuition and fees, refunds of the total tuition and fee assessment are made as follows:

1. Eighty percent during the first 12 days of the semester.
2. Sixty percent from the 13th day through the 22nd day of the semester.
3. Forty percent from the 23rd day through the 32nd day of the semester.

Withdrawal Procedure

To withdraw from the University, the student obtains approval of the academic dean's office, the Office of Financial Aid, and the Office of the Registrar.

1. Students holding a temporary visa must obtain clearance from the UCB Office of the Foreign Student Adviser.

2. Veterans must obtain clearance from the UCB Veteran's Office, Willard Administrative Center 160.

Notation is recorded on the student's permanent record page. Students who do not officially withdraw are subject to grades of *F* for all course work.

A graduate student who desires to withdraw from the University must apply to the dean of the Graduate School for permission to withdraw in good standing. Students who withdraw without communicating with the dean and filing the appropriate Withdrawal Form will be marked as having failed their courses for the term.

ORIGINALITY OF WORK

In all academic areas it is imperative that either work be original or explicit acknowledgment be given for the use of other persons' ideas or language. Students should consult with instructors to learn the specific procedures appropriate in each given field. Breaches of academic honesty can result in disciplinary measures ranging from lowering of a grade to permanent compulsory withdrawal from the University.

TRANSCRIPTS

Transcripts of academic record at the University of Colorado (all campuses) may be ordered from the UCB Office of the University Registrar transcript section, Regent Administrative Center 125, Boulder,

Colorado 80309. Official transcripts will not be available until approximately 4 weeks after final examinations. Grade reports may be obtained from the dean's office.

EXPENSES, BOULDER CAMPUS

Enrollment Confirmation Deposit

Confirmation deposits are required from all returning former graduate, law, and undergraduate applicants when they confirm their intent to enroll for the fall or spring semesters. Confirmation deposits are not required for the summer session, but freshman applicants are required to pay a designated advance payment, part of which is applied to housing for the following spring semester. The deposits are non-refundable. Students accepted for freshman, transfer, law, or graduate admission must confirm their intent to enroll by submitting the designated confirmation deposit, regardless of any financial aid or scholarship that may or will be received.

Confirmation deposits should be made by the date specified on the Student Confirmation Form; however, confirmation deposits will be accepted only until the enrollment limit is reached. Confirmation deposits received *after* enrollment limits are met will be returned.

Matriculation Fee

There is a one-time nonrefundable matriculation fee of \$15 for new degree students. This fee will be assessed at the time of initial registration. Charges then will not be made for adding or dropping courses or for transcript orders. A special student who is admitted to degree status will be assessed a \$15 matriculation fee at the time of the student's first registration after the change has been made.

Tuition and Fees, Per Semester¹

BOULDER CAMPUS

Tuition and fees for 1979-80 have not yet been set. The rates per semester for the 1978-79 school year are as follows:

Credit Hours of Enrollment	Resident	Nonresident	Fees
0.0 to 3.0	\$ 99	1,333	\$89.50
3.1 to 4.0	132	1,333	89.50
4.1 to 5.0	165	1,333	89.50
5.1 to 6.0	198	1,333	89.50
6.1 to 7.0	231	1,333	89.50
7.1 to 8.0	264	1,333	89.50
8.1 to 9.0	297	1,333	89.50
9.1 to 18.0	333	1,333	89.50
Over 18.0	333 + \$22 per hr.	1,333 + \$89 per hr.	89.50

Extra Tuition Surcharge: For every credit hour over 18 for which a student registers, and which the student retains past the 12th school day of a semester, there will be a tuition surcharge. The amount of the surcharge is 1/15 of the full time rate (\$22 per credit hour for Colorado residents and \$89 per credit hour for nonresidents).

¹The Board of Regents reserves the right to change tuition and fees without prior notice.

1. Students making separate registrations on more than one campus of the University for a single term will pay tuition and fees to each campus at the rate appropriate to the number of credits for which they are registered on that campus. Students using the advance concurrent registration system to enroll for courses on more than one campus for a single term will pay the applicable tuition and fee rates of the student's *home* campus for the total hours enrolled for at all campuses.

2. Students Admitted to Candidacy for a doctoral degree will pay \$99.

3. Nonresident students enrolled as Candidates for Degree only to take a comprehensive examination for a master's degree will pay resident tuition for 3 credit hours.

4. Nonresident graduate and nonresident special students enrolled for 3 hours or less will pay \$266 plus appropriate fees.

5. Students taking 6 hours or less have the option of waiving the student health fee of \$44.90. There will be an additional optional coverage available from Lone Star Life Insurance Company at a cost of \$36.75 per semester. Students must pay the Student Health Fee of \$44.90 in order to have the health insurance.

6. Members of the faculty at the rank of instructor and above, members of the classified staff, and unclassified professional administrative officers who are on full-time appointment may enroll for up to 6 credit hours per term on the Boulder Campus at one-half the resident tuition rate. Persons in these categories appointed for one-half or more but less than full time are eligible for resident tuition rates. Time taken to attend classes during normal working hours shall be made up and shall be limited to a maximum of one course during any term. Persons appointed for less than full time are not eligible for release time during assigned working hours.

7. Students enrolled for one course of 4 credit hours or less must pay a minimum student fee of \$21.15 and may elect to pay either the Student Health Fee or full student fees.

Summer term tuition and fees are listed in the *Schedule of Summer Courses*, available from the Office of the Registrar after March 1.

Some courses carry transportation or other fees for associated activities. Consult the *Schedule of Courses* for special fees.

Tuition for courses taken for no credit (NC) is the same as for courses taken for credit.

Zero or fractional credit is regarded as 1 hour in assessing tuition and fee charges.

All persons attending regularly scheduled classes must be registered or must have obtained an auditor's card. There is no auditor status in summer. Auditors, whether resident or nonresident, pay resident tuition for 3 credit hours per fall or spring semester for class instruction and library privileges only.

Students should see Drop/Add and Withdrawal Procedures for specific tuition and fee policies regarding drop/add and withdrawal.

LABORATORY BREAKAGE DEPOSIT

A \$10 or \$20 deposit is required for each laboratory course for which a student is registered. The unused portion of the deposit is returned at the end of the course.

Fee Regulations

1. *Payment of Fees.* Students enrolling at the University of Colorado Boulder Campus are responsible for full payment of tuition, fees, and University dormitory charges. A student's initial bill will include the following charges: tuition, student fees, and University Housing charges (when applicable). The bill will include the following credits when applicable: financial aid awards, teaching assistant tuition adjustments, and advance payments or deposits. (Current deposits include confirmation deposits, tuition deposits, and housing deposits.) Failure to receive an official University billing *will not* relieve the student of responsibility for payment by the established due date.

2. *Registration Deposit.* Whether or not students pay their fees just prior to the beginning of classes or mail in an advance payment, *all continuing* students are required to pay a minimum registration deposit (\$100 for residents and \$300 for nonresidents) by the last business day in July in order to guarantee their fall registration. (The registration deposit for the spring semester is due at the time of preregistration in November.) New students and transfer students guarantee their registration through their confirmation deposit.

3. *Deferred Payment Plan.* When paying their bill, students may choose a deferred payment option by paying one-half of the total bill by the due date and the balance plus finance charges 30 days later. The deferred balance will be subject to a finance charge computed at a periodic monthly rate of 1 percent per month on the unpaid balance (equal to an annual percentage rate of 12 percent) beginning the first day of class. Payments under the deferred tuition plan are due approximately the fifth and ninth week of classes.

4. *Enforcement.* Failure to make the required payment on any due date will result in the following action:

- a. The student will be disenrolled from the University, becoming ineligible for all University services;
- b. No grades will be issued for courses in progress;
- c. No transcripts, diplomas, certification, or preregistration materials will be issued for the student until the bill is paid in full;
- d. A late payment charge in addition to the interest on the unpaid balance will be assessed according to the following schedule:

<i>Balance Due</i>	<i>Late Charge</i>
\$ 1- \$ 99.99	\$ 5
100- 299.99	10
300- 499.99	20
500- 699.99	30
700- 899.99	40
.900 and over	50

When a student defaults on a payment, an official notification will be mailed by the registrar to the student's address of record. The letter will inform the student that his or her account is overdue and that he or she is disenrolled as of the date of the letter. The student will also be informed of the appeal procedure.

5. *Reinstatement.* Students who fail to make required payments and who are disenrolled may become eligible for readmission for the next term only upon full payment of the balance due as determined by the University policy, plus any finance charges which have accrued.

6. *Appeals.* Students who are disenrolled following the beginning of classes for failure to make required payments, may appeal to a Fee Payment Appeals Board for reconsideration. The board will consist of the registrar, two members of the University Board on Student Finance, and the Office of Student Affairs student administrator. Appeals must be made in writing and must be received within 10 days of the student's removal from registration or disenrollment.

7. *Personal Checks.* Any student giving a check not acceptable to the bank will be subject to disenrollment.

8. *Refunds and Withdrawal Charges.* No change of program or withdrawal is valid without the written consent of the dean of the college or school in which the student is registered. Payment of the registration or confirmation deposit and submission of registration materials obligate the student to pay the full amount of tuition and fees for the semester. If a student withdraws from the University prior to paying full tuition and fees, refunds of the total tuition and fee assessment are made as follows:

- a. Eighty percent during the first 12 days of the semester.
- b. Sixty percent from the 13th day through the 22nd day of the semester.
- c. Forty percent from the 23rd day through the 32nd day of the semester.

9. *Drop/Add Tuition Adjustment.* Complete adjustment of tuition and fees will be made on drop/add changes through the first ten days of classes only. No refunds of any changes will be made for dropping courses after the tenth day of classes. Charges will be assessed for the addition of courses.

10. *Late Registration Fee.* A late registration fee will be charged students who are authorized to register after their regular registration period. The late registration fee is \$20 for the first day, \$25 for the second day, and a maximum of \$30 beginning the third day and thereafter. The late registration fee is separate and distinct from any penalty that may be assessed for late payment of tuition and fees.

Classification of In-State and Out-of-State Students¹

A student is initially classified as an in-state or out-of-state registrant for tuition purposes at the time an

application and all supporting credentials have been received in the Office of Admissions. The classification is based upon information furnished by the student and from other relevant sources. After the student's status is determined, it remains unchanged in the absence of satisfactory evidence to the contrary. *The student who, due to subsequent events, becomes eligible for a change in classification, whether from out-of-state to in-state or the reverse, has the responsibility of informing the Tuition Classification Officer, Office of Admissions, in writing within 15 days after such a change occurs.*

An unemancipated minor whose parents move their domicile from Colorado to a location outside the state is considered an out-of-state student from the date of the parents' removal from the state. The student will be assessed nonresident tuition at the next registration. The student or parent is required to send written notification to the Tuition Classification Officer within 15 days after such a change occurs.

If an adult student or an emancipated minor establishes domicile outside Colorado, he or she is to send written notification within 15 days to the Tuition Classification Officer.

PETITIONING FOR CLASSIFICATION CHANGE

Detailed instructions concerning the procedure to follow, deadline information, the necessary petition forms, and information regarding tuition classification criteria are available from the tuition classification officer, University of Colorado. Boulder Campus students should address their requests to Regent Administrative Center 125.

CLASSIFICATION NOTES

1. Petitions will not be acted upon until an application for admission to the University and complete supporting credentials have been received.

2. Changes in classification are made effective at the time of the student's *next registration*.

3. A student who willfully gives wrong information to evade payment of the out-of-state tuition is subject to legal and disciplinary action.

Housing

Living quarters are an important facet of a college student's life. The UCB residence halls provide a wide range of facilities and a variety of residential programs which contribute to the intellectual, cultural, social, and personal growth of the 5,300 students in the University residence halls.

Entering, returning, or transfer freshmen who are unmarried are required to live in the University's residence halls.²

¹Classification standards conform to state statutes and judicial decisions and are applicable to all of Colorado's state-supported colleges and universities.

²Exception may be made by the director of Student Housing.

Housing rates per semester in the UCB residence halls for 1978-79 are as follows:³

Board and single room	\$833 to \$866
Board and double room	\$720 to \$752

A \$100 advance payment, which will be applied toward spring semester room and board, is required to reserve residence halls accommodations. All contracts are for the two-semester academic year. Only students entering the halls at midyear are granted one-semester contracts. A liquidated damage fee is charged if the student withdraws from the residence halls during the period of the contract.

For information concerning available housing off campus, write or contact the student-operated Off-Campus Listing Service, Room 336, University Memorial Center.

Single students desiring more information about housing should correspond with the Supervisor, Residence Halls Reservation Center, University of Colorado, Boulder 80310. Family housing information may be obtained from the Manager of Family Housing, 1350 20th Street, Boulder 80302. All new students receive, at the time of admission, an information booklet on student housing and a housing application form.

Estimate of Expenses

Expenses for students attending the University of Colorado, Boulder, may vary according to programs of study, personal needs, and individual interests. Tuition and fees may also vary substantially for students attending the Denver Medical Center professional health service programs, the Denver Campus, or the Colorado Springs Campus.

It is difficult, therefore, to provide exact statements of total expenses. The following costs per academic year are established for undergraduate students attending the University of Colorado Boulder Campus in 1978-79; however, the Board of Regents reserves the right to change the costs for tuition and fees and room and board at any time.

	<i>Resident</i>	<i>Nonresident</i>
Tuition and fees	\$845	\$2,845
Board and room (on campus)	\$1,440 to \$1,732	\$1,440 to \$1,732
Total	\$2,285 to \$2,577	\$4,265 to \$4,577

The cost of attending a single fall or spring semester would be one-half of the amount shown. Students planning to attend the optional summer sessions would add the appropriate amount as stipulated in the *Schedule of Summer Courses*. Additional costs would include transportation, books, supplies, special laboratory or departmental fees, special residential program fees, entertainment, any added health insurance, and any other personal needs or interest items or services. Many students are able to work part time on and off campus to earn room and board and pay for other miscellaneous expenses, substantially reducing the amount of outside financial help needed.

PARKING AND TRAFFIC REGULATIONS, MOTOR VEHICLES AND BICYCLES

Students who bring cars to Boulder and live on campus may purchase parking permits which entitle them to park on campus for fees ranging from \$12 to \$20 per semester. Since parking facilities are limited and distant from most dormitories, students are not encouraged to bring motor vehicles to campus. Good public transportation is available between Denver and Boulder, and within the city.

All bicycles operated or parked on University property must be registered with the University Parking and Traffic Office. The fee is \$1 for two years. All valid city licenses will be honored, provided the owner reregisters the bicycle with the Parking and Traffic Office at no charge. Any unregistered bicycle parked on campus is subject to impoundment.

Since parking and traffic regulations are frequently revised, all students should obtain copies of the latest regulations to avoid possible fines and/or impounding of their vehicles. Further information may be obtained from the Parking and Traffic Office, 1511 University Avenue, 492-7384.

STUDENT FACILITIES AND SERVICES

Counseling Services

The University Counseling Service is located in 134 Willard Administrative Center and has the responsibility for assisting students in the following areas:

Individual Counseling. Individual counseling services are offered to students who are experiencing concerns in some area of their personal, social, or educational lives. In addition, career counseling and testing are available to students through the University Counseling Service. Examples of the nature of student concerns are loneliness, family or marriage conflicts, or poor grades. Personal concerns of any type may be discussed openly, frankly, and privately with one of the professional psychologists or counselors on the staff.

Group Counseling. Frequently, problems and concerns which students experience are most effectively met through some method of group counseling. This form of personal assistance allows students to help one another under the direction of a group counselor or psychologist. Throughout the year, the Counseling Services offer a series of workshops designed to help students gain skills in specific areas. Examples of the workshops offered are: academic improvement, self-defeating behavior, assertiveness training, test-anxiety, career-decision making, and social skills development.

Educational Counseling. The Counseling Service assists students in various schools and colleges by offering educational and career exploration opportunities. These services are designed to assist the student who wants to choose a major, receive general

³The Board of Regents reserves the right to change board and room rates at any time.

academic advising, learn about careers related to majors, and develop educational goals and objectives.

Women's Center. The Counseling Service's Women's Center offers individual counseling; academic and job information; and testing services to University students, faculty, and staff, as well as to any mature woman or man who wishes to resume an interrupted academic program, or to change or enrich a career. Special educational, vocational, and personal insight workshops are offered several times a year both on campus and in cities throughout the state.

Peer Counseling. Peer counselors (undergraduate paraprofessionals) are trained to provide academic assistance in the College of Arts and Sciences and to assist in various workshops offered by the Counseling Service. The unique role served by the peer counselor is to assist students on a student-to-student basis.

Testing and Assessment. The Counseling Service uses achievement, interest, and personality tests as an aid to the counseling available for students. All test batteries which are assigned or administered are interpreted for students by one of the Counseling Service staff.

Academic Skills Center. The University Academic Skills Center helps students increase reading speed, improve comprehension, and improve personal study habits. Classes are offered each term and individual assistance is provided by a reading specialist. This service is located in Willard Administrative Center 282.

The above services are offered to University of Colorado students free, except the Reading and Study Skills Program, which requires a nominal fee. For further information about any of the Counseling Services, students may call 492-6766 or inquire in Willard Administrative Center 134.

Financial Aid and Student Employment Services

Many students and parents are finding it increasingly difficult to finance a college education without some help. The role of the Financial Aid Office is to assist students financially, so they can fully participate in their educational experience here at the University of Colorado, Boulder.

About 40 percent of the student body is attending the University with some type of scholarship, grant, long-term loan, or Work-Study assistance. Students interested in applying for financial assistance should contact the Office of Financial Aid, Willard Administrative Center. Inquiries concerning graduate fellowships, scholarships, assistantships, and associateships should be directed to the Graduate Office, Regent Administrative Center, or the student's respective academic department.

Both undergraduate and graduate students seeking campus employment or part-time work in the community should make application in the Student Employment Center, Willard Administrative Center, Room 83.

Priority deadlines for financial aid administered by the Office of Financial Aid are:

February 15 — Colorado Graduate Grant (resident students only).

March 1 — Summer and academic year for entering freshmen.

April 1 — Summer and academic year for transfer and continuing students.

October 15 — Spring semester only.

Special Note: Students whose applications are not complete by the established priority deadline dates will be considered on a funds-available basis, when their applications are complete.

For information concerning additional funding sources contact the following offices all located in Willard Administrative Center:

Veteran's Affairs Office
Women's Center
Office for Disabled Students

Career Counseling and Occupational Information Services

The Career Counseling and Occupational Information Services is located in Willard Administrative Center and assists students at all stages of their career development. No appointment is necessary and students are encouraged to drop in at any time. Activities and services are detailed below.

Career Counseling. A staff of professional counselors will assist students in any area of their career development from career choice to assistance with job placement.

Career Exploration Groups. These groups help students become more aware of themselves and the world of work. Activities include values clarification, skills analysis, receiving of occupational information, talking with individuals in occupations of interest, and decision making.

Computerized Career Information. A computerized system not only will help an individual select among more than 200 occupations, but also will give accurate job descriptions, salary levels, educational requirements, and information on outlooks for the future.

Career Library. Within the career library is a wealth of data on occupations, companies, schools and colleges, and many other types of career related information.

Job Skills Workshops. Workshops on resume writing, interviewing, and job search techniques teach students the most up-to-date skills in these three most crucial aspects of finding a job.

Job Information Services. The job information room contains current job openings throughout the United States. A *Job Vacancy Bulletin*, published weekly, lists hundreds of job openings of interest to students and alumni.

Job Interviews. Throughout the year companies and organizations recruit students on campus.

Credentials Service. Students and alumni may establish a file of references which can be mailed to prospective employers.

Career Fair. Each year, usually in March, the Career Services Office conducts a career fair. At this event, hundreds of companies come to campus to talk with students about careers within their organizations.

Liberal Arts Career Program. A job development specialist is available to assist liberal arts students in finding employment.

Alumni

The University of Colorado, Boulder, alumni program is maintained by both alumni and University funds. No dues are charged, but all graduates and former students who wish to become members of the association and receive all mailings must keep the Alumni Office informed of their current address. Notices of local alumni meetings are sent to alumni, and *The Colorado Alumnus* newspaper is mailed 11 times a year.

The Alumni Office maintains records of alumni and plans alumni events at homecoming, at commencement, and with local groups throughout the United States; organizes student-alumni and young CU alumni groups, and arranges class reunions, awards programs, and tours.

The Alumni Office arranges programs of continuing education for alumni. The office works closely with the chancellor, faculty members, staff, and students in an effort to foster better communication between the Boulder Campus and the alumni body.

Day Care Center

The University Family Housing Day Care Center, which includes preschool and kindergarten compatible programs, is located adjacent to the Boulder Campus. It is professionally staffed and state-licensed and serves primarily the children of University Family Housing residents. The center is open from 7:30 a.m. to 5:30 p.m. five days a week. Further information and rates may be obtained by calling 492-6185.

Educational Opportunity Program

The Educational Opportunity Program (EOP), located in Willard Administrative Center, provides minority students with an environment conducive to academic growth. Since 1967 EOP has been divided into five separate units: the Asian American Program (AA-EOP), Black Education Program (BEP), Migrant Action Program (MAP), Native American EOP (NA-EOP), and the United Mexican American Students (UMAS-EOP). Services provide students with individual assistance in the following areas:

Academic Support. This program helps to improve EOP students' basic educational skills through tutoring, academic advising, curriculum development, and special courses.

Personal and Cultural Development. Personal counseling, social/recreational/cultural activities, housing and family relations assistance, financial advising, and exit counseling aid in the social,

emotional, and cultural development of EOP students.

Career Development. Career and vocational guidance, job development, and graduate and professional school advising are offered to increase career opportunities for EOP students while assisting them in career and occupational choices.

Institutional Development. Program activities include curriculum development, recruiting, cultural activities, instruction and institutional relations in a continual effort to assist in the development of a campus environment more responsive to the academic and cultural needs of minority students.

Administration. Delivery of EOP services is facilitated through program planning and development program evaluation, community relations, and secretarial/clerical support.

For more information concerning admission to the University of Colorado through the Educational Opportunity Program, students may call 492-7884 or 492-7555.

Human Relations Center

The Human Relations Center concerns itself with both personal and intergroup relationships as they involve students, faculty, staff, and administration. The center staff attempts to affect the human environment of the Boulder Campus through a student internship program which includes ombudsperson services to students, an Information/Complaint Booth Service (SAIL), and a student leadership class. Student interns aid students with personal problems, assist the center in opening and maintaining channels of communication, and concern themselves with improving and strengthening relationships within the University community. The Human Relations Center also works closely with student organizations.

The center offers courses for student leaders and others who wish to become involved in the affairs of students. The course is directed toward providing students with skills, information, and experiences that contribute to effective leadership. For further information, contact the center at 492-5077, UMC 328.

Services for Disabled Students

The Office of Services for Disabled Students (OSDS) is a program recently established at UCB to assist disabled students in functioning within the University setting.

The goal of the office is to remove physical barriers and to provide supportive services to permit students with disabilities to participate fully in the academic, cultural, and social activities of the University. This is accomplished by providing individualized services in the areas of admissions, registration, parking, housing, recreation, career counseling, and personal counseling, etc. A media center has been established to provide equipment and materials required by blind students. A program for deaf students is also being developed which includes interpreter services and special assistance with reading and language skills.

At the present time much of the Boulder Campus is accessible to individuals in wheelchairs. An active program is underway to remove the remaining barriers. Provisions exist to transfer classes to accessible locations when necessary. Prospective students having disabilities are urged to correspond with the Office of Services for Disabled Students regarding special problems or needs.

Student Health Service

The Wardenburg Student Health Center is a 22-bed hospital and outpatient clinic located on the Boulder Campus. It is fully accredited by the Joint Commission on Accreditation of Hospitals and provides inpatient, outpatient, and emergency services. There are no facilities for major surgery or intensive care. If students do not have an insurance plan or prepaid health plan to pay for those services not available at the Student Health Center, it is recommended that they participate in the Lone Star Supplemental Student Health Plan.

The student health fee provides many services:

Hospital Service. A student is eligible for unlimited free hospitalization each semester at the Student Health Center. Except in cases of serious injury or illness, student patients are responsible for notifying their parents of their hospitalization and condition.

Outpatient Services. The clinic is available to students for unlimited clinic visits. Psychiatric and other specialty services also are available during clinic hours. The clinics are open from 8 a.m. to 5 p.m. Monday through Friday and from 8 a.m. to 1 p.m. Saturday.

Emergency Services. A doctor is in the Health Center after clinic hours and on weekends for emergency medical cases only. The Psychiatric Department has a doctor *on call* for psychiatric emergencies. The emergency entrance is on the south side of Wardenburg Health Center.

Ancillary Services. Laboratory, x-ray, and physical therapy services are available. Minimum charges are made for a very limited number of special tests, procedures, shots, and supplies.

Pharmacy Services. Prescriptions may be filled at reduced rates in the Apothecary.

Vacation Periods. The Student Health Center Outpatient Service is in operation, but does not provide all of its services during University holidays, vacation periods, and between semesters. If a student requires medical care not available at the Student Health Center during this time, the care received elsewhere is at the student's own expense.

Medical History. All full-time students entering the University for the first time are requested to complete a medical history form which is available from the Student Health Service.

Veterans Affairs

A counselor is available to work with returning veterans and dependents who need help in identifying and selecting realistic educational and career options.

Counseling appointments may be made months in advance of the start of a school term for veterans or dependents.

Veterans Educational Benefits, Chapter 34 (G.I. Bill). The University Veterans Office, 259 Willard Administrative Center, can assist the veteran to establish eligibility to receive veterans educational benefits at the University of Colorado. Requirements are that admission to the University is imminent, a form DD-214 (separation paper) is submitted, and an application for veterans benefits is completed along with a statement of the tentative number of hours the veteran expects to take. This and other necessary information allows the University Veterans Office to enroll the student with the Veterans Administration Regional Office in order to generate the appropriate monthly payment. *Promptness* is imperative because it affects the date of the student's payment. Advance payment may be received preceding the start of a term if the information is submitted to the VA Regional Office by the University Veterans Office approximately 60 days in advance.

Veterans who entered the service from Colorado may be eligible for some state tuition assistance. Dependents and veterans should also check with the University Veterans Office about tutoring and study skills benefits.

Dependents Educational Assistance Act, Chapter 35. Students between the ages of 18 and 26 who are eligible to receive educational benefits because of the death of a parent in active military service or because of a service-connected disability should establish their eligibility with their Veterans Administration Regional Office. Children and wives of totally disabled veterans, as well as widows of veterans, may also qualify. At each registration these students must register with the University Veterans Office as described above.

The V.A. Regional Office has a representative on the Boulder Campus. There is also a Veterans Outreach Office which encourages veterans to use their G.I. benefits in a variety of ways.

University Memorial Center

The University Memorial Center (UMC) serves as a focal point for campus nonacademic activities. The UMC houses and provides such special services and facilities as a reception desk which acts as a central campus information point; a Fine Arts Center with an art gallery, browsing room, and music listening rooms; the University Book Center; a conference center and special meeting rooms; a games area with bowling, billiards, and table tennis; the Glenn Miller ballroom; the Forum Room for special lectures and movies; a food service which includes a cafeteria, grill, delicatessen, pizza parlor, vending area, and catering operation with several private dining areas; attractive lounges; a photography laboratory for individual use; an arts and crafts area offering noncredit classes in macrame, jewelry, pottery, leathercraft, batik, and

others; a copy center/sign shop; a ticket service; and numerous offices for student organization use.

The UMC has been designated as the official state memorial to those who served in the U.S. armed forces. It has also been designated as a multicultural center where opportunities are provided for relationships and understanding between all cultures represented in the University and the community at large.

EDUCATIONAL FACILITIES

Medical Center in Denver

The University's Medical Center is located at 4200 East Ninth Avenue, Denver, on a 32-acre campus. It includes the School of Dentistry, the School of Medicine, the School of Nursing, the Medical Center Division of the Graduate School, the Colorado General and Colorado Psychiatric Hospitals, the Children's Day Care Center, the John F. Kennedy Child Development Center, and the Children's Diagnostic Center for the evaluation of emotionally disturbed children.

Also on the Medical Center Campus are the Florence R. Sabin Wing for Research in Cellular Biology, the Denison Memorial Library, and the Humphreys Postgraduate Center. On the Medical Campus and cooperating closely with Medical Center functions are the affiliated Webb-Waring Lung Institute, Eleanor Roosevelt Institute for Cancer Research, and Belle Bonfils Memorial Blood Center.

More than 1,700 students and trainees enroll annually at the Medical Center. In addition to those who study for the dental, medical, and nursing professions in the Schools of Dentistry, Medicine, and Nursing, others study in such allied health fields as medical technology, physical therapy, occupational therapy, and dental hygiene, and as advanced degree candidates in the life sciences and in health administration.

Extending the regular undergraduate, graduate, and paramedical courses of study within its 22 departments, the Medical School offers intensive refresher courses for practicing physicians, more than 6,500 of whom attend these classes every year. The School of Nursing has a separate department of continuing education which offers workshops and courses in the recent advances in knowledge and techniques to more than 1,500 practicing nurses and health care personnel each year. The School of Dentistry initiated an office of continuing education in 1970 and currently offers about 45 extension courses per year to dentists in Colorado and the region.

The Medical Center completed in 1965 a \$20 million building program which included the construction of the new Colorado General Hospital and a clinical research wing. Completed in 1971 was a \$10.9 million remodeling project to expand the facilities of the Schools of Medicine and Nursing and the Graduate School branch. A School of Dentistry building was completed in 1976.

Colorado Springs Campus

The University of Colorado at Colorado Springs is located on a 136-acre campus on Cragmor Road. Its programs and faculty recruitment are geared to serve the university-level needs of southern Colorado.

The College of Letters, Arts and Sciences offers the Bachelor of Arts degree in the fields of biology, chemistry, distributed studies, economics, English, fine arts, geography and environmental studies, history, mathematics, philosophy, political science, psychology, Spanish, and sociology. Course work also may be taken to fulfill partially the requirements for a baccalaureate degree from the College of Arts and Sciences at Boulder in anthropology, communications, French, German and geology.

The College of Business and Administration, the School of Education, and the College of Engineering and Applied Science offer programs leading to the baccalaureate degree.

Courses toward graduate degrees are available through the Graduate School, the Graduate School of Business Administration, and the Graduate School of Public Affairs.

Additional credit and noncredit courses are offered by the Division of Continuing Education.

Denver Campus

The University of Colorado at Denver, located at Fourteenth and Arapahoe Streets in downtown Denver, serves the urban student and community with programs especially sensitive to the needs of the urban population and environment.

UCD is sharing facilities in the Auraria Higher Education Center with Metropolitan State College and the Community College of Denver, each institution retaining its identity and serving its appropriate segment of a broad educational spectrum.

The University of Colorado at Denver is fully accredited by the North Central Association of Colleges and Secondary Schools and is a member of the Association of Urban Universities. Its educational endeavors emphasize quality instruction, professional and preprofessional training, research, and community service. Students may complete degrees in 45 undergraduate fields and 50 graduate areas.

Academic programs within the University are offered by colleges which admit freshmen, by professional schools which admit students who have completed at least two years of preprofessional study, and by the Graduate School. Colleges and schools at UCD include the College of Business and Administration and Graduate School of Business Administration, School of Education, College of Engineering and Applied Science, College of Environmental Design, Graduate School, College of Liberal Arts and Sciences, College of Music, and Graduate School of Public Affairs. Additional research, public service, and instructional programs are offered through the Institute for Advanced Urban Studies, Center for Urban Transportation Studies, Division of Continuing Education, Center for Community Development and

Design, Office of Community Relations, and Center for Urban Affairs.

Division of Continuing Education

The educational resources of the University of Colorado are made available to Coloradans through the Division of Continuing Education. The office of the division is located in the Academy Building, 970 Aurora Avenue, Boulder. The division includes one bureau, four centers, and one field office.

The Bureau of Conferences and Institutes specializes in short-term, intensive, educational experiences. Conferences, institutes, workshops, seminars, symposia, and short courses are conducted for a wide variety of scientific, educational, religious, and fraternal organizations. Programs are conducted throughout Colorado, with most conferences held during the summer on the Boulder Campus.

The Center for Lifelong Learning develops and administers university-level programs for adults, and high school and college courses for students. Credit and noncredit classes, workshops, study-discussion groups, lecture series, and opportunities for independently pursuing educational goals are provided in a wide range of fields. Traditional and non-traditional approaches to learning are utilized, and, with prior approval, credits earned may be applied to degree programs.

The Center for Management and Technical Programs designs and administers a broad range of executive and management development seminars, workshops, and courses. Engineering and technical programs which provide a unique service to business and industry are also offered.

The Educational Media Center provides media services to the Boulder Campus, to teachers, schools, colleges, and to the general public through its film library, television and radio selections, tape library, and graphics and photographic services.

The Intensive English Center provides instruction in English as a second language to students from foreign countries who plan to attend colleges and/or universities in Colorado and the surrounding states. Careful attention is given to all language skills including reading, writing, speaking, and listening at the beginning, intermediate, and advanced levels.

Fine Arts Exhibitions

The Department of Fine Arts sponsors contemporary and historical exhibitions of painting, graphic arts, photography, and sculpture from its own collections and from those of major museums and galleries throughout the country. The exhibitions are held in the Fine Arts Gallery in the University of Colorado Museum and in the gallery in the Fine Arts Building. The exhibition schedule includes a summer show of contemporary art.

The Phillips, Brackett, Faye, and Oliver collections and the Department of Fine Arts collections are also located on the campus.

Fiske Planetarium

The Fiske Planetarium on the Boulder Campus is one of the finest planetarium facilities in the world. Equipped with a Zeiss VI star projector, a 65-foot diameter dome, and 213 seats, the planetarium regularly presents astronomically oriented shows designed to entertain as well as inform. In addition, multimedia shows, dance, and musical concerts are presented in the planetarium. It is also used as a teaching tool in astronomy classes and by many other departments of the University. Students are employed on a part-time basis to help in the running of the planetarium.

International Education

The Office of International Education maintains liaison among academic departments, administrative units, foreign universities and governments, and U.S. governmental agencies and foundations to stimulate and provide administrative support for students and faculty members who desire to study or to conduct research overseas, and to assist foreign students, faculty members, and visitors who come to the University of Colorado.

Specific functions include expediting the exchange of students and faculty, arranging the programs of foreign visitors, promoting special relationships with foreign universities, and acting as an adviser for Fulbright and other international scholarships.

The Office of International Education also houses an International Travel Center which arranges charter flights and issues International Student Identification Cards.

STUDY ABROAD

The study-abroad office, a branch of the Office of International Education, offers over 20 different study-abroad programs around the globe. Some of these programs are of the traditional "junior year abroad" variety, which places a student directly in a foreign university for an academic year. Such programs are available at the Universities of Lancaster and East Anglia, England; the University of Bordeaux, France; the University of Costa Rica, San Jose; the American University in Cairo, Egypt; the University of Regensburg, Germany; the University of Legon, Ghana; universities in Benares, Madurai, and Waltair, India; the Hebrew University in Jerusalem, Israel; the University of Bologna, Italy; Konan or Sophia Universities, Japan; the University of Seville, Spain and the National Taiwan University, Taipei, Taiwan. Engineering students may be particularly interested in programs at ITESM in Monterrey, Mexico, and the Universities of Lancaster and East Anglia in England. Generally students need to have completed a minimum of two years of college work with a B average or better and have studied two years of the appropriate language.

For students unable to spend an academic year abroad, programs for a single semester are available with various emphases, particularly on inte

language learning. Students may study beginning/intermediate language in Berlin, Germany; Siena, Italy; or Chambéry, France, during the spring semester of each year. In either fall, spring, or summer, students may attend a one-semester language program in Jalapa, Mexico. Students who wish the experience of a foreign institution may attend a single-semester program in San Jose, Costa Rica; Jalapa, Mexico; Rennes, France; or Seville, Spain. Special summer programs, e.g., art history, in Florence, Italy, are organized with specific departments upon request.

Professional school students (business, education, engineering, environmental design, journalism, music) are encouraged to investigate five-year double degree programs leading to the professional bachelor's degree and a B.A. in area studies or language, incorporating a year of study abroad.

All participants in University of Colorado study-abroad programs remain enrolled at the University. Financial aid from the University can be applied to program costs in most cases, and all credit earned while abroad is considered resident credit.

FOREIGN STUDENT ADVISER

The University of Colorado has welcomed foreign students for many years. Currently more than 400 students from other countries are enrolled. The foreign student adviser, a member of the staff of the Office of International Education, provides information and assistance to foreign students regarding University regulations, legal requirements, financial matters, and personal affairs. All foreign students are urged to visit the foreign student adviser as soon as they arrive on campus and to maintain contact with him during their stay at the University.

The Office of International Education is located in the University Administrative Center, 914 Broadway.

Libraries

The University Libraries support the academic study, teaching, and research at UCB. The collection of library materials contains over 1,700,000 books, periodicals, audiovisual materials, and maps plus 1,700,000 microforms. The libraries include the central library (Norlin Library) and branch libraries. Within Norlin Library are located the audiovisual, education, government publications, and the life sciences collections in addition to the major resources in humanities and social sciences and the college undergraduate library. The branch libraries include art and architecture, business, earth science, engineering, law, mathematics/physics, and music.

The government publications library serves as a depository for publications of the U.S. government, European Communities, GATT, and the Organization of American States. The Technical Reports Center, housed there, contains research materials published by agencies such as NASA and the Department of Energy.

Norlin Library also contains the Rare Books Room, Western Historical Collections, and the University Archives which provide specialized resource materials.

Computer-based reference service is offered at cost to library users. There are copying facilities in all the libraries.

The Interlibrary Loan Department serves faculty, students, and staff by borrowing research materials from other libraries when those materials are not available in the University Libraries' collection. The University's membership in the Center for Research Libraries (Chicago) further extends the resources available to users.

Museum

The University of Colorado Museum—through its collections in anthropology, botany, geology, and zoology—is a primary resource for teaching and research. It preserves physical evidence of what is known about the Rocky Mountain region, making it indispensable for faculty and graduate student research. Its extensive program of foreign studies and exchanges of specimens and information has given the museum an international reputation. Nearly a million and a half specimens are available for study.

Through assistantships, the museum gives professional instruction to students in the field and in the laboratory. Museum faculty members teach courses in their specialties including Southwestern archaeology and ethnology, bryology and lichenology, vertebrate paleontology, malacology, and entomology, in addition to museology and museography. Financial support is provided to selected, qualified students through the Walker Van Riper Fund to encourage participation in museum-related research.

The exhibit halls, open daily to the public, present informative exhibits for education and enjoyment at all levels. The Hall of Earth contains exhibits of minerals, rocks, and fossils, particularly illustrating local geology. The Hall of Life shows highlights of the plant and animal worlds, with emphasis on Colorado and Rocky Mountain forms. The Hall of Man exhibits samples of the cultures of widely separated primitive peoples of recent times, as well as synoptic series illustrating the North American Indian cultures, with special emphasis on those of the prehistoric Southwest.

Recreation Program

The Boulder Campus recreation program is designed to fulfill a vital educational function and to provide students and other members of the University community the opportunity to participate in a variety of activities for personal enjoyment and satisfaction.

The Student Recreation Center provides excellent facilities for instructional programs and individual or group activities ranging over approximately 30 sports activities, including an intramural program. The center contains two swimming pools with an adjoining patio-sun deck; an ice skating rink enclosed by glass

windows; handball courts, squash/racquet-ball courts; a large gymnasium for gymnastics, fencing, dance, badminton, etc.; a combatives gymnasium; exercise rooms for both men and women; men's and women's locker rooms equipped with showers and hair dryers; a first aid and therapy room and two dry-heat saunas.

The student-oriented Recreation Department staff gives personal attention to the needs of individual students, faculty, and staff. Detailed information regarding programs and events may be obtained from the various offices within the Recreation Center complex.

Reserve Officers Training Corps

Navy and Air Force Reserve Officers Training Corps (ROTC) units are established at UCB, operating in the fall and spring semesters only. Army ROTC offers courses in the fall and spring semesters and the summer session. All services provide undergraduate and selected graduate students with the opportunity to combine academic study with a military officer's educational program. The three services conduct courses in their respective areas leading to regular or reserve commissions upon graduation. The Navy also offers a program leading to regular or reserve commissions in the Marine Corps. Scholarships paying full tuition, fees, book costs, and a monthly stipend to assist in defraying living expenses are available to qualified ROTC enrollees on a selected basis. Flying instruction, which can lead to the awarding of a private pilot's license, is provided to qualified ROTC students in their senior year.

For further information concerning these programs see the ROTC sections of this catalog or write to the following at the University of Colorado, Boulder, Colorado 80309:

ARMY: Professor of Military Science

NAVY: Professor of Naval Science

AIR FORCE: Professor of Air Force Aerospace Studies

Semester at Sea

The University of Colorado at Boulder offers a unique opportunity for college sophomores and juniors—the Institute for Shipboard Education's Semester at Sea Program. Around the world voyages of three and one half months' duration sail in September and February. Also, special teacher in-service and cultural enrichment programs and adult education Voyages of Discovery are scheduled during the summer and between academic semesters. The University of Colorado approves the academic program and faculty. Academic credits earned meet the usual standards for transfer to other institutions in the United States. Both University of Colorado degree students and degree students attending colleges and universities other than the University of Colorado are eligible to apply for this program. For

application materials and/or further information, contact the Semester at Sea Program, Center for Lifelong Learning, 970 Aurora Avenue, Boulder, Colorado 80309 or call toll free (800) 854-0195.

Speech and Hearing Center

The Speech and Hearing Center has a two-fold purpose. It provides facilities for the training of undergraduate and graduate students, and speech and hearing therapy services for the Boulder community. Any student of the University or member of the Boulder community is eligible for the services offered. Services include evaluations of speech and language skills, training for the improvement of communication skills, hearing tests, lipreading instruction, and auditory training for the hearing-impaired. The clinic is at 930 Broadway. The offices and classrooms for the Department of Communication Disorders and Speech Science are located at 934 Broadway. Address inquiries to Chairman, Communication Disorders and Speech Science, University of Colorado, Boulder, 80309.

Theatre

Facilities for dramatic arts include Macky Auditorium, the University Theatre ("Downstairs"), the beautiful outdoor Mary Rippon Theatre, Theatre 300 ("Upstairs"), and the Old Main Theatre.

Macky, the main University auditorium, seats 2,500 and is used for Artist Series productions, convocations, concerts, and other musical and dramatic productions.

The Department of Theatre and Dance presents a major season bill of eleven productions each academic year.

Each summer the College of Music and the Department of Theatre and Dance present, in conjunction with the Creative Arts program, an opera and a musical as part of the Music-Theatre workshop. The Colorado Shakespeare Festival, presented each summer in the outdoor Mary Rippon Theatre, is a project of the Department of Theatre and Dance under the sponsorship of the Creative Arts Program.

Throughout the year, the Department of Theatre and Dance presents various workshop productions, touring companies, story theatre, and dance programs, including a summer dance artist-in-residence workshop. Also produced by the Department of Theatre and Dance is the Colorado Caravan, a troupe of actor-teachers which tours during the academic year with an offering of plays and workshops.

RESEARCH AND PUBLIC SERVICE

Combined sponsored research and related instructional programs within the University represent annual expenditures amounting to some \$45 million. Of this total, the expenditures on the Boulder, Denver, and Colorado Springs campuses are now approximately \$25 million per year. The sponsored rese

and instruction program of the Medical Center in Denver totals more than \$19 million annually. The principal sources of these funds for research and training contracts and grants are various agencies of the federal government. There is also assistance in the support of the research activity from appropriations of the state of Colorado, private foundations, and private donors.

Research programs and agencies are described in the Graduate School section of this catalog.

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College of Arts and Sciences

INFORMATION ABOUT THE COLLEGE

History and Purpose

Incorporated by an act of the First Territorial Legislature of Colorado in 1861, the University of Colorado enrolled its first students in September 1877. The College of Arts and Sciences is the oldest academic division of the University, dating to 1878.

The College of Arts and Sciences provides a broad range of educational opportunities in the liberal arts and the sciences. The college recognizes the fact that its students have a wide variety of educational objectives, ranging from a highly specialized interest to a desire for the broadest and most general education.

The objectives of the college are based on the belief that each student, no matter how specific and professional his aims, should have sufficient knowledge of other areas to be able to see his own discipline in its proper perspective. At the same time, each student, no matter how broad and general his educational objectives, should have sufficient grasp of at least one field to enable him to deal with its problems in depth and with sophistication.

Pursuant to these beliefs, the college requires all of its students to undertake work in the areas of humanities, the social sciences, and the natural sciences. Students are also required to present a considerable body of work in at least one major field of study.

Liberal education cannot, however, be conceived solely in terms of courses taken and proficiency attained. Contact with members of the faculty outside the classroom and with other students in informal discussion, independent study and research, and participation in the broader intellectual and cultural life of the academic community are factors that significantly enrich the student's education. It is hoped that all students in the College of Arts and Sciences will avail themselves of such opportunities to enhance their university experience.

Academic Advising

The College of Arts and Sciences maintains an advising staff located in the college office, Hellem 152. *Students in the college are expected to assume the responsibility for planning their academic programs in accordance with college rules and policies and departmental major requirements.* However, they are urged to consult with advisers in the dean's office and in their major department concerning their academic progress and objectives.

Academic Ethics (Dishonesty, Cheating)

Students are expected to conduct themselves in accordance with the highest standards of honesty and integrity. Cheating, plagiarism, illegitimate possession and disposition of examinations, alteration, forgery, or falsification of official records, and similar acts or the intent to engage in such acts are grounds for suspension or expulsion from the University.

In particular, students are advised that plagiarism consists of any act involving the offering of the work of someone else as the student's own. It is recommended that students consult with their instructors as to the proper preparation of reports, papers, etc., in order to avoid this and similar offenses.

Appeals

Students are advised that they have the right to appeal decisions of academic dishonesty and to petition for exceptions to the academic policies stated in this catalog. The former appeals should be directed to the Committee on Academic Ethics and the latter petitions to the Appeal Committee on Academic Rules and Policies, both in the Office of the Dean, Hellem 152.

Area Requirements

All students pursuing a Bachelor of Arts or a Bachelor of Fine Arts degree in the College of Arts and Sciences are required to complete the following area requirements. Students pursuing a Bachelor of Science degree must complete all of the area requirements with the exception of the foreign language requirement.

The list of specific courses meeting the area requirements may be found in the *Schedule of Courses* published each semester for registration.

<i>Humanities</i> e.g., English, philosophy art history	Two two-semester combinations
<i>Natural Science</i> e.g., geology, chemistry, biology	Two two-semester combinations
<i>Social Science</i> e.g., economics, history, political science	Two two-semester combinations
<i>Foreign Language</i>	

a. Completion of a Level III high school course in any modern or classical foreign language

or

b. Completion of an appropriate third-semester college course

or

c. Demonstration of third semester proficiency or its equivalent by examination in any foreign language.

Questions about placement should be referred to the appropriate department. Students who elect to enroll in a foreign language course below their placement level may be denied credit for the course.

Students are strongly urged to start their college-level language study immediately upon enrollment in the college, either by continuing a language previously studied or by beginning a new language.

Students planning to go on to graduate work are advised to complete the fourth semester of a foreign language in preparation for the language requirements of graduate schools.

Attendance Regulations

The matter of classroom attendance is left to the discretion of the instructor. It is the responsibility of the student to determine at the beginning of each semester his instructors' policies on attendance.

Bachelor's Degree Programs

The College of Arts and Sciences offers the following degrees:

BACHELOR OF ARTS

Majors

African and Middle Eastern studies	Geography
American studies	Geology
Anthropology	German
Asian studies	Greek
Biological sciences	History
Black studies	Humanities
Central and East European studies	Individually structured
Chemistry	International affairs
Chinese	Italian
Classical antiquities	Japanese
Classical languages	Latin
Communication	Linguistics
Communication disorders and speech science	Mathematics
Dance	Philosophy
Distributed studies	Physics
Economics	Political science
English	Psychology
Environmental conservation	Religious studies
Fine arts	Russian
French	Sociology
	Spanish
	Theatre

BACHELOR OF FINE ARTS

Majors

Studio arts	Dance
Art history	Theatre
Art education	

BACHELOR OF SCIENCE (PHYSICAL EDUCATION)

BACHELOR OF SCIENCE (RECREATION)

The College of Arts and Sciences also has the following programs which do not offer undergraduate majors:

Astro-Geophysics
Chicano studies
Computer science

Film studies
Experimental studies

College Expository Writing Program (CEWP)

The College of Arts and Sciences requires that students who have failed to demonstrate adequate proficiency in writing skills take a course in developmental expository writing. This course carries 3 hours of credit but will not count toward the minimum requirements for the bachelor's degree.

College Level Examination Program (CLEP)

The College of Arts and Sciences accepts a maximum of 30 hours of CLEP credit from *subject* (not general) examinations towards its bachelor's degree programs. For information as to what subject examinations have been approved for credit, students should contact either the University of Colorado Office of Admissions or the College of Arts and Sciences dean's office. More detailed information regarding the College Level Examination Program may be found in the General Information section of this catalog.

Comprehensive Examinations

Departments may require candidates for degrees to pass comprehensive examinations in their major during the senior year.

Correspondence Study

With the approval of the dean of the College of Arts and Sciences, students in the college may take work in correspondence study offered by the University's Division of Continuing Education. A maximum of 30 hours of correspondence work may count toward the degree. This work carries resident credit.

Courses and Credits

UCB operates on the semester system. The term "course" as used in the catalog means a one-semester course. Except for laboratory courses, the credit-hour value assigned to a course is roughly equivalent to the number of hours per week of class work involved in the course (a 3-semester-hour course normally meets 3 hours per week).

The normal course load is 12-18 hours. Upper division courses are those numbered 300 and above.

Credit by Examination (Challenging Courses)

Students in the College of Arts and Sciences may obtain credit in courses taught by the college by taking advanced standing examinations. Information regarding the registration procedure for such examinations may be found in the General Information section of this catalog under Advanced Standing Examinations.

Dismissal

See Scholastic Dismissal.

Double Degrees

Two degrees may be earned from the University of Colorado at Boulder (e.g., a B.A. from the College of Arts and Sciences and a B.S. from the College of Business and Administration) if the following conditions are fulfilled:

1. The student has completed all area and major requirements of this college.
2. The student has completed at least 30 hours of liberal arts course work offered in this college.
3. The student presents a total of at least 150 hours passed.
4. For the B.A. and B.F.A. degrees, the student presents a total of 94 hours of liberal arts course work.
5. The student notifies the office of the College of Arts and Sciences of his intent to graduate with two degrees during the semester prior to that in which he is to receive the degrees.

A student who has been awarded a bachelor's degree, either from this college or elsewhere, may be granted a second bachelor's degree provided the following conditions have been fulfilled:

1. All general requirements for the degree have been met.
2. The major for the second bachelor's degree is different from the first.
3. At least 30 hours in the major field, including 16 hours of upper division work, are taken in this college after admission to a second degree program.

Double Majors

Students pursuing the B.A. or B.F.A. may graduate with more than one major (e.g., biological sciences and French) by completing all requirements for both majors.

Drop/Add Procedure

A detailed description of the drop/add procedure may be found in the General Information section of this catalog.

Ethics

See Academic Ethics.

Experimental Studies

The Experimental Studies Program offers a large number of innovative courses which are taught by undergraduates, graduate students, or other qualified members of the Boulder community under the sponsorship of a regular member of the University faculty. Faculty members are also welcome to submit proposals for such courses. These proposals are due early in the semester preceding the one in which the course is to be taught. The Experimental Studies Committee, composed of four faculty members and four students, screens all proposals and publishes a list of those selected prior to preregistration. These

courses either fall outside the subject-matter orientation of regular departments, or cross subject-matter boundaries in an interdisciplinary fashion. In no case may an experimental studies course be taught more than twice consecutively; hence, there is an ever-changing list of innovative subject matter available through this program. All courses are graded pass/fail, but these hours do not count in the 16-hour limit established by the college. Experimental studies courses may not be counted toward the fulfillment of area requirements nor for the major, with the exception of the individually structured major.

For information and guidelines about proposing an experimental studies course, contact the Office of Innovative Education in Hellems 151.

Expulsion From the University

See Academic Ethics.

Foreign Language House

The Foreign Language House is a small academic community in Williams Village for students who are interested in French, German, or Spanish from both the linguistic and the cultural point of view. Students who are accepted into the program earn 2 semester hours of upper division credit per semester by participating in a weekly class (classes which they help to plan) and by speaking the foreign language in their dormitory routine. Instructors from the appropriate language departments live on the floor to supervise the classes, organize cultural events, and give personal guidance to resident students enrolled in the course. Students are not required to be language majors, but they must have had three semesters of the language in college or three years in high school or have acquired an equivalent fluency on their own. A modest surcharge must be paid for the privilege of participating in Foreign Language House in addition to regular dormitory room and board.

For more information consult the Office of Innovative Education in Hellems 151 or the staff in Darley Commons 207, Williams Village.

Foreign Language Requirement

See Area Requirements.

General Requirements for the Bachelor's Degree

1. A total of 124 semester hours passed.
2. A 2.0 (C) grade average on all University of Colorado work.
3. Forty semester hours of upper division work (courses numbered in the 300s and 400s). Note that all courses transferred from junior colleges carry lower division credit. Exceptions to this require the approval of the dean of the college.
4. The last 30 hours in University of Colorado courses as a degree student in the College of Arts and Sciences.

For information concerning area requirements and major requirements see the sections dealing with these topics in this section of the catalog.

Grade-Point Average

The grade-point average is computed by multiplying the credit points per hour ($A=4$ credit points per hour, $B=3$, $C=2$, $D=1$, $F=0$) by the number of hours for each course, totaling the hours and the credit points, and dividing the latter by the former. For example:

English	120-3	B = 9 credit points
Geology	101-4	C = 8 credit points
Mathematics	110-5	A = 20 credit points
Sociology	211-3	B = 9 credit points
	<hr/> 15 hours	<hr/> 46 credit points

The grades received at another institution will not be used in computing the student's grade-point average at the University of Colorado.

The grade-point average is therefore $46 \div 15 = 3.067$.

Graduate Degree Programs

Curricula leading to advanced degrees are offered by most of the departments in the College of Arts and Sciences. Students should consult the Graduate School section of this catalog for admission and degree requirements of the Graduate School. Curricula for graduate programs are listed alphabetically in this section.

Graduation With Distinction

Students who do not graduate with Honors from the College of Arts and Sciences may graduate with distinction if, prior to their final semester, they have taken at least 30 hours at the University of Colorado and if their cumulative grade-point average by the end of the semester prior to their final semester's work toward the degree is 3.5 or higher, both at the University of Colorado and in all collegiate work attempted.

Graduation With Honors

The award of honors at graduation (*cum laude*, *magna cum laude*, *summa cum laude*) is determined by the Honors Program of the college and is based on several criteria. Honors are not conferred on a graduate simply by virtue of high grades in courses. Students should consult the Honors Program listing in the course description section of the catalog or contact the Honors Program, Norlin Library.

Independent Study

With the approval of the department, students may register for independent study. Not more than 8 hours of independent study may be credited toward the major minimum requirements and not more than 16 hours may be credited toward the degree.

A student may not use independent study projects in partial fulfillment of the college's area requirements.

Students may register for not more than 8 hours of independent study credit during any term. Beginning with the summer term 1978, all independent study courses will be numbered in the 900 series.

Innovative Education

The Office of Innovative Education offers information, advice, and assistance to students, faculty, and staff interested in experimental classes and curricula. The office attempts to keep abreast of all innovative arts and sciences courses and programs which might be of special interest to students, especially those that are too recent to be listed in the catalog. In particular the office coordinates the activities of the Experimental Studies Program and Practicum in the Liberal Arts, as well as distributed studies and individually structured majors (see departmental listings). The office is located in Hellems 151.

Investigation Paper

See Senior Thesis.

Limitations on Course Work

1. Students may take not more than 45 hours in any one department.

2. Students may count toward the fulfillment of requirements for the Bachelor of Arts and Bachelor of Fine Arts degrees a total of 30 hours in the following categories, subject to the maxima specified:

a. Up to 30 hours, including Math. 103 and Math. 121, in curricula leading to degrees other than the B.A. (e.g., physical education, recreation, business education, and the other professional schools and colleges).

b. Up to 8 hours in physical education activities courses.

c. Up to 6 hours in approved ROTC courses.

Majors

All students pursuing a B.A. or B.F.A. must declare a major. As soon as the student has determined his major (certainly no later than the beginning of his junior year), he must formally declare his intentions to his department, inasmuch as the department will be responsible not only for his advising but also for the certification of the completion of his major program for graduation.

The college will assume no responsibility for difficulties arising out of the student's failure to establish and maintain contact with his major department or program.

Major Requirements

1. A minimum of 30 semester hours in the major area (for the B.F.A. a minimum of 50 hours).

2. Thirty hours of C-grade or higher in the major area.

3. A 2.0 (C) grade average in all major work.

4. Sixteen hours of upper division courses in the major, all with grades of C or higher.

5. Special requirements as stipulated by the major department.

Natural Science Requirement

See Area Requirements.

Pass/Fail

Beginning fall 1979, students in the College of Arts and Sciences *may not* use the pass/fail option for courses taken for the completion of the area requirements or the minimum requirements for the major.

Students exercising the pass/fail option may take up to 16 hours of elective credit on a p/f basis; for transfer students, the limit is 1 hour in every 8 attempted at the University of Colorado.

Petitions

See Appeals.

Probation

Students whose grade averages fall below 2.0 will be placed on probation and will have one semester to raise their grade point average to 2.0 cumulative or be dismissed from the college.

If students who have been placed on probation elect to remain out of school for a full calendar year, they may return to the University in good standing, but will be placed on probation again at the end of the semester in which they return if the grade-point average is still below 2.0 at that time.

Residential Academic Program

The Residential Academic Program at Sewall Hall is a living-learning community which integrates academic exploration and personal experience for freshmen. Residents include in their regular course load one of the Sewall seminars which provide the focus of the Residential Academic Program. These seminars are taught in the dormitory by Sewall Fellows selected from the faculty of the University on the basis of the commitment to undergraduate education and their ability to convey the excitement of their disciplines to students. Some seminars are traditional in structure and content, differing from other classes on the campus only in their size (the average enrollment is 20). Others are designed as small classes of a specialized nature which are not available elsewhere in the University. All classes carry full academic credit, and most will fill college requirements.

Scholastic Dismissal

Good academic standing in the college requires a grade-point average of 2.0 (C) on all University of Colorado work. Grades earned *at another institution* are not used in calculating the grade-point average at the University of Colorado. However, grades earned in another school or college *within the University of Colorado* will be used in determining the student's scholastic standing and progress toward the degree in the College of Arts and Sciences.

Students *dismissed* from the college shall be eligible for *reinstatement* when they have achieved a cumulative 2.0 average by virtue of work done in the University of Colorado's summer session and/or Division of Continuing Education. They may also return as transfer students when they have overcome their deficiencies by enrolling at another institution (i.e., by achieving an overall 2.0 average in the University of Colorado work *plus* all work taken elsewhere since dismissal).

It should be noted that UCB's summer session does not count as a probationary semester, nor are students dismissed as a result of summer work. It should also be noted that students reinstated following dismissal will be eligible to re-enroll only if the enrollment quotas have not been filled (i.e., that reinstatement does not necessarily entail re-enrollment).

Study Abroad

For information regarding study abroad programs available to students in the College of Arts and Sciences see the General Information section of this catalog under the topic International Education.

Senior Thesis (Investigation Paper)

A senior student may register for as many as 6 hours of Senior Thesis in the major with the approval of the departmental honors committee and the chairman of the department. The title of this project and the credit hours awarded will be entered on the student's transcript. The hours awarded for Senior Thesis will count toward the major and must be included in the maximum 45 hours allowable toward the degree.

Social Science Requirement

See Area Requirements.

Sewall Hall

See Residential Academic Program.

Suspension

See Scholastic Dismissal.

Transfer Credit

Work from accredited institutions of higher education which has been completed with a grade of C or better may be transferred to the University of Colorado. All courses transferred from junior colleges carry lower division credit. A maximum of 72 hours taken at junior colleges may be applied toward the bachelor's degree in the College of Arts and Sciences. No courses taken at a junior college will be credited toward graduation at the University of Colorado after a student has completed 72 hours of course work at any institution. However, any specific course taken in a junior college after completion of 72 hours may be substituted for any course or courses representing an equivalent number of hours included in the original 72 hours.

Withdrawal Procedure

See General Information section.

AFRICAN AND MIDDLE EASTERN STUDIES

Office in IBS Building 5, Unit 11
Professor Gottfried Lang, Chairman

The University of Colorado offers an interdisciplinary program leading to the Bachelor of Arts in African and Middle Eastern Studies. The purpose of the program is to provide the undergraduate with a broad acquaintance with either or both of these areas. Within the framework of the requirements, students have considerable latitude to shape their studies in the areas and disciplines that most interest them. In addition to the courses listed below, other courses may be taken to meet the requirements with the approval of the chairman. Information may be obtained from Professor Lang.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.
2. Completion of at least 48 hours in courses pertaining to Africa and the Middle East, all with a grade of C or better.
3. Second-year (college) competence in a language appropriate to Africa or the Middle East.
4. Completion of the senior seminar in African and Middle Eastern Studies, included in the 48 hours specified in item 2.
5. The specific courses that may be counted to meet these requirements are to be determined by the advising committee for the Bachelor of Arts in African and Middle Eastern Studies and the dean of the College of Arts and Sciences.

Students are encouraged to seek courses, seminars, and independent studies (including appropriate ones from black studies) deemed relevant upon consultation with their advisers, and to submit these to the chairman for consideration as fulfilling requirements.

<i>Anthropology</i>	<i>Semester Hours</i>
Anth. 226. Old World Archaeology	3
Anth. 425. Archaeology of Africa	3
Anth. 426. Biblical Archaeology	3
Anth. 432. Archaeology of Ancient Egypt	3
Anth. 455. Culture Dynamics	3
Anth. 461. Africa: Peoples and Societies in Change	3
Anth. 483. Egyptian Hieroglyphics I	3
Anth. 484. Egyptian Hieroglyphics II	2

<i>Black Studies</i>	
Bl.St. 101. Swahili I	5
Bl.St. 102. Swahili II	5
Bl.St. 201. Swahili III	3
Bl.St. 211. Politics of Contemporary Africa, II	3
Bl.St. 260. Introduction to African Literature I	3
Bl.St. 415. Pre-Colonial History of West Africa	6
Bl.St. 480. The African Novel	3
Bl.St. 490. Critical Approaches to African Literature	3

<i>Economics</i>	
Econ. 456. Agricultural and Rural Economics	3
Econ. 458. Comparative Agricultural Systems and Development	3
Econ. 477. Economic Development—Theory and Problems	3
Econ. 478. Policies of Economic Development	3
Econ. 489. The Economics of Africa and the Middle East	3
Econ. 499. Independent Study	Variable Credit

<i>Fine Arts History</i>	
F.A. Hist. 461. The Art of Ancient Egypt	3
F.A. Hist. 470. Art of Oceania and Africa	3
F.A. Hist. 404/504. The Art of the Ancient Near East	3
F.A. Hist. 406/506. The Art of Islam	3
F.A. Hist. 407/507. Byzantine Art	3

<i>Geography</i>	
Geog. 384. Geography of the Middle East	3
Geog. 499. Independent Study	1 to 3

<i>History</i>	
Hist. 103. Introduction to Asian History: The Middle East and India	3
Hist. 104. Introduction to the Asian History: China and Japan	3
Hist. 488. The Medieval Middle East, 500 to 1600	3
Hist. 489. The Modern Middle East, 1600 to the Present	3
Hist. 491. The Arab-Israeli Problem	3

<i>Oriental Languages and Literatures</i>	
Arab. 101. Beginning Arabic	10
Arab. 211. Second-Year Arabic	3
Hebr. 101, 102. Beginning Hebrew	10
Hebr. 211. Second-Year Hebrew	3

<i>Political Science</i>	
P.Sc. 222. Contemporary World Problems	3
P.Sc. 411. Third World Politics	3
P.Sc. 415. Political Systems of the Middle East and North Africa	3
P.Sc. 419. Political Systems of Sub-Saharan Africa	3
P.Sc. 473. The Middle East and World Affairs	3
P.Sc. 474. Sub-Saharan Africa and World Affairs	3
P.Sc. 475. Africa in U.S. Foreign Policy	3
P.Sc. 511. Seminar: Political Development	3
P.Sc. 519. Seminar: Comparative Politics Sub-Saharan Africa	3

<i>Religious Studies</i>	
R.St. 260. World Religions: Western	3
R.St. 264. Traditional African Religions	3
R.St. 410. Biblical Judaism	3
R.St. 196. Jesus and the New Testament	3
R.St. 363. Jewish Thought	3

AMERICAN STUDIES

The College of Arts and Sciences, through its various departments and its American Studies Committee, offers a broad interdisciplinary program of courses relating to American thought and culture.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.
2. Completion of 6 upper division credit hours in three of these primary fields:

Anthropology	History
Art history	Journalism
Economics	Political science
English	Sociology

3. Completion of the two-semester Senior Seminar in American Studies, Am.S. 495-496.

4. Completion of 6 upper division credit hours in the history, culture, or language of a non-American civilization.

5. Completion of 6 credit hours in architecture, black studies, geography, integrated studies, music, or philosophy.

All major programs must be approved by the American studies adviser.

ANTHROPOLOGY

*Office in Hellems Building, Room 86
Professor Jack Kelso, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

Majors in anthropology must take Anth. 103 and 104, Principles of Anthropology; Anth. 201 and 202, Introduction to Physical Anthropology; Anth. 220, Introduction to Archaeology; Anth. 453, History of Anthropology; one topical course in cultural anthropology (Anth. 441-459); one ethnographic area course (Anth. 460-477); and write a research paper using the HRAF files in Norlin Library.

GRADUATE DEGREE PROGRAMS

Prerequisites. To be admitted as regular degree students, applicants must have a minimum undergraduate grade-point average of 2.8 (4.0=A) or a Master of Arts degree. Graduate Record Examination scores for verbal and quantitative aptitude tests are required. Letters of recommendation and evidence of previous anthropologically oriented experience and work are carefully considered. Students with less than 18 semester hours of previous course work in anthropology are considered deficient and will be asked to present a correspondingly greater number of hours for a degree.

Application. All applicants must complete their applications by February 1 preceding the academic year in which they expect to enter. Processing an application often requires from four to six weeks. Students with no previous graduate work should apply for entrance into the M.A. program which, if successfully completed, will prepare them for the Ph.D. program. Students who have or will have completed an M.A. degree in anthropology by the time of their admission may apply for direct admission into the Ph.D. program.

Course Requirements. All entering graduate students must have had the equivalent of Quantitative Methods in Anthropology (Anth. 405/505) or take it during their first semester in residence.

Other specific course requirements will be established through a qualifying interview and consultation with an academic adviser. Plan I M.A.'s require a minimum of 30 hours and Plan II M.A.'s require a minimum of 36 hours of course work. The Ph.D. requires a minimum of 36 hours of which up to

24 may be transferred from M.A.-level work at the University of Colorado. A doctoral student may, in some instances, be required to qualify in a foreign language or other research tool which is in addition to the standard requirements established by the Graduate School.

Additional information about specific areas of specialization available and the degree programs may be obtained by writing directly to the Department of Anthropology.

ARTS AND SCIENCES

College Expository Writing Program (CEWP)

*Office in Hellems Building, Room 125
Professor Rise B. Axelrod, Director*

The College Expository Writing Program is designed to teach University students the skills of written discourse essential to a successful college and professional career. The program is composed of expository writing courses on three levels: Basic (AS 099), Beginning (AS 100-103), and Intermediate (AS 110). Basic (AS 099) is a controlled enrollment course open only to specially required freshmen. Students selected for AS 099 will receive notification by mail or will have the course marked on their advisement cards; these students may not register for any other expository writing course until they have satisfied their AS 099 requirement. On the beginning level, the program offers a general course (AS 100) and topic-oriented courses in the humanities (AS 101), social sciences (AS 102), and natural sciences (AS 103). All beginning courses are equivalent; students may not take more than one semester on this level. Students who wish to take an additional semester of expository writing should register for the intermediate course (AS 110). Upon instructor referral, expository writing students may obtain additional help with their writing problems through the writing clinic.

Practicum in the Liberal Arts

The practicum program offers courses that normally entail a seminar on a given topic and an additional component of field work. It is also possible to propose an individually structured practicum under the sponsorship of a faculty member, who will supervise independent study including both readings and paper writing in conjunction with a project in the field. In no case is work experience per se considered for credit towards the B.A. degree, and students must plan an individually structured practicum well in advance of the semester in which the work is to be carried out. A student may register for up to 6 semester hours of practicum work in a single term and not more than 12 hours total as a part of the B.A. degree.

For more information about courses offered through the practicum program, consult the Office of Innovative Education, Hellems 151.

ASIAN STUDIES

Office in Ketchum Building, Room 136
Professor Lawrence W. Beer, Chairperson

The University of Colorado, through its various departments and the Asian Studies Committee, offers a broad interdisciplinary program of courses on East Asia, Southeast Asia, and South Asia, including an undergraduate degree major in Asian studies. (A number of departments offer graduate degree training with an emphasis on Asia.) Among the departments providing courses on Asia are anthropology, economics, fine arts, history, philosophy, political science, religious studies, Oriental and Slavic languages and literatures, and theatre and dance. (See description of degree programs under Oriental and Slavic Languages and Literatures.)

Students planning to major in Asian Studies are encouraged to consider study abroad in Asia. The University of Colorado offers year-long study abroad programs in Kobe or Tokyo, Japan, Taipei on Taiwan, and Varanasi, Madurai or Waltair, India. Students are also encouraged to consider a concurrent major in another discipline appropriate to career goals. For further information, contact the program adviser.

BACHELOR'S DEGREE REQUIREMENTS

A student majoring in Asian studies may choose to emphasize a study of either East Asia (China, Japan and Korea) or Southeast Asia and South Asia, or a general study of all subregions of Asia, with some variation in degree requirements.

1. Students operating under either option must fulfill the following requirements:

- a. Satisfaction of the regular college requirements for the Bachelor of Arts degree in the College of Arts and Sciences.
- b. Completion of Asian Studies 499, Senior Seminar, offered each spring.
- c. A grade of C or higher in all course work taken to fulfill degree requirements in Asian studies.
- d. At least two courses each in the social sciences (e.g., economics, anthropology, political science) and in the humanities (e.g., fine arts, history, literature, philosophy, religious studies, and theatre and dance) concerning Asia, from among the courses approved by the Asian Studies Committee.
- e. At least one course on each of the subregions of Asia.
- f. Consultation with the Asian studies program adviser during the preregistration period each semester.

2. In addition to the requirements under number one, students choosing the *East Asia option* must fulfill the following requirements:

- a. Take 41 hours of work in Asian studies (20 hours of this total will consist in two years of study of Chinese or Japanese). If, in the judgment of the Department of Oriental and Slavic Languages and Literatures, a student

has already accumulated the equivalent of two years of such language study, the student will be required to take 30 hours of credit in Asian studies courses.

- b. The student doing the required language study at the University of Colorado must take 6 hours of upper division work in Asian studies, including Asian Studies 499.

3. Under the *Southeast Asia and South Asia option*, in addition to requirements specified under number 1, the student will take 30 credit hours of work in Asian studies, of which 21 hours must be in upper division offerings, including Asian Studies 499.

Although the University of Colorado does not offer on a regular basis many of the Asian languages, particularly of Southeast and South Asia, the student is encouraged to consult with the program adviser for assistance in pursuing study of whatever Asian language the student may wish to learn. The student will be methodically helped in efforts to learn such languages through arrangements with other institutions or study abroad.

4. Under the *general option*, in addition to requirements in number one, the student will take 30 credit hours of work in East, Southeast and South Asia, of which 21 hours must be in upper division offerings, including Asian Studies 499. There is no language requirement for the major, but a student with an outstanding record may be recommended for graduation with honors in Asian studies, upon petition to the Asian Studies Committee and successful completion of an honors paper and examination designated by the Asian Studies Committee.

Upon completion of 80 semester hours of course work, each student should seek a Progress Report from the Office of the Dean, so that neither oversight nor technicality may interfere with graduation on schedule.

Courses that may be counted toward fulfillment of degree requirements are determined by the Asian Studies Committee and the dean of the College of Arts and Sciences. Not all courses listed below are offered every academic year. Additional courses on Asia are offered at times by other programs such as Honors and Humanities. An advanced student may be allowed by the instructor to enroll in one of the graduate offerings listed here.

<i>Anthropology</i>	<i>Semester Hours</i>
Anth. 470/570. Ethnography of China, Japan, and Korea	3
Anth. 476/576. Ethnography of Southeast Asia and Indonesia . . .	3

<i>Asian Studies</i>	
Asian Studies 498. Independent Study	1-3
Asian Studies 499. Senior Seminar (for seniors only)	3

<i>Economics</i>	
Econ. 490/590. Economic Development of East Asia	3

<i>Fine Arts History</i>	
F.A. Hist. 284. Introduction to Asian Art	3
F.A. Hist. 405/505. Arts of India and Southeast Asia	3
F.A. Hist. 474/574. The Arts of Japan	3
F.A. Hist. 475/575. The Arts of China	3

F. A. Hist. 560. Graduate Seminar: Selected Topics in Art History (Asian Arts) 3

History

Hist. 103. Introduction to Asian History: Middle East and Asia 3
 Hist. 104. Introduction to Asian History: China and Japan 3
 Hist. 270. Japanese History through Cinema 3
 Hist. 271. History of the Modern Far East (Fall) 3
 Hist. 272. History of the Modern Far East (Spring) 3
 Hist. 277. Topics in the History of India 3
 Hist. 318. Selected Readings in Japanese History 3
 Hist. 320. Selected Readings in Recent Chinese History 3
 Hist. 348. Research Seminar: Japanese History 3
 Hist. 350. Research Seminar: Recent Chinese History 3
 Hist. 378. Japan at War 3
 Hist. 400/500. Women in Japanese History 3
 Hist. 422/522. World War II in Asia and the Pacific 3
 Hist. 472/572. History of Modern Chinese Intellectual Thought 3
 Hist. 473/573. History of China 3
 Hist. 474/574. History of China 3
 Hist. 475/575. History of Japan 3
 Hist. 476/576. History of Japan 3
 Hist. 477/577. Ancient and Medieval India 3
 Hist. 478/578. Modern India 3
 Hist. 671. Readings in Chinese History 3
 Hist. 674. Readings in Southeast Asian History 3
 Hist. 675. Readings in Modern Japanese History 3
 Hist. 676. Readings in Modern Indian History 3
 Hist. 771. Seminar: Premodern Chinese History 3
 Hist. 772. Seminar: Modern Chinese History 3
 Hist. 776. Seminar: Modern Japanese History 3

Oriental and Slavic Languages and Literatures

Chin. 101. Beginning Chinese 5
 Chin. 102. Beginning Chinese 5
 Chin. 211. Second-Year Chinese 5
 Chin. 212. Second-Year Chinese 5
 Chin. 311. Third-Year Reading and Composition 3
 Chin. 312. Third-Year Reading and Composition 3
 Chin. 385. Chinese Religion (R.St. 385) 3
 Chin. 411. Fourth-Year Reading and Composition 3
 Chin. 412. Fourth-Year Reading and Composition 3
 Chin. 421. Literary Chinese I 3
 Chin. 422. Literary Chinese II 3
 Chin. 431. Problems in Chinese Language 2
 Chin. 432. Problems in Chinese Language 2
 Chin. 483. Survey of Chinese Literature I 3
 Chin. 484. Survey of Chinese Literature II 3
 Chin. 485. Taoism (Phil.485, R.St. 485) 3
 Chin. 486. Ancient Chinese Prose 3
 Chin. 487. The Confucian Classics 3

Jap. 101. Beginning Japanese 5
 Jap. 102. Beginning Japanese 5
 Jap. 211. Second-Year Japanese 5
 Jap. 212. Second-Year Japanese 5
 Jap. 301. Third-Year Conversation 2
 Jap. 302. Third-Year Conversation 2
 Jap. 311. Third-Year Reading and Composition 3
 Jap. 312. Third-Year Reading and Composition 3
 Jap. 411. Readings in Classical and Modern Japanese 3
 Jap. 412. Readings in Classical and Modern Japanese 3
 Jap. 431. Problems in Japanese Language 2
 Jap. 432. Problems in Japanese Language 2
 Jap. 435. The Modern Novel: Japan and the West 3
 Jap. 483. Survey of Japanese Literature I 3
 Jap. 484. Survey of Japanese Literature II 3
 Jap. 485. Survey of Japanese Literature III 3
 Jap. 486. Modern Japanese Fiction 3
 Jap. 487. Japanese Poetry 3
 OLL. 112. Structure and Writing of Chinese Characters 2

Philosophy

Phil. 310. Chinese Philosophy 3
 Phil. 389. Philosophies of India 3

Phil. 485. Taoism (Chin. 485, R.St. 485) 3
 Phil. 489. Comparative Oriental and Western Philosophies 3
 Phil. 597. Seminar: Comparative Philosophy (Asia) 3

Political Science

P.Sc. 112. Asian Americans in United States Politics 3
 P.Sc. 203. Introduction to Asian Politics 3
 P.Sc. 416. Political Systems of China, Japan, and Korea 3
 P.Sc. 418. Government and Politics in Southeast Asia 3
 P.Sc. 460. Governments of South Asia 3
 P.Sc. 466. Problems in Japanese Politics and Diplomacy 3
 P.Sc. 476. International Relations of China, Japan, and Korea 3
 P.Sc. 516. Seminar: Political System of Japan 3
 P.Sc. 518. Seminar: Southeast Asian Politics 3
 P.Sc. 548. Seminar: Comparative Human Rights: Asia and the U.S. 3
 P.Sc. 561. Seminar: Political Systems of China and Korea 3
 P.Sc. 566. Seminar: Comparative Legal Systems: East Asia and the U.S. 3

Religious Studies

R.St. 262. World Religions: Eastern 3
 R.St. 320. Hinduism 3
 R.St. 330. Buddhism 3
 R.St. 340. Japanese Religions 3
 R.St. 351. Religion and the Arts (Eastern) 3
 R.St. 361. Islam 3
 R.St. 380. Tibetan Buddhism 3
 R.St. 385. Chinese Religion (Chin. 385) 3
 R.St. 420. Hindu Vedanta 3
 R.St. 440. Japanese Buddhist Scriptures 3
 R.St. 480. Zen 3
 R.St. 485. Taoism (Chin. 485, Phil. 485) 3

Sociology

Soc. 408. Selected Topics on Asian Americans 3
 Soc. 464/564. Revolutionary Change in China 3

Theatre and Dance

Thtr. 472. Theatre of Asia 3
 Thtr. 572. Problems in Asian Theatre 3
 Thtr. 672. Seminar: Asian Theatre 3
 Occasionally, innovative courses on Asia are offered on a one-time-only basis by Asian studies faculty. Consult the program adviser for information.

ASTRO-GEOPHYSICS

*Office in Duane E 226
 Professor J. McKim Malville, Chairman*

Although an undergraduate major is not offered in Astro-Geophysics, it may be used as a primary field in a distributed studies major program. A list of courses recommended for a distributed studies major may be obtained in the departmental office.

GRADUATE DEGREE PROGRAMS

The curriculum in the Department of Astro-Geophysics offers advanced study in solar, space, atmospheric, planetary, and stellar physics; and the associated basic disciplines of plasma physics, fluid dynamics, and radiative transfer. The department offers the M.S. and Ph.D. degrees. Students interested in the curriculum are invited to correspond with the Chairman, Department of Astro-Geophysics, University of Colorado, Boulder 80309.

A doctoral program in astrophysics is offered jointly with the Department of Physics and Astrophysics. For information on this program, see section on Astrophysics and course listings under Physics and Astrophysics in this catalog.

Departmental Requirements

Those wishing to pursue graduate work in astrophysics leading to candidacy for an advanced degree should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. The following are special departmental requirements.

Master's Degree

Prerequisites. A thorough undergraduate preparation in physics and mathematics. Courses should include thermodynamics, mechanics, electricity and magnetism, atomic physics, and mathematics at least through differential equations.

Qualifying Examination. Students starting work in the Department of Astro-Geophysics will be given a written qualifying examination prior to registration. This examination will test fundamental knowledge in classical physics and mathematics and will help students plan a program of graduate studies. Should a student fail this examination, he must show evidence by the end of the first year that his deficiencies have been mastered.

Course Requirements. Under Plan I, a student must present a thesis plus 24 semester hours of course work, at least 12 of which must be in astro-geophysics courses numbered 500 or above. The remaining hours will normally be in physics and mathematics. Under Plan II, additional hours of approved graduate courses must be presented for a total of 30 semester hours of which at least 16 must be in astro-geophysics courses numbered 500 or above. The master's examination under Plan I is generally oral, covering the thesis and related topics. Under Plan II the examination, which is more comprehensive, may be either written or oral or both. Master's examinations are given after other degree requirements have been completed, but may be given during the last semester of residence if the student is making satisfactory progress on required courses. Students are encouraged to follow Plan I except under special circumstances.

Doctor's Degree

Prerequisites. See prerequisites above.

Qualifying Examination. See above.

Course Requirements. A student may receive a Ph.D. degree with a minimum of 30 semester hours of work in courses numbered 500 or above, provided his grasp of the field and his ability to do original research showing mature scholarship and critical judgment have been adequately demonstrated. The emphasis is on independent study and research, not on the fulfilling of course requirements.

Language Requirement. Graduate School language requirement.

Examinations. Students in a Ph.D. program are required to take two examinations, both of which are written and oral. The preliminary examination, which is given early each semester, deals with the fundamental physical and mathematical principles that form the basis for continued work in the Ph.D. program. The comprehensive examination is given on demand as an individual examination within one year after the preliminary examination has been passed. Students must submit to the Graduate School a formal application for admission to Ph.D. candidacy at least two weeks before the comprehensive examination. The language requirement must also be satisfied by this time. The comprehensive examination is designed to test the student's scientific judgment and initiative as well as his mastery of the knowledge and skills necessary for research. Students entering the department are supplied with a detailed description of the two examinations.

BIBLIOGRAPHY

*Office in Norlin Library, Room M 405
Assistant Professor Leo Cabell, Director*

Several courses in bibliography (see College of Arts and Sciences in Course Description section of this catalog) are offered to students who wish to develop competence in the use of information tools for their study and career needs.

On approval of the major departments, graduate courses may be accepted as a minor field and as part of the requirements for an advanced degree.

BIOLOGICAL SCIENCES

The Division of Biological Sciences consists of the Department of Environmental, Population, and Organismic Biology and the Department of Molecular, Cellular, and Developmental Biology. Several programs leading to the B.A. degree with a major in biological sciences are available. Each department defines and administers its own programs separately.

Biology—Environmental, Population, and Organismic

*Office in Ramaley Building, Room 110
Professors Hobart M. Smith and
Carl E. Boch, Cochairmen*

BACHELOR'S DEGREE REQUIREMENTS

The department offers majors in biological sciences, biological sciences with education, and distributed studies. Each student has the option to develop an area of concentration in any one of three areas: environmental, population, or organismic biology. Students selecting any of these majors must report to the departmental office for lists of options available and for assignment to area advisers. Courses in chemistry, mathematics, and physics are required.

Courses acceptable toward the minimum of 35 semester hours required for an undergraduate major

may include (subject to the explicit approval of the student's adviser) any appropriate course given in any other department of the University and in any other college, within College of Arts and Sciences limitations up to a maximum of 12 semester hours.

For an introductory course in biology, science majors should enroll for either EPOB 101-110, 102-111 or MCDB 105-106, and nonscience majors in either EPOB 101-102, Biol. Sci. 103-104 (Integrated Studies) or MCDB 105-106; credit can be given in only one of the three sequences. No credit toward a biology major is given for Biol. Sci. 103-104 although a student presenting these courses will not be required to take EPOB 101-102.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in biology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. The equivalent of an undergraduate major in biology is expected. Consultation with an adviser is mandatory when making up a study plan.

At the graduate level the department offers the M.A. and Ph.D. degrees and a Plan II M.A. degree, without thesis. In addition, there are several associated accessory and peripheral institutes and departments which greatly increase the available teaching and research facilities: the Department of Molecular, Cellular, and Developmental Biology, the Department of Aerospace Engineering, the University Museum, the Institute of Arctic and Alpine Research, and the Institute of Behavioral Genetics. Within the department itself there are special laboratories for animal behavior, comparative endocrinology, comparative reproduction, cryptogamic botany, data systems, ecoenergetics, experimental plant ecology, entomology, environmental physiology and hygrobiology, fish physiology, herpetosystematics, limnology, microbiology, plant physiology, population genetics, and vertebrate ecology.

Biology—Molecular, Cellular, and Developmental

Office in Biosciences Building, Room 131
Professor William B. Wood III, Chairman

BACHELOR'S DEGREE REQUIREMENTS

	<i>Semester Hours</i>
MCDB 105-106 or EPOB 101-110, 102-111	8
MCDB 312, 310 (LAB)	4
MCDB 384	4
MCDB 461 or 462	4
Chem. 103-106 or Chem. 107-108	10
Chem. 331-332 or Chem. 335-336	8-10
Chem. 481-482	6
Phys. 111 or 201 and Phys. 112 or 202	8-10
Math. 130, Math. 230	8-10
Electives in MCDB, EPOB, or related subjects to be approved by department	11-26

Students interested in MCD Biology should consult with an adviser in the department. Recent changes in

the list of available courses and other pertinent information for majors are described in a mimeographed brochure available in the departmental office.

GRADUATE DEGREE PROGRAMS

Opportunities for graduate study and original research are available in a variety of areas, including animal virology, biosynthesis of macromolecules, structure and function of ribosomes, control of gene expression, cellular regulatory mechanisms, cellular motility, sensory transduction, development and fine structure of intracellular organelles, molecular structure of membrane systems, nuclear-cytoplasmic interactions, growth and reproduction of cells, mechanisms of cellular differentiation and aging, interactions of cells and tissues, visual neurophysiology, embryogenesis, and mechanisms responsible for congenital deformities.

Entrance Requirements and Prerequisites. The graduate programs of the Department of Molecular, Cellular, and Developmental Biology are sufficiently flexible to accommodate students with a wide range of training. Students with bachelor's degrees in any of the biological, biochemical, or physical sciences are encouraged to apply. Background necessary for the program includes the equivalent of undergraduate courses in cell biology, developmental biology, genetics, organic chemistry, chemical thermodynamics, differential and integral calculus, and general physics. These requirements are intentionally stated in terms of areas of knowledge rather than as credits in specific courses. Students accepted with deficiencies may demonstrate mastery of the required areas by taking appropriate undergraduate courses, by passing advanced-standing examinations, or by successfully completing graduate-level courses that require the undergraduate courses as prerequisites.

Areas of Study. All students will be expected to develop competence in five areas: (1) *biochemistry*, including biochemical phenomena associated with cellular and molecular biology; (2) *genetics*, including molecular mechanisms of gene function, regulation of gene activity, and genetic control of development; (3) *cell structure and function*, including interaction of organelles, molecular organization, ultrastructure, biosynthesis, growth and reproduction; (4) *developmental systems and mechanisms*, including types of developmental phenomena and the morphological and molecular mechanisms involved; and (5) *current research techniques* of experimental biology.

Doctoral Program

Course of Study. The faculty of the department offers a variety of courses to help graduate students acquire knowledge in the various areas of study. Further, students are encouraged to work in several different laboratories to broaden their education and to help them identify the field of greatest interest for their thesis work.

Examination Sequence. At the time of entrance a counseling committee examines each student's

background and interests and recommends courses for the first year in residence. A member of the faculty is then appointed as adviser for each new student to serve until the student is ready to select a sponsor for his or her thesis research.

A preliminary examination is held at the beginning of the student's second semester in residence to determine eligibility for continued graduate study, to identify areas of weakness, if any, and to assist in ranking for fellowship competition.

The comprehensive examination, which is normally scheduled during the student's fourth regular semester in residence, consists of two parts: a written research proposal and an oral examination designed to test the student's mastery of the broad field of knowledge related to his or her overall degree program.

Language. Before admission to candidacy for the Ph.D. degree, students must satisfy the language requirement established by The Graduate School.

Thesis. The principal elements in graduate training are: defining a thesis problem, investigating this problem with a coherent piece of research that constitutes a substantial contribution to knowledge, and writing a report on this work in the form of a thesis submitted to a departmental committee for approval. After completion of the thesis, each candidate for the Ph.D. degree is required to present a public seminar and to take a final oral examination on his or her thesis and related topics.

Teaching. Two semesters of apprentice teaching are required of each candidate for the Ph.D. degree. Normally this obligation is met during the student's second or third year of graduate study.

Course Requirements. A minimum of 30 semester hours of courses numbered 500 and above is required. Specific courses depend on the student's background and field of specialization.

In view of the strong research orientation of the fields involved, the department does not accept applications from students seeking the M.A. as a terminal degree. The Master of Arts degree, either with a thesis (Plan I) or without (Plan II) is awarded under special circumstances. Candidates must pass the preliminary examination (described under Doctoral Program) and a comprehensive final examination. There is no foreign language requirement. For Plan I a thesis based on original research must be submitted. Final determination of whether a student will follow Plan I or Plan II is made by the department.

BLACK STUDIES PROGRAM

*Office in Woodbury Building, Room 302
Professor Charles H. Nilon, Chairman*

The Black Studies Program is multidisciplinary and offers courses in the humanities and social sciences. Although its primary purpose is to study and judge the Afro-American experience and to present the significance of that experience in American culture and life, it also offers courses on African and Caribbean subjects that support its primary concern. The program offers a major that leads to the B.A. degree.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfactory completion of the regular College of Arts and Sciences requirements for the B.A. degree.

2. Satisfactory completion of Bl.St. 200, Introduction to Black Studies; Bl.St. 450, Research Methods in Black Studies; and Bl.St. 495, Senior Seminar in Black Studies.

3. Satisfactory completion of the core program in Black Studies as defined below. At least 3 credit hours are required from each of the categories below.

History

Bl.St. 215-216. Afro-American History

Literature

Bl.St. 232-233. Afro-American Literature

Bl.St. 260. African Literature

Bl.St. 385. Development of Caribbean Literature

Music, Art, Religion, Dance

Bl.St. 240. Ethnic Dance

Bl.St. 264. Traditional African Religions

Bl.St. 270-271. Afro-American Art History

Bl.St. 280-281. Afro-American Music History

Social Sciences

Bl.St. 203-204. Behavioral Analysis

Bl.St. 220. Black Social Movements

Bl.St. 226. The Black West

Bl.St. 250. Capitalism and Slavery

Bl.St. 255. The Black Woman in American Society

4. Satisfactory completion of Black Studies courses in an area of concentration. This includes 15 hours of additional course work in a subject area chosen by the student and approved by the Black Studies Program faculty for a total of 36 hours of credit in Black Studies. Of this total, at least 16 hours must be in upper division courses.

CENTRAL AND EAST EUROPEAN STUDIES

*Office in Ketchum Building, Room 215
Professor Edward J. Rozek, Chairman*

All schedules for students majoring in Central and East European Studies must be approved by the adviser of the program.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.

2. A demonstrated proficiency in German, Russian, Polish, Serbo-Croatian, or any other Central European language.

3. At least 48 semester hours selected from courses numbered 200 or above, dealing with problems of Central or Eastern Europe or the Soviet Union, which are offered by any department in the College of Arts and Sciences; i.e., economics, geography, history, political science, Slavic languages, and sociology.

4. The specific courses that may be counted to meet these requirements are to be determined by the advising committee for the Bachelor of Arts in Central and East European Studies and the dean of the College of Arts and Sciences.

CHEMISTRY

Office in Chemistry Building, Room 109
Professor William P. Reinhardt, Chairman

BACHELOR'S DEGREE REQUIREMENTS

For graduation with a regular chemistry major, students must present credits in the following courses or their equivalent: Chem 103, 106 (or 107, 108), 335, 336, 418, 451, 452, or 453, 455; Phys. 111, 112, 114; Math. 130, 230, 240. It is important that all students majoring in chemistry or considering this major be assigned a departmental adviser. This should be done in the freshman or sophomore year if possible; delays in graduation may thereby be avoided.

Students may also take a degree in the chemistry department with a biochemistry option. They must present credits in the following courses or their equivalents: Chem 103 and 106 (or 107, 108); 331 and 332 (or 335, 336); 451 and 452 or 453; 481, 482, and 486; Phys. 111, 112 and 114; Math. 130, 230 and 240; MCDB 105, 106 (or EPOB 101, 102); and MCDB 384 or EPOB 383. Biochemistry division approval is required for the biochemistry option, and students should apply through any biochemistry division faculty member.

Qualified majors are strongly urged to participate in the departmental honors program during their junior and/or senior years. Enrollment in Independent Study (Chem. 493) is also recommended. Information on these programs is available from the adviser.

A departmental adviser must be consulted before a Distributed Studies Program with chemistry as the primary field is undertaken. Such a program must include the following courses or their equivalent: Chem. 103, 106 (or 107, 108), 335, 336, (or 331, 332), 451 (or 346). Thirty hours of chemistry courses are required. For further information, see the Distributed Studies Program section of this bulletin and the advisers.

Students planning chemistry as a career should be familiar with the recommendations of the American Chemical Society for the professional training of chemists. Among these recommendations are a reading knowledge of German or Russian, one semester of inorganic chemistry (Chem. 401), a semester of an advanced laboratory course such as Chem. 481 or 493, and a semester of another advanced course such as Chem. 501, 506, 516, 517, 518, 531, 532, 533, 538, 550, 551, 552, 553, 554, 556, 559, 581, or 582. An advanced course in physics or mathematics may be substituted for one semester of advanced work in chemistry. Further information regarding these recommendations may be obtained from the advisers.

Candidates must also pass their final Ph.D. oral examinations at the time of completion of their graduate study.

Ph.D. candidates must present a thesis describing original research and making a worthwhile contribution to chemical knowledge. They must also pass the Ph.D. final examination covering the thesis work and related topics.

Students wishing to pursue graduate work in chemistry leading to candidacy for advanced degrees

should read carefully Requirements for Advanced Degrees in the Graduate School section. Following are special departmental requirements.

Prerequisites. An undergraduate major in chemistry is desirable, since entering graduate students are required to pass examinations covering the major fields of chemistry. GRE scores are required for fellowship competition; they are strongly recommended but not required for admission to the department.

GRADUATE DEGREE PROGRAMS

Master's Degree

Language. A student must demonstrate proficiency in a foreign language at a level comparable to a third-semester undergraduate course. This requirement may be satisfied either by having received a satisfactory grade in a third-semester course or by an equivalent grade in the GSFLT. Organic chemistry majors must satisfy this requirement in German; students in other fields may fulfill the requirement in French, German, Japanese, or Russian.

Examinations. Qualifying-preliminary examinations are given during registration week of the fall and spring semesters. These examinations are offered in five fields: analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. They cover undergraduate-level material and their purpose is to determine qualifications for advanced study. A student must pass three of these at the master's degree level, including the examinations in physical chemistry and in the student's proposed major area. Students may attempt more than three examinations if they wish, but are required to pass only three. If the first attempt at the examinations is not successful, they may be attempted once more at the start of the next semester. Entering students who have had no training in a particular area, or who have been out of school for some time may request a deferment from the graduate adviser until they have a chance to make up their deficiencies.

Candidates must also pass final master's oral examinations at the time of completion of their work.

Course Requirements. There are two methods of obtaining a master's degree from the Department of Chemistry. Plan I requires 24 credit hours including 15 to 20 credit hours of formal course work, 4 to 9 credit hours in research courses, the completion of a research investigation, and the presentation of a thesis. Plan II requires 24 credit hours of formal course work plus 6 credit hours of research. The student should consult with the graduate adviser in the department to ascertain that the proposed plan satisfies the major and minor field requirements.

Doctor's Degree

Language. The language requirement is similar to that for the master's degree except that the level of proficiency required is that of a fourth-semester undergraduate course.

Examinations. The qualifying-preliminary examinations are the same as those described for a master's degree, and the requirements are the same except that they must be passed at the Ph.D. level.

The comprehensive examination consists of written and oral parts. These examine candidates for advanced knowledge in their field of specialization. The written part consists of a series of monthly cumulative examinations, of which the candidate must pass six over a two-year period. Students entering with bachelor's degrees must start taking these in their third semester of graduate school; those entering with master's degrees must start in their second semester. The oral comprehensive must be taken during the fourth semester or the second semester depending upon whether the student enters with a bachelor's or a master's degree.

CHICANO STUDIES

*Office in Ketchum Building, Room 11
Associate Professor Albert Ramirez, Acting Director*

The Chicano Studies Program at the University of Colorado provides all students a conceptual means by which bilingualism and biculturalism, in a context of racial/ethnic pluralism, can be fully developed. The undergraduate program provides students majoring in related disciplines an extensive knowledge and insight into the largest single language minority in the country. It also provides an academic context for the study of the Chicano experience in both a historic and demographic/structural framework. No major is offered.

CLASSICS

*Office in Education Building, Room 320F
Professor Hunter R. Rawlings, III, Acting Chairman*

BACHELOR'S DEGREE REQUIREMENTS

The Department of Classics offers four majors: Greek, Latin, classical languages, and classical antiquities. The department requires for all majors a minimum of 30 semester hours but in most cases 35 to 42. Majors in Greek or Latin or classical languages require that all hours be in language courses.

The major in classical languages will be allowed for those students who, in the judgment of the department, are of outstanding promise in Latin and Greek. Students expecting to teach either at the secondary or college level are encouraged to enroll in this major.

The major in classical antiquities requires the equivalent of two years of language, and 36 semester hours selected by consultation from general classics and honors courses covering the fields of literature, philosophy and religion, art, and archaeology and history. The student should consult a major sheet available from the department.

General classics courses do not require a knowledge of Greek or Latin and may also be used as a secondary field in the distributed major or in an individually structured program.

Students who have completed a Level III high school Latin course have automatically satisfied the college graduation requirement in foreign language. This requirement may also be satisfied by completion of Lat. 211 or by demonstration of equivalent proficiency by placement test. Students who have studied Latin in high school and wish to continue with the language will be placed according to their high school records, verbal SAT and/or ACT scores, and an interview. Students may not receive credit for a course at a lower level than that into which they are placed. Questions concerning language placement should be directed to the classics department office.

GRADUATE DEGREE PROGRAMS

Master's Degree

The candidate may choose to emphasize Greek, Latin, classical antiquities, or classical humanities.

The student choosing to emphasize Greek or Latin as a major will be required to take a qualifying examination to demonstrate proficiency in translating Greek or Latin.

The student choosing to emphasize classical antiquities or classical humanities will be required to take a qualifying examination to determine a breadth of knowledge in the general area of classical Greek and Roman culture.

Language Requirement. The department requires a reading knowledge of one modern language for those students emphasizing the study of Greek or Latin. If the major emphasis is in Greek (Latin), the candidate will be required to demonstrate a reading proficiency in Latin (Greek) appropriate for a student with two years of college Latin (Greek).

Degree Requirements. Candidates for the M.A. degree in Latin (Greek) will be required to take written comprehensive examinations in the following fields:

1. The language (translation test), literature, and history of Rome (Greece). This examination will be both comprehensive and detailed.

2. The literature and history of Greece (Rome). This examination will test the candidate's general survey knowledge of these fields.

Candidates for the M.A. Plan I (24 hours including thesis) will take an oral examination in defense of thesis. Candidates for the M.A. Plan II (30 hours without thesis) must have departmental approval.

Candidates for the M.A. degree with emphasis upon either classical antiquities or classical humanities will be required to complete at least one graduate-level course in either Greek or Latin with a grade of *B*, will be required to take written comprehensive examinations, and must take Plan II (30 hours without thesis).

Doctor's Degree

The candidate may choose to emphasize Greek and Latin languages and literatures or classical archaeology and history. For those selecting the languages and literatures emphasis, the following are required:

1. Excellent command of Greek and Latin languages and a knowledge of Greek and Roman history and literature.

2. A reading knowledge of two modern foreign languages; one must be German and the other is to be approved by the department.

3. Successful completion of at least four graduate seminars.

4. Comprehensive examinations. The candidate will be tested in Greek and Latin languages (translation tests) and will write examinations on a major classical author and one of the following special fields: art and archaeology, history, linguistics, mythology and religion, palaeography, or philosophy. There will be an oral examination in which the student is expected to demonstrate his or her overall factual knowledge of the field of classics.

For those selecting the archaeology and history emphasis, the following are required:

1. Excellent command of the Greek (Latin) language and literature and satisfactory course work in the Latin (Greek) language and literature.

2. A reading knowledge of two modern foreign languages; one must be German and the other is to be approved by the department.

3. Successful completion of at least four graduate seminars.

4. Comprehensive examinations. The candidate will be tested in the Greek (Latin) language (translation tests) and will write examinations in classical archaeology, history, and on a major classical author. There will be an oral examination in which the student is expected to demonstrate his or her overall factual knowledge of the field of classics.

COMMUNICATION

*Office in Communication Building, Room 104
Professor Harold Hill, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

The program in communication is humanistically based. Major areas of undergraduate and graduate interest are general communication theory; radio, television, and film; and human resources development.

Majors must present a minimum of 30 semester hours, including Comm. 102 and 400, for graduation. However, some programs within the communication field may require additional hours. Lists of required and suggested courses may be obtained from the departmental office. (Freshmen are not eligible for 400-level courses.)

Special Requirements. Communication majors planning to teach at the secondary level should acquaint themselves with the School of Education Professional Year Program.

Communication Proficiency Requirements for Prospective Teachers. Each student pursuing a program in the School of Education must meet minimal standards of competence in communication. Normally this requirement is met by completing

Communication Principles in Instruction (Comm. 230). Additional information may be obtained through the department office or the School of Education.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in communication for advanced degrees should read carefully both Requirements for Advanced Degrees and the following departmental requirements.

Admissions Policy. Ph.D. applicants are required to submit a scholarly paper. All applicants except those who have not attended an academic institution recently should have at least three of their four letters of recommendation from academic sources who have worked with them in classes or in their degree programs.

Ph.D. applicants receiving an M.A. degree from this department cannot take any course work for the Ph.D. program, nor any course work that will transfer to that program at a later date, until reevaluation has been made by the student's committee and admission to the departmental Ph.D. program has been granted.

Diagnostic Examinations. Every M.A. candidate must take a qualifying examination, and every Ph.D. candidate must take a preliminary examination, before completion of 9 semester hours. (Those who can make themselves available may take this examination prior to enrollment.) These diagnostic examinations, and all other information available, are used to design the best possible course of study for the student.

Adviser and Graduate Committee. For every student who declares the intention to qualify for an advanced degree, an adviser and committee will be selected not later than the beginning of the student's second semester (or second summer session) in residence. It is the duty of the adviser and committee to assume the responsibility for (1) approving the student's graduate program, (2) evaluating the student's qualifying or preliminary examination, (3) directing and evaluating the student's thesis or dissertation, and (4) administering the comprehensive examination and the final examination.

Each candidate for a degree has the responsibility of making certain that the appropriate persons or committees have been appointed to supervise the various steps in his graduate program. Details of specific requirements are available from the department office.

A student may change major adviser at any time and for any reason, providing another member of the faculty is willing to accept the responsibility.

Master's Degree

Course Requirements. All M.A. candidates are required to complete Comm. 601 or its equivalent with at least B-level proficiency. All communication course work counting toward degree must be taken at the 500 level or above. At least two courses (4 to 8 hours) must be taken outside the department.

Plan I, With Thesis. After any undergraduate deficiencies have been removed, students under Plan I must normally earn 27 semester hours, 10 of which must be earned at the 600 level or above. Four to 6 thesis credit hours may be counted toward the 27-hour requirement.

Plan II, Without Thesis. After any undergraduate deficiencies have been removed, students under Plan II must normally earn 30 semester hours, 12 of which must be earned at the 600 level or above.

All Plan II students must submit three scholarly works. These works may be completed either as parts of the courses taken or specifically assigned and completed to meet this particular requirement.

Doctor's Degree

All Ph.D. candidates in communication will normally be expected to earn 40 semester hours of course work beyond the master's degree, 21 of which must be at the 600 level or above. Candidates will be required to complete Comm. 601, 702, 703, or their equivalents, with at least B-level proficiency. All communication course work counting toward a degree must be taken at the 500 level or above. Candidates are also required to take at least three courses outside the department.

Students admitted to the Ph.D. program at the Denver Campus will be expected to take approximately half of their communication courses on the Boulder Campus.

Ph.D. students must meet the communication requirement for one foreign language as established by the Graduate School. (For a clarification of this distinction, see the discussion of Language Requirements in the Graduate School section of this catalog.)

COMMUNICATION DISORDERS AND SPEECH SCIENCE

Office at 934 Broadway
Professor Richard F. Krug, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The Bachelor of Arts degree with a major in communication disorders and speech science (1) provides a broad general education; (2) develops concepts basic to human communication and normal language processes; and (3) provides sufficient background for entrance into professional training at the graduate level.

Majors must present a minimum of 37 semester hours of course work listed in the schedule below. Prior to entering the third year of study, students should have completed at least 6 semester hours of psychology.

Enrollment is limited, and prospective majors must apply for assignment to an academic adviser during the freshman year.

Students wishing to pursue an undergraduate emphasis in the area of general phonetics should see the special listing of courses in this catalog under the title Phonetic Sciences.

PREREQUISITE: Recommended for those who do not have high school biology.

Fall

EPOB 101. General Biology 3

Spring

EPOB 102. General Biology 3

(All courses offered in Sequences A, B, and C are required for graduation with a major in communication disorders and speech science.)

SEQUENCE A: (FRESHMAN OR SOPHOMORE YEAR)

Fall

EPOB 307. Introduction to Human Anatomy 4

Phon 304. General Phonetics 3

Spring

Phon 305. Physiological Phonetics 4

SEQUENCE B: (SOPHOMORE OR JUNIOR YEAR)

Fall

Aero 395. Musical Acoustics 3

CDSS 200. Voice and Diction 3

Spring

Phon 308. Acoustic Phonetics 2

CDSS 301. Speech and Language Development in Children .. 4

SEQUENCE C: (JUNIOR OR SENIOR YEAR)

Fall

CDSS 450. Speech Disorders I 4

CDSS 470. Audiology I 3

Spring

CDSS 451. Speech Disorders II 4

CDSS 471. Audiology II 3

(Courses in Sequence D are available to students who have completed Sequence A, B, and C. Sequence D is not required for B.A. in communication disorders and speech science.)

SEQUENCE D: (SENIOR YEAR)

Fall

CDSS 407. Articulatory Phonetics 2

CDSS 457. Methods of Appraisal and Remediation 2

Spring

CDSS 469. Observation and Cotherapy 1

GRADUATE DEGREE PROGRAMS

The graduate curriculum in communication disorders and speech science leads to either the master's or doctor's degree. All courses of study are planned by the student and an adviser and formalized in a degree plan. The programs in speech pathology and audiology are accredited by the American Speech and Hearing Association.

Phonetics courses are listed under Speech Science. Students wishing to emphasize phonetics studies should refer to the Phonetic Sciences section of this catalog.

Prospective students should read Requirements for Advanced Degrees in the Graduate School section and request additional information from this department.

Master's Degree

The master's program emphasizing communication disorders places heavy emphasis upon clinical training and experiences. The program leads to certification by ASHA and the State of Colorado. Students having an undergraduate degree in speech pathology and audiology can expect to spend two years in completing the program. Those without such background are required to make up undergraduate deficiencies which normally require at least an additional year. Students not seeking clinical certification may place major emphasis on speech science or phonetics, and should review additional course offerings listed elsewhere in this catalog under Phonetic Sciences.

Doctor's Degree

The doctoral program demands demonstrated expertise beyond the academic knowledge and clinical skills required for clinical certification. Supervisory, administrative, instructional, and research activities are provided to acquaint the student with problems and concepts of a high level of activity and responsibility.

A great deal of latitude prevails in planning individual programs. It is preferred that students have some professional experience before entering the program, and that they have specific academic or professional goals in mind. Student degree plans are individually prepared through the joint efforts of the student and an advisory committee.

Ph.D. candidates are required to take a three-course sequence in statistics.

COMPARATIVE LITERATURE

Office in Woodbury, Room 205

Assistant Professor Kaye Howe, Chairperson

Although comparative literature is a graduate program, undergraduates should be aware that any two comparative literature courses satisfy half of the humanities requirement, and comparative literature may form either a primary or secondary field in a distributed studies major (see Distributed Studies Program) as well as function as a related field in individually structured majors. Any student selecting comparative literature as a field in such a major program should confer with the chairman as early as possible.

Students wishing to pursue graduate work in comparative literature should consult the Graduate School section of this catalog.

Prerequisites for Admission to Courses. On the 400 level students may read all texts in translation; however, reading knowledge in at least one foreign language is highly recommended. On the 500 level students must be able to read in two foreign languages or obtain the consent of the instructor. Comparative literature seminars (numbered 600) are open only to those who have the necessary linguistic qualifications and literary background.

For Latin/Greek for graduate students, see Classics.

For foreign literatures in translation, see the individual foreign language departments.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in comparative literature leading to candidacy for advanced degrees should read the information provided in the Graduate School section of this catalog and the special memoranda for the M.A. and Ph.D. degrees in this field. These memoranda can be obtained from the secretary, Woodbury 205.

Master's Degree

Prerequisites. For those seeking the M.A. degree, the following are required:

1. At entrance to the program a student must have a reading, speaking, writing, and auditory ability in one foreign language and knowledge of its literature and civilization.

2. By the completion of M.A. work, a student must have acquired reading competence in a second foreign language and knowledge of its literature.

Requirements. In consultation with the graduate adviser, students will plan as the basis of their M.A. programs a set of interrelated courses, with emphasis on the two literatures for which their B.A. degrees have equipped them. Students will take a minimum of 12 hours in comparative literature (including C.L. 510 and at least one proseminar in literary theory and research methods). Reading competence in an ancient language is recommended.

Examinations and Thesis. Students should consult the memorandum available in Woodbury Hall 205.

Doctor's Degree

Prerequisites. An M.A. degree in comparative literature or in a single literature (which may be English), with a proven capability in a second literature. Reading competence in two foreign languages.

Requirements. Candidates for the degree Doctor of Philosophy in comparative literature must fulfill the general requirements of the Graduate School. They must take at least 30 semester hours of work at the 500 level or above in comparative literature or related courses approved by their advisory committee. Students will be responsible for one language and literature as a chronological whole (including its philology), and will take at least 18 hours of graduate work in that department. In addition students, who must have mastered two foreign languages to enter the doctoral program, must master a third to complete it. They will also be required to master the literature of those languages in their areas of specialization.

Students are, in addition, required to take one year of an ancient language. If study of an ancient language is a substantial element in a student's work and is pursued beyond one year's work, it will count as one of the student's three languages (see above).

C.L. 560 (The Art of Translation) is required for all doctoral candidates.

COMPUTER SCIENCE

*Office in Engineering Center, ECOT 7-7
H. Paul Zeiger, Chairman*

The Department of Computer Science offers a number of undergraduate service courses as well as M.S. and Ph.D. graduate programs. Students in the college may enroll in courses in computer science for College of Arts and Sciences credit. The department participates in the Distributed Studies Program. In addition, students may develop an individually structured major in consultation with departmental advisers and the Office of the Dean of the college. Information on these programs can be obtained from the Department of Computer Science office. It is suggested that students seriously interested in computer science take the following course sequence: C.S. 210-310, 401, 402, 413, 445, 453, and 465, along with other computer courses which match the student's area of interest. Mathematics, electrical engineering, and business majors may select an option in computer science.

Other courses and programs offered by or jointly with the Department of Computer Science are described in the Graduate School section.

Courses of special interest in computer applications outside the Department of Computer Science are Psych. 403 and 503; Soc. 523, 528, and 529; E.E. 257, 258, 351, 459, 460, 551, 559, 561, 562, and 565.

GRADUATE DEGREE PROGRAMS

The following are specific requirements for the computer science graduate program. (For undergraduate degree programs in computer science, see Mathematics and Electrical Engineering.) An applicant should have two upper-level mathematics courses above the calculus; for example, probability, differential equations, linear algebra, advanced calculus, etc. In addition, the following courses (or equivalent) are required: C.S. 210 (Fundamentals of Computing), C.S. 310 (Introductory Programming), C.S. 401 (Programming Languages), C.S. 445 (Data Structures), C.S. 453 (Assembly Language), and C.S. 465 (Numerical Analysis). Graduate Record Examination scores indicating a promise of ability in graduate work should be presented.

Master's Degree

Admission requirements for this program are given above under general admission requirements. Plan I or Plan II may be followed. The requirements for Plan I (thesis) are as stated under the general requirements of the Graduate School in the Graduate School section. Students in Plan I and Plan II must pass a written comprehensive examination. Students in Plan I are examined orally on their theses. Under Plan II (no thesis) a student must take C.S. 701 (3 hours), do independent reading from a list supplied by the department, and be examined on this material. Under Plan I

or Plan II a student may take 6 hours in a minor field. Students are expected to work out an acceptable program of course work with their adviser. Specific courses depend on the student's background and field of specialization. Opportunities exist for independent study and work at selected laboratories and industries through a one-year internship.

Doctor's Degree

Admission requirements for this program are given above under general admission requirements. Applicants who have accumulated at least 18 hours of graduate work with a minimum grade-point average of 3.5 may have requirement 2 of the general admission requirements waived. Students in this program must pass a preliminary examination to be eligible for admission to Ph.D. candidacy. This examination consists of participation in a special seminar involving the solution of a variety of problems in computer science, and a written examination covering elementary topics in computer science. The language requirement is as stated under the general requirements of the Graduate School. A minimum of 30 semester hours in courses numbered 500 or above is required for the degree, but the number of hours in formal courses will ordinarily be greater than this. Specific courses depend on the student's background and field of specialization. Following the formal course work a student must pass a comprehensive examination aimed primarily at determining whether the student is adequately prepared to begin doctoral thesis work. Finally, the student is expected to prepare a doctoral thesis based on original research in the field of computer science. Further details are available in the departmental office.

CONFLICT AND PEACE STUDIES

*Office in Muenzinger E227
Associate Professor John Forward, Director*

Conflict and Peace Studies is a multidisciplinary concentration of courses, seminars, field work, and independent study possibilities centering in the peace development process. Analysis of peace and war systems, dispute settlement techniques, social movements, working for creative change, world order studies, and conflict analysis and regulation are among the areas of faculty expertise represented in the concentration. While no CPS major is offered, it is possible for a student to design an Individually Structured Major with a faculty advisory committee.

DISTRIBUTED STUDIES

Students working toward the B.A. degree may elect a major in distributed studies. Requirements are a minimum of 60 semester hours in two or three subjects in each of which a departmental major program for the B.A. is offered. Astro-geophysics, comparative literature, and computer science are also acceptable as primary or secondary subjects. One of these shall be designated the primary subject. Departments shall

have the prerogative of designating acceptable secondary subjects. A student's distributed studies shall be approved by a committee composed of an adviser in the student's primary subject and one in each of his secondary subjects.

Primary Subject. Minimum of 30 hours. Not more than 30 hours may be required. The grade-point average in the primary subject must be at least 2.0; 30 hours of work must carry grades of C or better; 12 hours must be in upper division courses in which grades of C or better have been earned.

Secondary Subjects. Minimum of 30 hours distributed in one or two departments. A secondary subject shall consist of at least 12 hours in one department.

Language Courses. No first-year course in English (100-101) or foreign language (101-102) may be used in satisfaction of the requirements of either a primary or a secondary subject.

For guidelines and application forms, consult the Office of Innovative Education, Hellems 151.

ECONOMICS

*Office in Economics Building, Room 212
Professor Larry Singell, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

Students majoring in economics must take a minimum of 36 semester hours and not more than 45 semester hours in economics, of which 22 semester hours must be in upper division courses. The following courses are required of all economics majors: Econ. 201, 202, 381, 407 and 408, 480; Math. 107 and 108 or equivalent. (Students planning a career in economics will find it advantageous to take Math. 130 instead of Math. 108.) Six semester hours of accounting may count toward the economics major.

For all courses numbered 300 and above, the prerequisite, unless otherwise indicated, is Econ. 201 and 202 or permission of the instructor.

Students who have had Econ. 201 and 202 may not take 100-level courses. Qualified seniors may take 500-level courses.

GRADUATE DEGREE PROGRAMS

Admission Requirements for Graduate Study in Economics

1. Three letters of recommendation.
2. Undergraduate degree with grade-point average of 2.75, or better.
3. Minimum of 16 semester credit hours of work in economics.
4. The Graduate Record Examination (verbal, quantitative, and advanced economics) is required of all applicants who reside in the United States. This includes all foreign students enrolled in U.S. colleges or universities at the time the application is made. All students who submit their applications for Graduate School while residing in a foreign country are urged to take the Graduate Record Examination (verbal and

quantitative). Foreign applicants must exhibit competence in the English language. This can be demonstrated either through the TOEFL or other comparable English language examination.

5. Students who do not meet one of the above admission requirements may be given provisional status by the graduate advisers, with the proviso they make up deficiencies.

Master's Degree

1. Required Courses:

- a. Theory: Econ. 507, Applied Economic Theory, or Econ. 601 and 602.
- b. Quantitative Methods: Econ. 581, Introduction to Econometrics, or Econ. 681, General Economic Statistics.

The graduate adviser may permit substitutions of courses taken outside the department for the required courses if, in his judgment, at least the same body of material was covered at an equivalent level; except that when such substitution is for (new) Econ. 507 and/or 581, the student must take and pass the 507 and/or 581 final examination(s) with grade of B or better to effect the substitution. A course syllabus will be prepared for each of the required courses to provide a basis for materials to be covered wherever and whenever these courses are offered and for making up the final examinations in these courses.

M.A. candidates are required to attempt the courses or examinations in theory and quantitative methods within two academic years and be passed within two and one-half academic years from the date that they enrolled in the graduate program. Passing the Ph.D. preliminary examinations in theory, quantitative methods, and history of thought also satisfies this M.A. requirement.

For any student entering the Ph.D. program from the master's program, the preliminary examinations for the Ph.D. must be attempted within three academic years and passed within three and one-half years from the date the student enrolled in the graduate program. The Graduate Review Committee is empowered to make exceptions for regular and provisional students in M.A. and Ph.D. programs.

2. Credit Hours:

Plan I

- a. Minimum of 24 semester hours of graduate work, including a thesis to count for 4 semester hours;
- b. Minimum of 12 semester hours, exclusive of thesis, in courses at the 600 level or above;
- c. A B or better average in all work presented for the degree.

Plan II

- a. Minimum of 30 semester hours of graduate work;
 - b. Minimum of 16 semester hours in courses at the 600 level or above.
 - c. A B or better average in all work presented for the degree.
4. No thesis requirement.

3. Examinations:

a. Qualifying Examination:

- (1) Graduate Record Examination (GRE) Advanced Test in Economics.
- (2) Foreign students are not required to take the Graduate Record Examination. Their applications will be evaluated by the AEA Foreign Student Credential Evaluation Service.

b. Field Comprehensive Examinations:

- (1) Plan I candidates will be required to take an oral examination after all other requirements for the degree have been completed, including final thesis.
- (2) Plan II candidates will be required to take final written examinations in two fields. In each of the fields offered, the candidate must have had a minimum of 6 semester hours of course credit, of which at least 3 semester hours must be at the 600 level or above. One of the examination fields offered may be individually structured to meet the needs of the student, subject to the approval of the student's major adviser and campus graduate adviser. Passing the Ph.D. comprehensive examinations in two fields also satisfies this requirement. Also, one of the examination fields offered may be outside the field of economics, but the work must be taken at the University of Colorado; or the course credits offered for one of the examination fields may be transferred credits in economics from another university.

c. Supplemental Examinations:

If a master's degree candidate fails the same examination twice, the possibility of a supplemental examination to acquire further information about the candidate's knowledge of the field in question remains open. To qualify for a supplemental examination the candidate must, within ten days of the notification of failure, submit a written appeal to the Graduate Review Committee requesting further examination and stating the reasons for the appeal. The Graduate Review Committee shall examine evidence related to the overall competence of the student as an advanced degree candidate. The committee must decide within 20 days of the notification of failure whether or not a supplemental examination is warranted.

If the supplemental examination is approved, it shall be conducted by a committee composed of two members of the original examining committee plus the student's major adviser. The format of the examination will be determined by the supplemental examination committee, and this examination must be administered within 30 days of the notification of failure. The examining committee shall pass or fail the candidate solely

on the basis of demonstrated competence in the field in question; the overall potential of the student as an M.A. candidate should not enter into the judgment of the examining committee.

d. Other Requirements:

M.A. requirements regarding (1) transfer of credits, (2) residence, (3) time limitations, (4) thesis, and (5) admission of candidacy, all remain as presently stated in the Graduate School section of this catalog.

4. Administration:

- a. Degree requirements for admission, courses, credits, examinations and grading are the same for both the Boulder and Denver campuses *without exception*.
- b. The Denver Campus has its own graduate adviser and its own admission procedures. Both the Boulder and Denver advisers will consult and review all marginal cases for admission. If disagreement occurs, the cases will be referred to the Graduate Review Committee.
- c. All master's degree candidates from both the Boulder and Denver campuses will be given the same examinations in each of the specialized fields offered. Whenever students from both campuses are expected to take the same examination, the committee making up and grading the examination will have at least one faculty representative from each campus.
- d. Members of the graduate faculty, in addition to giving grades to M.A. and Ph.D. candidates in graduate-level courses, will prepare a classroom list in which the students are ranked according to their course performance. These lists will be kept on file in the Department of Economics office.

The Denver Campus has its own graduate adviser and its own admission procedures. All master's degree candidates from both the Boulder and Denver campuses will be given the same examinations in each of the specialized fields offered.

e. Special Program in International Economic Development:

Students participating in the special program in International Economic Development must meet the general requirements for the Master of Arts degree specified above. In addition, the following course and examination requirements must be satisfied for a master's degree with a double field of specialization in development:

- (1) Completion of at least 6 hours in general economic development (Econ. 577, 478 and 677);
- (2) Completion of at least 9 hours from at least two of the following allied fields:
 - (a) Agricultural and rural economics
 - (b) Resources and environment
 - (c) International trade and finance

- (d) Comparative economics
 - (e) Other field studies approved by the Development Program Committee.
- (3) In place of the two separate field examinations, successful completion of a two-part comprehensive examination covering material from sections E.1 and E.2 above. The examining committee will consist of one faculty member representing the field of general economic development and two from the allied fields.

Students electing to combine a single field of specialization in development with a second separate field of specialization will complete a minimum of 9 hours of course work from sections E.1 and E.2, including Econ. 577 or 677 to meet the course requirements for a single field in development. The comprehensive examination in development will be administered by at least one faculty member from general development (E.1) and at least one from the allied fields (E.2).

Doctor's Degree Requirements

1. Satisfactory completion of the written preliminary examination covering microeconomic theory, macroeconomic theory, statistics, and history of economic thought. Preliminary examinations are given regularly in August and January. The four examinations may be taken all at once or may be split up over a maximum of two examination periods, subject to the approval of the graduate adviser. The examination in microeconomic theory and macroeconomic theory must be taken in one examination period. An examination failed in one examination period must be taken again and passed in the next examination period. Students admitted as regular degree students must attempt these examinations within their first two academic years and pass them within the first two and one-half academic years. Students admitted as provisional degree students must attempt these examinations within their first three academic years and pass them within the first three and one-half academic years. It is strongly recommended that students attempt at least part of the preliminary examinations by the beginning of the second academic year. The Graduate Review Committee is empowered to make exceptions for regular and provisional students in M.A. and Ph.D. programs.

2. Satisfactory completion of the written and oral comprehensive examinations covering two or three fields of specialization in course work at the 600 level or above. The third may be taken in lieu of the elective courses requirement as stated in 4 below. These examinations must be attempted no later than two years after the student's first sitting for his preliminary examinations. These examinations will be offered at the beginning of each fall term and candidates are expected to take them at this time; but if the plan of course work conflicts with taking the examination in the fall, the candidate may arrange with

the graduate adviser to take the comprehensive examination at the beginning of the spring semester. Those failing all or part of these examinations have the option of repeating them once at the beginning of the following term.

Doctoral students electing a field of specialization in economic development are required to complete a minimum of 9 credit hours of course work at the 600 level or above selected from the areas of general economic development and the following allied fields:

- a. Agricultural and rural economics;
- b. Resources and environment;
- c. International trade and finance;
- d. Comparative economics;
- e. Other field studies approved by the Development Committee.

Econ. 677 must be taken as part of the required 9 hours. The examining committee in development shall consist of one faculty member from the General Development field and two from the allied fields.

A student will normally complete a minimum of 6 semester hours in each field of specialization. In lieu of one of the standard fields, the student may offer a combination field when the material in certain courses spans two or more areas or when courses from different areas are complementary in meeting the specialization objectives of the student. Courses may be included from outside the economics department on approval of the student's adviser and the graduate adviser. Students offering a special field are responsible for obtaining the written agreement of at least two faculty members who will be involved in evaluating their competence in the field.

3. The student is expected to choose a general thesis topic before the comprehensive examinations and be prepared to discuss it briefly in the examination.

4. For students presenting two fields for comprehensive examinations, the following requirement must be fulfilled: four elective courses, which include at least two fields other than the two in which the student has chosen to specialize, must be completed with a B or better before the student may take the comprehensive examinations. (In the case of students transferring schools, this requirement may be modified by the Graduate Advisory Committee.) In all cases, two formal courses at the 600 level or above must be taken at the University of Colorado in fulfillment of this requirement. This will provide students with a working familiarity in areas in which they have a professional interest without requiring them to specialize in these areas. Two of these elective courses may be taken outside the economics department. This will develop a broad, possibly interdisciplinary, perspective while allowing the student to specialize in two chosen areas of concentration within economics.

5. As much as 10 hours of work towards fulfillment of all requirements may be transferred on the basis of previous graduate work at another institution, subject to the approval of the graduate adviser and subject to the exception in 4 above.

6. Demonstration of competence in one foreign language before taking the comprehensive examinations.

7. Ph.D. thesis and final examination on the thesis. This must be completed within four years after the student has completed his comprehensive examinations.

8. Members of the graduate faculty, in addition to giving grades to M.A. and Ph.D. candidates in graduate-level courses, must prepare a classroom list in which the students are ranked according to their course performance. These lists will be kept on file in the Department of Economics office.

ENGINEERING

The following courses offered in the College of Engineering and Applied Science are accepted for College of Arts and Sciences credit (see College of Engineering in Course Description section).

Engr. 109-3. Creative Uses of Technology I.
Engr. 110-3. Creative Uses of Technology II.

ENGLISH

Office in Hellem's Building, Room 101
Professor Paul M. Levitt, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Expository Writing Program

Expository writing courses are now offered by the Arts and Sciences College Expository Writing Program (CEWP). See listings under College of Arts and Sciences.

Students Who Contemplate Teaching

Sheets listing curriculum required for a teaching certificate may be obtained in room 247, Education Building. Students should consult Mrs. Cline, Mr. Olson, or Mr. Di Stefano, who supervise the teacher-training program. Since requirements for education and English make a very tight schedule, students should fulfill most of the college requirements during their freshman and sophomore years.

Departmental Honors

Students interested in graduating with departmental honors should confer with the director of undergraduate studies as soon as possible, but definitely no later than the beginning of spring term in their junior year.

Students Majoring in English

Expository writing courses (freshman composition) do not apply toward the major but may be included in the 45 maximum hours allowed in one department by the College of Arts and Sciences. English courses taken *P/F* will not fulfill major requirements. Transfer students must take a minimum of 18 hours in English at the University of Colorado and must have English courses taken at other colleges evaluated by the English Department and recorded on a Faculty Note.

Courses taken in other departments will not count in the English major. Each prospective English major must, by the end of the sophomore year, choose to be in Program A, B, or C.

Program A. A minimum of 36 credit hours is required for a major in the Department of English: 3 credit hours in Introduction to English Studies, 3 credit hours in Critical Writing, and 24 credit hours in courses numbered 300 or above. The upper-division credit hours must be divided as follows: 9 credit hours in English literature before 1800, 6 credit hours in English literature after 1800, 6 credit hours in American literature, 3 credit hours in English 490 through 498 (the senior seminar in "Authors" or "Topics") and 6 credit hours in "period" courses. Some of these credits will coincide.

Program B. A minimum of 36 credit hours in the Department of English is required, of which 6 must be earned in the courses Introduction to English Studies and Critical Writing and 24 in courses numbered 300 or above. There will be a Senior Examination, three-and-one-half hours in length, covering the items on the reading list. The student is responsible for signing up for the examination. It should be taken in the first semester of the senior year; it may be taken no more than two times. The exam will be graded *P/F*.

Program C: The Creative Writing Program. The Creative Writing Program requires a minimum of 36 hours in English: 18 hours of creative writing courses, 9 of which must be upper division writing workshops; and 18 hours of English and American literature, 9 of which must be upper division courses (300-level or above). English 119 is the basic introductory course. The workshop classes (200-level and above) are open to students with the consent of the instructor (manuscripts must be submitted). Admission to the program is not automatic, although all courses are open to all students whether or not they are majors. Students who have reached second-semester sophomore standing and have taken at least 6 hours of writing courses can be considered for admission. Students must have an advocate-adviser (a Creative Writing faculty member with whom they have studied) and must submit a manuscript of 10-12 pages for faculty approval. Transfer students must take at least 3 hours of writing with the program before being considered for admission, no matter how many courses they have taken previously. A student must be accepted formally into the major before the last semester of the senior year. The student should apply by the second semester of the junior year at the latest (or be prepared to complete the English major in program A or B).

GRADUATE DEGREE PROGRAMS

English Graduate Calendar

Aug. 29, 1979—Required meeting of all new graduate students with graduate director; 10 a.m., Hellem's 141.

Oct. 1979—Comprehensive examination for the Ph.D. degree by prior arrangement with the director of graduate studies.

Oct. 11, 12, 1979—Written part of the final examination for the M.A. degree.

Feb. 1980—Comprehensive examination for the Ph.D. degree by prior arrangement with the director of graduate studies.

March 13, 14, 1980—Written part of the final examination for the M.A. degree.

Graduate students planning to take any departmental examination must state their intention to the secretary of the director of graduate studies at least three weeks prior to the date of that examination.

Admission Requirements

Master's Degree in English Literature. Satisfactory scores on verbal and advanced literature parts of the GRE, plus at least 24 semester hours in English (exclusive of composition, creative writing, and speech). These hours *must* include a survey of English literature. Sixteen of the 24 hours must be in upper division courses. The candidate must meet the additional requirements specified in the brochure, *Graduate Study in English*, issued by the department.

Master's Degree in English With Emphasis in Creative Writing. Candidates seeking this degree must meet all of the above-listed minimum admission requirements. In addition, each student must submit a manuscript of at least 10 pages of poetry or a minimum of 25 pages of fiction for evaluation. The candidate must meet the additional requirements specified in the brochure, *Master of Arts Degree in English With Emphasis in Creative Writing*, issued by the department.

Doctor's Degree. Satisfactory scores on verbal and advanced literature parts of the GRE; either an M.A. degree in English or at least 30 hours of postgraduate English course work beyond the B.A. degree, exclusive of speech, creative writing, and composition. Entering graduate students with no degree beyond the B.A. will normally be admitted to the M.A. program. They may later petition for admission to the Ph.D. program. Candidates must meet the additional requirements specified in the brochure, *Graduate Study in English*, issued by the department.

Degree Requirements

Students wishing to pursue graduate work in English should note Requirements for Advanced Degrees in the Graduate School section of this catalog and should obtain from the department a copy of the appropriate brochure as indicated by the three categories above.

ENVIRONMENTAL CONSERVATION

Office in Guggenheim Building, Room 110
Professor David Greenland, Program Coordinator

The environmental conservation (EC) major is a program administered through the Department of

Geography. The formal structure of the program includes a Committee for Environmental Conservation composed of representatives from the Departments of Economics, EPO Biology, and Geography.

Environmental conservation, although similar to majors in environmental studies elsewhere, stresses conservation, i.e., a reasoned use of the natural environment so that utilization does not impair the environment's capacity for self-renewal. The major combines the study of technique and philosophy, natural and social science, with course options from nine areas: biology, computer science, economics, English, geography, geology, physics, political science, and quantitative methods.

Students should consult with the secretary in Guggenheim 110 for further information.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular degree requirements for the College of Arts and Sciences.
2. A total of 44 to 47 hours distributed as follows: 29 to 31 hours of Required Courses, 6 to 7 hours selected from the Skills Courses, and 9 hours from the Elective Courses group.
3. Each course applied to the major requires a minimum grade of "C".
4. Courses taken on a pass/fail basis may not be applied toward the major.
5. A double major of environmental conservation and geography is not permissible.
6. All transfer credit toward the environmental conservation major must be evaluated.

	Semester Hours
<i>Required Courses</i> (29-31 hours from the following)	
Econ. 201. Principles of Economics I	3
Econ. 202. Principles of Economics II	3
EPOB 101/110. General Biology I (with laboratory)	4
EPOB 102/111. General Biology II (with laboratory)	4
EPOB 341. Principles of Ecology	3
Geog. 100. Environmental Systems—Climate and Vegetation (laboratory optional)	3 or 4
Geog. 101. Environmental Systems—Landforms and Soils (laboratory optional)	3 or 4
Geog. 341. Conservation Practice	3
Geog. 342. Conservation Thought	3

Skills Courses (6-7 hours; select any two courses)

C.S. Any introductory computer science course	3
Econ. 480. Introduction to Mathematical Economics	3
Eng. 315. Report Writing	3
EPOB 430. Classification of Flowering Plants (with laboratory)	4
EPOB 438. Biometry	3
Geog. 301. Geographical Techniques	3
Geog. 305. Cartography I	3
Geog. 306. Map Interpretation and Intelligence	3
Geog. 401. Introduction to Quantitative Methods in Human Geography	3
Geog. 406. Geographic Interpretation of Aerial Photos	3
Geog. 409. Remote Sensing of the Environment	3
Geog. 417. Research Seminar	3
Geol. 477. Statistics for Earth Sciences	3
Q.M. Any introductory statistics course	3

<i>Elective Courses</i> (9 hours: select any courses from this group)	
Econ. 453. Natural Resources Economics	3
Econ. 454. Environmental Economics	3
EPOB 303. Entomology (with laboratory)	4
EPOB 345. Introduction to Arctic and Alpine Environments (same as Geog. 330)	3
EPOB 418. Limnology	3
EPOB 421. Dynamics of Mountain Ecosystems	3
EPOB 434. Ornithology	3
EPOB 437. Mammalogy (with laboratory)	4
Geog. 440. Land Management Systems	3
Geog. 443. Seminar: Conservation Trends	3
Geog. 450. Water Resources and Water Management of Western U.S.	3
Geog. 473. Geography of Populations	3
Geog. 370. Environmental Geology	3
Phys. 207. Energy in a Technical Society	3
Phys. 208. Physics of Contemporary Social Problems	3
P.Sc. 435. The Environment and Public Policy	3

EXPERIMENTAL STUDIES

The Experimental Studies Program offers a large number of innovative courses which are taught by undergraduates, graduate students, or other qualified members of the Boulder community under the sponsorship of a regular member of the University faculty. Faculty members are also welcome to submit proposals for such courses. These proposals are due early in the semester preceding the one in which the course is to be taught. The Experimental Studies Committee, composed of four faculty members and four students, screens all proposals and publishes a list of those selected prior to preregistration. These courses either fall outside the subject-matter orientation of regular departments or cross subject-matter boundaries in an interdisciplinary fashion. In no case may an experimental studies course be taught more than twice consecutively; hence, there is an ever-changing list of innovative subject matter available through this program. All courses are graded pass/fail, but these hours do not count in the 16-hour limit established by the college. Experimental studies courses may not be counted toward the fulfillment of area requirements nor for the major, with the exception of the individually structured major.

For information and guidelines about proposing an experimental studies course, contact the Office of Innovative Education in Hellems 151.

FILM STUDIES

Office in Hunter Building, Room 102
Associate Professor Virgil Grillo, Director

Photography and cinematography are attracting increasing interest as media of communication and artistic expression. Various departments of the college offer courses dealing wholly or to a significant degree with film as an art form, film history, film in contemporary society, and the art of still photography. Frequent showings of important films are presented on campus for educational purposes, at nominal admission charge, by the University Film Committee and the Experimental Cinema Group.

Students who are interested in study of the film should consult the film studies listing in the current

Schedule of Courses and its supplement issue each semester.

The Arts and Sciences Committee on Film Study hopes to offer a bachelor's degree program in the near future. Interested students are advised to check with the Film Studies office, extension 7903, for information on the possibilities of a degree in film studies.

FINE ARTS

Office in Fine Arts Building, Room 104
Associate Professor Jerry W. Kunkel, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The College of Arts and Sciences awards both the B.A. and B.F.A., a professional degree in fine arts. Both degrees have areas of emphasis in art education, studio arts, and art history. A student may earn both the B.A. and B.F.A. degrees, provided the areas of emphasis differ (consult the department regarding stipulations for the double degree).

The department does not have a commercial art program and does not offer any courses in illustration, advertising, graphics, or design.

B.A. Degree Requirements

Art Education. An art education major must complete the Teacher Education Program. Because early advising is important to insure that the necessary program prerequisites are met, students are urged to consult with the art education faculty early in their programs.

Art History. A minimum of 34 semester hours in fine arts is required.

Studio Arts. A minimum of 31 semester hours in fine arts is required.

In each of the above areas, a student may have no more than 45 hours in fine arts.

B.F.A. Degree Requirements

1. A student must have between 50 and 67 semester hours in fine arts.

2. In order to receive a B.F.A., a student must apply for candidacy. Candidacy is determined by submission of the student's recent work for examination by the faculty.

3. A student with 40 semester hours or more may apply. The student will be notified of the faculty decision to accept or defer.

4. Until the student makes application, submits work for faculty review, and receives official notification of acceptance into the B.F.A. program from the fine arts department, the student may not declare the B.F.A. degree as a major. Note: only those students in residence at UCB may apply for the B.F.A. degree.

Students should consult the current "Major Requirements for the Fine Arts Major" concerning required fine arts courses, which may be obtained in the fine arts office, Fine Arts 104.

General Requirements

Candidates for both the B.A. and B.F.A. degrees must satisfy the general college requirements for the B.A. A fine arts major may not count toward the major any fine arts course above the 200 level taken on a *pass/fail* basis. Not more than 8 hours of independent study may be credited toward the major.

A transfer student who is a candidate for the B.A. degree must take a minimum of 9 hours in fine arts while attending the University; and a transfer student who is a candidate for the B.F.A. degree must take a minimum of 15 hours in fine arts while attending the University. Majors who are transferring fine arts credits must have an evaluation of those credits made by a fine arts transfer adviser during registration or as soon as possible thereafter. It is the student's responsibility to obtain the Transfer Evaluation form from the Fine Arts Office.

The student must arrange for an Application for Degree Candidacy with the Department of Fine Arts during the next to last semester. A student may be graduated with departmental or general honors. If students are interested in pursuing the Honors Program, they should contact the fine arts office as early as possible in their academic careers.

The Department of Fine Arts may retain a limited number of best examples of student work. Students should be aware that work left in studios and/or exhibited in the Fine Arts Building is at their own risk so far as loss or damage is concerned.

Special Programs

Art History Program in Italy. The Department of Fine Arts annually conducts an art history summer program in Italy. The program offers 6 semester hours of credit during a six-week term, operating from a center in Florence and including numerous visits to other Italian towns and cities. The teaching responsibilities are shared by professors on the art history faculty so that the course offerings vary each year according to the specialties of the directors, which include Ancient Etruscan and Roman art, Late Medieval and Early Renaissance art, the later Quattrocento and the High Renaissance, and the Late Renaissance and Mannerism.

Inquiries regarding the art history program in Italy may be directed to the Department of Fine Arts or the Office of International Education.

Other programs, such as Art History in India are arranged by the department in conjunction with the Office of International Education.

Exhibitions Program. The department sponsors exhibitions from its own collections and from those of museums, collectors, and galleries throughout the country. The exhibitions are held in the Fine Arts Gallery in Henderson Museum and in the gallery in the Fine Arts Building. The exhibition schedule includes a summer show of contemporary art.

Visiting Artist Program. The department brings to the campus distinguished, nationally known artists throughout the academic year. The program provides opportunities for the student to attend lectures, slide

presentations, and seminars conducted by the artists.

Slide Library. An extensive collection of slides representing art from prehistoric to modern times is maintained for student and faculty use by the Department of Fine Arts. This collection is especially strong in the areas of North American, European, Asian, Pre-Columbian, Islamic, Oceanic, and African art.

Permanent and Thesis Collections. The Department has an extensive collection of old master prints and drawings, paintings, sculpture, and photographs. Art history graduate students use this collection for research.

A collection of thesis work donated by M.F.A. candidates from their thesis shows also is owned by the department.

GRADUATE DEGREE PROGRAM

Prior to admission, candidates for advanced degrees in the Department of Fine Arts, with the exception of candidates for the Master of Arts (history of art) degree, must submit slides showing at least 10 examples of their creative work. Acceptance in the program is based on an evaluation of these as well as a review of undergraduate scholastic achievement.

Students wishing to pursue work in fine arts leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. Following are special departmental requirements.

Master of Arts Degree (Art Education)

Prerequisites. The following are required for graduate work:

1. The baccalaureate degree in art or art education from an approved college or school of art.
2. At least 34 semester hours of acceptable work in art, including a background course in the history of art.
3. Some teaching experience should precede beginning graduate study, but experience may be obtained during the period in which one is studying for the master's degree. A teacher certification program may be pursued concurrently with the master's program.
4. A satisfactory score on the Graduate Record Examination.

Course Requirements. Not fewer than two semesters of acceptable graduate work, amounting to a total of at least 24 semester hours beyond a bachelor's degree, are required. Of this total at least 18 hours must be in the major field, with 6 hours devoted to a minor in an approved academic area. A minor must be approved early in the graduate program. The student must include in the 18 hours of art a minimum of 6 hours in F.A. 564 (Seminar in Art Education). Four hours in F.A. 700 (Master's Thesis) may also be required.

Students should expect that the total number of hours for the degree may be in excess of the minimum.

Examinations. A written comprehensive-final examination of approximately 3 hours in the fields of art education, history of art, and general theory of art must be taken not more than one semester in advance

of the graduation date. After acceptance of the written thesis, the candidate may be required to present at the end of his final semester an exhibition of original creative work completed during the student's graduate study. This exhibition may form part of the final oral examination.

Thesis. The M.A. thesis may be in two parts: (1) a written thesis dealing with a definite topic related to the field of art education, and (2) a creative thesis made up of original works of art, which demonstrates the student's competency in studio work. The written and creative part of the thesis may or may not be directly related to one another.

Under certain circumstances, and with prior approval of the art education faculty, the exhibition and creative thesis may not be required.

1. The subject for the written thesis must be approved by the designated faculty adviser and must comply in mechanical features with the specifications of the Graduate School.

2. If creative work is part of the thesis and of the final oral examination, it may come from the fields of painting, drawing, sculpture, printmaking, ceramics, jewelry, or photography. From this exhibition the thesis committee will select work to be retained for the permanent collection of the University. Full-page black and white photographs of the creative thesis will accompany the written thesis in accordance with departmental rules, and the actual objects will remain in the permanent possession of the University.

3. With the specific approval of the art education faculty, the student may substitute a non-thesis research study for the written thesis requirement. Either a thesis or research study proposal must be presented for approval at least one semester prior to the expected date of graduation; the proposal must be submitted in a form established by the art education faculty.

Master of Arts Degree (History of Art)

Prerequisites. The following are required for graduate work:

1. A baccalaureate degree from an approved college with a minimum cumulative grade-point average of at least 3.0.

2. A satisfactory score in the Graduate Record Examination.

3. A broad general background in history, literature, and philosophy as well as at least two semesters of art history survey or its equivalent.

Qualifying Examination. A written examination will be given to each accepted candidate within two months of entering the graduate program. This will cover the field of western art history at the elementary level, whatever the student's intended eventual specialization. The results of the examination will serve as a partial guide to advising students in their course work and may result in additional course requirements above the minimum listed below. In cases where the examination is clearly inadequate, the student may be required to retake it at a later date. If the

second examination is unsatisfactory, the student will be dropped from the program.

Course Requirements. At least three semesters of acceptable graduate work, of which two semesters must be spent in residence, are required. This degree may not be obtained through summer residence alone. A minimum of 30 semester hours is required, of which 18 hours (including F.A. Hist. 649, Tools of Research, to be taken the first term) must be in the field of art history, and a minimum of 6 hours in a minor field or fields to be determined by the needs of the student in preparing his thesis. Twelve hours must be at the advanced (500) level, including at least 6 hours of seminars.

Examinations. All degree candidates will be given a written comprehensive examination approximately six hours in length. After acceptance of the final draft of the thesis, an oral examination will take place dealing with the subject matter of the thesis and any areas of weakness which may have been found in the written comprehensive.

Thesis. See thesis requirements under Master of Arts and Master of Science in the Graduate School section of this catalog. Plan II, an alternate to the thesis, is not an option in the graduate program in art history.

Master of Fine Arts Degree

The work offered for this professional degree is designed to provide superior preparation for those whose aim is professional work in the field of art.

Prerequisites. The following are required for graduate work:

1. The Bachelor of Arts or Bachelor of Fine Arts degree from an approved college or school of art.

2. At least 34 semester hours of acceptable work in art, including a background course in the history of art.

Course Requirements. Not fewer than four semesters of acceptable graduate work, amounting to a total of at least 54 semester hours beyond a bachelor's degree, are required (see exception below). At least 38 hours must be completed at the Boulder Campus. All fine arts courses must be at the 500 level or above. F.A. 603 plus 3 hours of art history, or 6 hours of art history, must be taken with 8 credit hours in nonstudio areas. Nonstudio areas of study are construed to be courses in the history of art, criticism, and art seminars and must be at the 500 level if taken in the Department of Fine Arts; courses taken outside the department may be at the 400 level or above. Photography students must enroll in graduate photography, F.A. 519, each semester. Courses will be elective and chosen in consultation with the student's adviser. In some cases, however, the department may prescribe certain courses on the basis of the student's performance in the first-year review described below.

Exception: Printmaking graduate students are expected to complete a three-year, 60-hour program. All basic requirements must be completed during the first

two years so the final year may be devoted exclusively to work on the student's creative thesis.

Upon admission, each student is assigned an adviser from the student's specialization. The student will select a different adviser by the end of the first year of graduate work.

At the end of the first year the work of each student will be reviewed by a committee of the graduate faculty. At the time of this review students will be required to submit to the committee (1) examples of their studio work and (2) a written statement concerning their nonstudio work. On the basis of this review the committee will determine whether the student may continue in the program and will identify specific requirements for further work in both studio and non-studio areas.

The first-year review for printmaking students will take place at the end of the student's third semester. At that time, the student may petition to complete the program in two years. This would be granted only if the student shows an exceptional aptitude as a productive, creative artist.

If a student wishes to take related work in art education and to qualify for art education teaching at the college level, the candidate must fulfill all prerequisites required for the Master of Arts (art education) degree. All of the work may be done in residence and the last year must be spent in residence. If the first year is not in residence, approval should be secured in advance.

M.F.A. Thesis Requirement. M.F.A. degree candidates must enroll in F.A. 750 (Master of Fine Arts Creative Thesis) during the final semester and must present a critical essay concerned with their own creative work as a part of this course. The essays must be accompanied by photographs of work selected from the creative thesis exhibition by the thesis committee and must be presented in a form consistent with requirements for the written thesis as specified by the Department of Fine Arts.

M.F.A. Creative Thesis. M.F.A. creative thesis work presented in partial fulfillment for the degree may have been produced earlier in the candidate's program as well as during his creative thesis enrollment. It must take the form of original creative work of acceptable professional standards in the student's primary field of study, i.e., ceramics, drawing, jewelry design, painting, photography, printmaking, or sculpture.

Presentation of this work will take place in a thesis exhibition held at a time concurrent with the oral examination. From this exhibition the thesis committee may retain work for the permanent collection of the University. The candidate must furnish a set of 6 to 10 slides for the departmental slide collection made from work chosen for this purpose by the thesis committee chairman.

Credit by Transfer. Credit, not to exceed 16 semester hours, may be approved for transfer from an institution of approved standing toward the professional degree M.F.A., which requires at least two years of work beyond the bachelor's degree.

FRENCH AND ITALIAN

Office in Main building, Room 107
Professor Andr e Kail, Chairman

French

Students who have completed a Level III high school French course have automatically satisfied the college graduation requirement in foreign language. This requirement may also be satisfied by completion of Fr. 201 or 211 or by demonstration of equivalent proficiency by placement test. Students who have studied French in high school and who wish to continue with the language will be placed according to their high school record and verbal SAT and/or ACT scores. A student normally may not receive credit for a course at a lower level than that into which he is placed. Exceptions are determined through consultation with the department.

BACHELOR'S DEGREE REQUIREMENTS

Students majoring in French must complete 35 hours beyond the first year. Students presenting four years of high school French for admission must complete 30 hours beyond the second year. Required courses are Fr. 211-212, if applicable, 301-302, 305 or 306 or upon consultation, 311-312, 401-402, plus 9 hours of literature/civilization or linguistics courses at the 400 level. A distributive major in Business French is also available. Courses at the 400 level are closed to freshmen.

Students majoring in French may not take any of their major requirements *pass/fail*.

For students interested in study abroad, the University of Colorado offers a year-long study abroad program at the University of Bordeaux, a semester program in Rennes, France, and a semester program in Chamb ry for near-beginners. Further information is available from the Office of International Education. The Ayer Romance Language Scholarship is available through the department for application toward study abroad programs.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in French leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. Also, a graduate teaching exchange is available to students who have earned a master's degree.

Master's Degree

Prerequisites. The following are prerequisite to graduate study in French:

1. A reading, speaking, writing, and auditory comprehension ability in French (all candidates must have a reading knowledge of one foreign language in addition to the major language).

2. A general knowledge of French literature and civilization.

Prerequisite for a Minor in a Foreign Language. Two years of college work or the equivalent, a course in conversation, and some knowledge of the literature and civilization of the country or countries concerned.

Required Courses. The department allows students to specialize in literature, in linguistics, or in teaching. Each of these tracks differs somewhat from the others in its requirements. See the department's guidelines for M.A. candidates.

Examinations. Graduate Record Examination required for admission; final examination (conducted partly in French) on the areas covered in the student's program (see M.A. memorandum and reading lists).

Doctor's Degree

Prerequisites. Excellence in reading, speaking, writing, and auditory comprehension in French; a general knowledge of French literature and civilization. Reading knowledge of two other foreign languages.

Required Courses. The department allows students to specialize in literature or in linguistics. Each track differs from the other in its requirements. See the department's guidelines for Ph.D. candidates.

Language Requirement. A reading knowledge of a modern foreign language other than that used for the Graduate School communication requirement. This language may be one of the following: German, Spanish, Italian, Russian; other languages will be considered depending upon the student's area of research.

Proficiency will be tested by a reading examination administered by the appropriate language department at this University.

Italian

Students who have completed a Level III high school Italian course have automatically satisfied the college graduation requirement in foreign language. This requirement may also be satisfied by completion of Ital. 211, or by demonstration of equivalent proficiency. Students who have studied Italian in high school and who wish to continue with the language will be placed according to their high school record and verbal SAT and/or ACT scores and interview. Students may not receive credit for a course at a lower level than that into which they are placed.

Students interested in study abroad will find further information under the section on Special Educational Opportunities. The Ayer Romance Language Scholarship is available through the department for application toward study-abroad programs. A junior year abroad program in Bologna and a semester program in Siena are available. For further information students may inquire at the Office of International Education.

For comparative literature and linguistics courses with Italian emphasis, see those sections.

BACHELOR'S DEGREE REQUIREMENTS

The primary goals of the undergraduate Italian major program are to provide a mastery of the language skills (listening, speaking, reading, writing) and to promote an understanding of the Italian literary and cultural tradition within Western civilization. At the same time, the major provides the necessary background for advanced professional study and specialization.

Students wishing to major in Italian are required to have a thorough advising session with the Italian program undergraduate adviser. In this session the student's program of study will be outlined in detail. Students are required to see the undergraduate adviser in the event that any of their major courses are cancelled so that substitutions and revisions in their programs can be made. The department will not approve a major in Italian unless the student has been advised by the undergraduate adviser.

Students will be offered the option of a senior seminar for 1 credit hour in which direction and advising will be given in order to fill in gaps in their studies.

Students majoring in Italian may not take any of their major requirement courses *pass/fail*.

A student is required to complete 30 credit hours of course work *beyond* the first year of Italian with a 2.0 average or better. A student may not take more than 45 credit hours in Italian (including the first year).

GRADUATE DEGREE PROGRAM

Master's Degree

Prerequisites. The following are prerequisite for graduate study in Italian: (1) a reading, speaking, writing, and auditory comprehension ability in Italian (all candidates must have a reading knowledge of one foreign language in addition to the major language); (2) a general knowledge of Italian literature and civilization.

Prerequisites for a Minor in a Foreign Language. Two years of college work or the equivalent in the minor language, a course in conversation, and some knowledge of the literature and civilization of the country or countries concerned.

Required Courses. One course in Italian linguistics or Romance linguistics, and Ital. 600, Bibliography and Research Methods.

Minor Field. A minimum of two courses. French language and literature or Spanish language and literature are preferred. Also accepted are Latin language and literature, German, Russian, comparative literature, general linguistics, English, Greek, music, fine arts, philosophy, or history.

Language Requirement. A reading knowledge of a classical or modern foreign language: Latin, ancient Greek, French, German, Portuguese, Russian, or Spanish. Language proficiency should be demonstrated as nearly as possible after entering the degree program.

Examinations. Qualifying examinations (first semester of residence) on the prerequisites for

graduate study in Italian; comprehensive-final examination (conducted partly in Italian) on the literature and linguistics, specific subjects pursued, and the thesis (for Plan I students).

GEOGRAPHY

Office in Guggenheim Building, Room 110
Professor M. John Loeffler, Chairman

BACHELOR'S DEGREE REQUIREMENTS

In addition to the college requirements, students majoring in geography shall successfully complete the following regularly scheduled courses or their equivalents: Environmental Systems—Climate and Vegetation (Geog. 100) and Environmental Systems—Landforms and Soils (Geog. 101), Introduction to Human Geography (Geog. 199), World Geographic Problems (Geog. 200) and two of the following: Geographical Techniques (Geog. 301), Cartography I (Geog. 305), Map Interpretation and Intelligence (Geog. 306), Introduction to Quantitative Methods in Human Geography (Geog. 401), Statistics for Earth Sciences (Geog. 402), Geographic Interpretation of Aerial Photos (Geog. 406), Introduction to Remote Sensing (Geog. 409), Research Seminar (Geog. 417).

In addition, majors are expected to have or to achieve a reasonable level of competence in clearly conveying their ideas and perceptions. Basic skills in one or more (preferably more) communications methods—written, oral, symbolic, or graphic—are considered an essential part of a university student's intellectual attainment. Students exhibiting deficiencies in writing, speaking, mathematics, statistics, or graphics will be urged by their professors to take appropriate remedial action.

Distributed majors selecting geography as a primary or secondary subject should consult with the departmental undergraduate advisers. Distributed majors selecting geography as a primary subject shall complete those geography courses identified as departmental requirements plus any other departmental offering relevant to their total program consisting of a minimum of 30 credit hours in geography.

Distributed majors with geography as a secondary subject shall complete Environmental Systems—Climate and Vegetation (Geog. 100) and Environmental Systems—Landforms and Soils (Geog. 101), Introduction to Human Geography (Geog. 199), and World Geographic Problems (Geog. 200).

Students should consult the departmental office for further information and referral to departmental advisers.

GRADUATE DEGREE PROGRAMS

The sections of this catalog concerning Graduate School general, admissions, thesis, degree, etc., requirements should be read carefully. The following are departmental requirements.

Prerequisites. For admission without deficiency, the minimum requirements are approximately 20

semester hours of geography, including one year of introductory physical geography and introductory human geography. Quantitative skills (mathematics, statistics, computer) are important, and graduate students are encouraged to have some background in college mathematics and statistics. For general background, it is desirable that the student have formal courses in at least two of the following subjects: anthropology, biology, economics, geology, history, mathematics, physics, political science, or sociology.

Students applying for admission are required to have taken the Graduate Record Examination Aptitude Test. Normally students are admitted at the beginning of summer and fall semesters only.

Master's and Doctor's Degrees

All incoming graduate students are required to consult with a departmental adviser to outline their academic program and to carefully review the departmental requirements for either the M.A. or Ph.D. degrees. Specific degree requirements are obtainable upon request to the department.

The department's minimum language requirement is the same as the Graduate School's minimum foreign language requirement. It is possible that more than minimum proficiency may be required for library and/or field research. In any case, the choice of the language(s) must be approved by the student's advisory committee.

Specific Course Requirement. Entering graduate students are required to take at least three graduate-credit courses or seminars with three different instructors during their first semester of residence.¹ One of these courses must be in human geography and one must be in physical geography. The group of three or more instructors involved will automatically constitute the student's Preliminary Evaluation Committee; if the student's adviser is not one of these three instructors, the committee shall be expanded to include the adviser. At the end of the semester, the Preliminary Evaluation Committee will decide (1) whether the student is approved to continue studies toward an advanced degree, and (2) what deficiencies if any, need to be removed. They will also recommend the method (courses, readings, papers, examinations) and the deadline by which any such deficiencies are to be removed.

As in the past, the Graduate Admissions Committee will exercise its authority and identify clear deficiencies in an applicant's credentials in general human and physical geography and other appropriate background areas. The committee will require appropriate remedial action if the student is to be admitted. These stipulations will become part of the student's permanent file and must be completed by no later than the end of the first academic year of residence if the student is to continue in the program. The entering student has the option of taking a

¹In those rare instances in which a new graduate student has a full-time job (such as teaching in the public school system) and cannot take three courses in the first semester of residence, the same evaluation rules will apply, but only after the student has had a chance to take the requisite three courses.

diagnostic written examination in order to remove any deficiencies.

GEOLOGICAL SCIENCES

*Office in Geology Building, Room 205A
Professor Don Eicher, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

Undergraduate students majoring in the geological sciences may select one of six curriculum options, depending upon their interests and objectives. General Geology (Geol. 207-208) is required for all majors; other course requirements in geology, chemistry, physics, biology, and mathematics depend upon the option selected. Information on the curriculum options may be obtained from the departmental office.

GRADUATE DEGREE PROGRAMS

Students interested in graduate work in the geological sciences should read carefully the detailed information regarding admission, registration, and degree requirements that is available from the departmental office. A brief summary follows.

All students applying for admission must take the Graduate Record Examination. Results of this examination will be used both for determining admittance and for initial academic counseling.

Entering students will normally have completed at least 24 semester hours of basic courses in geological science, and two semesters each of chemistry, physics, and calculus. In some cases, exceptional undergraduate preparation in other fields of science, mathematics, or engineering will substitute for part of the 24 hours in geological science.

Initial counseling will be provided on an individual basis by the departmental Committee on Academic Progress. Thereafter each student will acquire an advisory committee which will provide guidance throughout the degree program.

Master's Degree

Candidates for the master's degree in geological sciences must complete at least 24 semester hours of course work numbered 500 or above, including a thesis (Plan I), or 30 semester hours in courses numbered 500 or above without a thesis (Plan II). The Plan II program requires at least three hours of Geol. 699 under the supervision of the advisory committee, or five hours of Geol. 562 (Field Vertebrate Paleontology). Upon the recommendation of the advisory committee, a student may substitute up to 12 hours of course work taken in related outside departments, including courses numbered below 500.

Doctor's Degree

Candidates for the doctoral degree must complete at least 30 semester hours in course work numbered 500 or above, of which at least 20 must be taken at UCB. In addition to course work, candidates must take 16 hours minimum to 24 hours maximum of 800 thesis credit.

Doctoral candidates are required to demonstrate second-year college proficiency in a foreign language of their choice.

GERMANIC LANGUAGES AND LITERATURES

*Office in McKenna Building, Room 129
Assistant Professor Robert Firestone, Chairman*

Students who have studied German in high school and wish to continue with the language will be placed according to their high school record and verbal SAT and/or ACT scores. The general rule is that one level in high school is the equivalent of one semester in college. Students who are not certain where they should be placed should consult the department.

The academic program may be supplemented by residence on the German Floor of the Language House, located in the Williams Village dormitories. Language House participants may earn 2 hours of credit in the College of Arts and Sciences each semester.

The department sponsors two programs in Germany for undergraduate students. Students with approximately one semester of college German or the equivalent may apply for a one-semester program in Berlin, earning up to 15 hours in German language and civilization courses. Students with at least four semesters may apply for a Junior Year Program in Regensburg, Federal Republic of Germany. Further information on these programs may be obtained from the Office of International Education.

Each summer the department sponsors a program in Aspen, Colorado, entitled Literature and Music: Towards a Definition of Culture. Participants must register through the University of Colorado at Boulder for both Ger. 484 (Literature and Music) and Ger. 485 (Music and Humanities). Both courses are in translation, and each carries 3 hours of credit. The Aspen program is designed to consider the relationship between literature and music, integrating the many cultural offerings of Aspen.

BACHELOR'S DEGREE REQUIREMENTS

The primary goals of the undergraduate German major program are to provide a mastery of the language skills (understanding, speaking, reading, writing) and to promote an understanding of the German literary and cultural tradition within its place in Western civilization. The German major is thus a liberal arts major. At the same time the major provides the necessary background for advanced professional study and specialization.

The German major will normally present a minimum of 35 semester hours from the courses listed in the Course Description section of this catalog; however, the minimum number of hours will be 30 if all the hours are at the 300-level or above. Courses at the 100 level will not be counted toward the 35 hours. Majors must take at least one departmental 400-level course on the Boulder Campus.

German literature and culture courses in English translation normally do not count toward the 35 hours. However, majors may arrange with their respective instructors and the major adviser to supplement the course work by reading the material and writing papers in German, in which case major credit may be granted.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in Germanic languages and literatures leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section, and the departmental memoranda for the M.A. or Ph.D. degree.

Master of Arts

Prerequisites. For students seeking admission to the M.A. program in German the following are required.

1. The ability to speak, read, and write German and to comprehend spoken German.
2. Some knowledge of the main currents and masterpieces of German literature and civilization.
3. A reading knowledge of one foreign language other than German. Students lacking such knowledge when entering the program must demonstrate that they have made up this deficiency by passing an examination or by completing appropriate course work in a foreign language before they can be admitted to candidacy for the M.A. degree.

Specialization. The program is designed to provide a broad, general knowledge of German literature and linguistics, but it is possible to choose elective courses to provide greater depth in literature, linguistics, or language instruction in the secondary schools, or related fields outside this department.

Examinations. For information concerning qualifying and comprehensive examinations and the master's thesis, consult the departmental memorandum for M.A. candidates.

Doctor of Philosophy

Prerequisites. For students seeking admission to the doctoral program in German the following are required:

1. Excellence in the German language and a broad knowledge of German literature and civilization. This usually means the M.A. in German, with a thesis, or a comparable level of university training.
2. Reading knowledge of two foreign languages other than German. Students entering the program with a deficiency in this requirement must demonstrate that they have made it up by passing an examination or by completing appropriate course work in a foreign language before they can be admitted to candidacy for the Ph.D. degree.

Specialization. At this time the department is not accepting applications from candidates who wish to specialize in Germanic linguistics; doctoral candidates must specialize in German literature.

Related Fields. The department does not require studies in a related field, but students are encouraged to broaden their knowledge by taking appropriate courses outside the department in consultation with the graduate adviser or the chairman of their graduate examination committee.

Examinations. For preliminary and comprehensive examinations and the doctoral dissertation, consult the departmental memorandum for Ph.D. candidates.

HISTORY DEPARTMENT

Office in Hellems Building, Room 204
Professor George Pilcher, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Students majoring in history must complete a minimum of 30 hours, 16 of which must be upper division with a grade of C or better. A student must have a grade-point average of 2.0 or better in the major to graduate.

The following courses or options are required:

1. Hist. 101 and 102, or any two 200-level courses in ancient or European history. Either semester of Western Civilization may also be combined with a 200-level course in ancient or European history.
2. Hist. 151 and 152 or any two 200-level courses in American history. Either semester of Hist. 151-152 may also be combined with a 200-level course in American history.

Hist. 103-104 may be substituted for Hist. 101-102, or any two 200-level courses in Asian and Middle Eastern history, or a combination of either semester of 103-104 with a 200-level course in Asian or Middle Eastern history.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in history leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section. Following are special departmental requirements. Additional information should be obtained from the Department of History.

Master's Degree

Prerequisites. As general preparation for graduate work in history, it is desirable that a student have had undergraduate courses in government, geography, and economics as well as a major in history. Candidates for graduate degrees may be required to pursue such fundamental courses in history as the department deems necessary to provide a suitable historical background.

For purposes of admission to the graduate program the verbal portion of the Graduate Record Examination is required and a score in the 80th percentile or above shall normally be required for admission. The department also encourages students to take the advanced history test of the GRE which, if submitted, will be used in conjunction with other materials pertinent for admitting graduate students.

Residence. While it is possible to obtain the M.A. degree in two full semesters of residence, it is frequently advisable and at times necessary that more time be spent in graduate work.

Degree Requirements. A total of 24 semester hours of course work plus 4 to 6 hours in M.A. Thesis, or 30 semester hours of course work without a thesis is required for the degree. The required qualifying examination is met by a satisfactory score on the Graduate Record Examination. A comprehensive examination must be passed in the major field of concentration before the degree is granted. Candidates should request from the Department of History the set of instructions for M.A. candidates.

Doctor's Degree

Prerequisites. Students who wish to work toward the Ph.D. degree in history must indicate familiarity with certain fields of history, acquaintance with the fundamental tools of historical scholarship, and the ability to do original work. The Departmental Preliminary Evaluation for the Ph.D. program shall be the successful completion of the M.A. degree (or its equivalent) and the positive recommendation of the Graduate Admissions Committee that the student be admitted to the Program.

Residence. At least three years of graduate study, two of which must be spent in residence, are required for the Ph.D. degree.

Degree Requirements. The number of credit hours required of each candidate is determined by the dean of the Graduate School on the recommendation of the Department of History. One language is required; students should be able to use those languages essential to research and advanced study in their respective fields.

A comprehensive written and oral examination, a dissertation which is an original contribution to knowledge, and an oral examination on the dissertation must be successfully completed. Candidates should request from the Department of History the set of instructions for the doctoral candidates.

HONORS PROGRAM

Office in Norlin Library,
Professor Walter Weir, Program Chairman

The Honors Program of the College of Arts and Sciences is designed to help interested and especially able students to close major gaps in their educations, to achieve higher quality work in their fields of specialization, and to plan their curricula of liberal studies.

The Honors Program is also responsible for determining which students merit the award of the bachelor's degree with honors: *cum laude*, *magna cum laude*, and *summa cum laude*. These awards are made on the basis of special honors work and not simply on the basis of grades earned in courses.

All students interested in graduating with honors should report to the Honors Office by October 1 if they

are graduating in the spring and by May 1 if they are graduating in the fall.

A student may participate in either departmental honors or general honors, or both. *Departmental honors* may require a junior or senior honors seminar, an independent research project, and/or directed readings. Each department has information pertaining to its own particular program. *General honors* is designed to help students explore areas outside their major fields and to broaden the basis of their liberal education. Each semester, some 35 honors courses in a wide variety of areas are offered; each course is limited to an enrollment of 12 students. There are no examinations, and no letter grades are awarded, only the marks *H* (honors), *P* (pass), or *F* (fail).

With a few specific exceptions, Honors courses do not count toward area requirements for the bachelor's degree nor toward requirements for the major.

Detailed information concerning the Honors Program may be obtained in the Honors Office in Norlin Library, either in person or by mail. Application for admission to the Honors Program can also be made in the Honors Office. Freshmen are accepted for honors work on the basis of achievement in high school; students currently enrolled are accepted on the basis of academic achievement at the University of Colorado. While honors students are expected to have a grade-point average of at least 3.0, no student who shows ability and promise is excluded from consideration.

HUMANITIES

Office in Ketchum Building, Room 128
Assistant Professor James Palmer, Program Chairman

The humanities major is structured on an interdisciplinary approach to the arts. In addition to taking courses which combine the study of literature, music, and the visual arts, all students must do work in depth in the literature of a single language. Beyond these requirements students may select a secondary field of concentration as listed below. Since the program is tailored as much as possible to the individual student's interests, majors should see their departmental adviser each semester. Departmental advisers for the major are Professors Palmer and Hill. Early completion of the foundation course, Hum. 101-102, is essential.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.
2. A total of 63 semester hours distributed as follows:
 - a. 12 hours: introduction to Humanities (Hum. 101-102).
 - b. 12 hours: upper division humanities courses.
 - c. 24 hours: language/literature courses. These must be within a single language—English or a foreign language, either ancient or modern. First-year courses in a foreign language cannot be counted. Literature courses where

material is studied in translation cannot be counted as meeting requirements, though they may be recommended as electives.

d. 15 hours: courses chosen from any one of the following with approval of the humanities major adviser. These 15 hours may not include more than 6 hours of studio or "practice" courses.

- (1) A second language/literature (*not* courses with material studied in translation). Not more than 6 hours of a beginning course may be counted.
- (2) Fine arts.
- (3) Music.
- (4) Dance.
- (5) Theatre.

INDIVIDUALLY STRUCTURED MAJOR

The individually structured major is designed by the student during the sophomore year in consultation with a three-member faculty advisory committee. It must be approved by the dean of the College of Arts and Sciences, and once approved, it may be amended only with approval of the student's committee and the dean. The proposal must include a Senior Thesis (A.S. 450) for a maximum of 6 semester hours of credit. Guidelines and proposal applications, as well as advising, are available in the Office of Innovative Education, Hellems 151.

INTEGRATED STUDIES

Office in Ketchum Building, Room 128
Professor Richard J. Schoeck, Chairman

The Department of Integrated Studies creates and offers interdisciplinary courses and programs in the major areas of learning: biological sciences, humanities, physical sciences, and social sciences. It also sponsors interdisciplinary courses, taught by faculty of other departments in the college.

INTERNATIONAL AFFAIRS

Office in Ketchum Building, Room 103
Professor George Coddling, Program Chairman

With the increasing involvement of the United States in world problems, opportunities in government, business and international organization have expanded enormously. Today there is need for young people with strong backgrounds in international affairs. To meet this need the University of Colorado offers a comprehensive and flexible interdisciplinary program leading to the degree Bachelor of Arts in international affairs.

BACHELOR'S DEGREE REQUIREMENTS

In addition to the general college requirements for the Bachelor of Arts degree, the major in international affairs requires the following:

1. Requirements:

- a. *General*—45 hours (30 upper division and 30 of grade C or better), distributed as follows (*none* may be taken pass/fail):

	Semester Hours
Anth. 451. Applied Cultural Anthropology	3
Econ. 201-202. Principles of Economics	6
Econ. 441. International Trade	3
Econ. 442. International Finance	3
Econ. 471. Comparative Economic Systems	3
or	
Econ. 477. Economic Development	3
Geog. 471. Political Geography	3
Hist. 432. Twentieth-Century Europe	3
Hist. 468. U.S. Diplomatic History Since 1900	3
or	
P.Sc. 423. American Foreign Policy	3
P.Sc. 100. Introduction to Political Science	3
P.Sc. 110. American Political System	3
P.Sc. 201. Introduction to Comparative Politics I: Developed Political Systems	3
or	
P.Sc. 202. Introduction to Comparative Politics II: Developing Political Systems	3
or	
P.Sc. 203. Introduction to Asian Politics	3
P.Sc. 421. International Politics	3
or	
P.Sc. 428. International Behavior	3
P.Sc. 425-426. International Law and Organization	6

b. *Area*—12 hours of upper division courses concentrating on the whole or part of a region outside the U.S. (principally, but not exclusively, Africa and Middle East, Asia, East Europe and the Soviet Union, Great Britain and the Commonwealth, Latin America, and Western Europe). *None* may be taken pass/fail.

c. *Language*—A third-year proficiency in a foreign language appropriate to the area of concentration. This requirement may be met (1) by completion of two third-year grammar courses in the language or (2) by a certification by the appropriate department of such competence.

2. Recommendations:

- a. Students should choose electives with a view to their relevance to this program.
- b. During the semester prior to graduation, programs of students majoring in international affairs must be approved by the chairman of the Committee on International Affairs.
- c. Students in the International Affairs Program are encouraged to consider the possibility of participating in one of the study abroad programs directly or indirectly affiliated with the University of Colorado. The student wishing to participate in such a program should contact his adviser and the chairman of the Committee on International Affairs to work out an appropriate program. Some variation in the general requirements will be permitted in these cases.

The specific courses that may be counted to meet the requirements in this program are determined by

the Committee on International Affairs and the dean of the College of Arts and Sciences.

LATIN AMERICAN STUDIES

Office in Hellems Building, Room 84
Assistant Professor James R. McGoodwin,
Program Chairman

Colorado's close proximity to Mexico and the long-standing mutual influences of the United States and Latin America make Latin American Studies a timely and interesting field. The Latin American studies program offers a broad and flexible interdisciplinary approach designed to provide a comprehensive rather than narrow, single-discipline understanding of Latin America. The curriculum leads to the Bachelor of Arts degree with a major in Latin American studies.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.

2. A demonstrated proficiency in Spanish or Portuguese (successful completion of at least one upper division Spanish or Portuguese course).

3. At least 48 hours in courses pertaining to Latin America, to be distributed among as many of the following fields as possible: anthropology, art history, economics, geography, Hispanic literature, history, and political science. No more than 24 hours in one department may count toward the major. Majors are encouraged to include a study-abroad semester or summer (at Jalapa, Mexico, San Jose, Costa Rica, or Lima, Peru) in their academic programs.

4. The senior seminar in Latin American studies 498, normally given during the fall semester.

5. All schedules for students majoring in Latin American studies must be approved by the adviser of the program. Prospective majors in Latin American studies should consult with the adviser at the first opportunity.

6. The specific courses that may be counted to meet the requirements in this program are determined by the committee on Latin American studies and the dean of the College of Arts and Sciences. In addition to the courses listed below, special offerings in the honors program, experimental studies, comparative literature, etc., may also be applied with the adviser's consent.

Other related courses may be counted toward the major in Latin American studies with the approval of the adviser.

	<i>Semester Hours</i>
Anth. 227. New World Archaeology	3
Anth. 342. Peoples and Cultures of Latin America	3
Anth. 421. Southwestern Archaeology	3
Anth. 422. Archaeology of Mexico and Central America	3
Anth. 449. Peasant Societies and Revolutions	3
Anth. 462. Ethnography of the American Southwest	3
Anth. 463. Ethnography of Mexico and Central America	3
Anth. 467. Ethnography of South America	3
C.Lt. 464. International Literary Relations; The United States and the Hispanic World	3

Econ. 486. Economic Development and Income Distribution	3
F.A. Hist. 471. Pre-Columbian Art	3
F.A. Hist. 472. North American Indian Art	3
F.A. Hist. 473. Latin American Art	3
Geog. 381. South America	3
Geog. 382. Mexico, Central America, and the Caribbean	3
Hist. 281. History of Latin America: The Colonial Experience	3
Hist. 282. History of Latin America: The National Experience	3
Hist. 383. Rural Societies of Mexico, 1800-Present	3
Hist. 384. The Cuban Revolution	3
Hist. 385. Latin America: Dependency and Development in the 20th Century	3
Hist. 483. Brazil and Argentina Since Independence	3
Hist. 484. The Andean Countries Since Independence	3
Hist. 485. History of Spain	3
L.Am. 495. Interdisciplinary Seminar in Latin American Studies (offered periodically)	3
L.Am. 498. Senior Seminar in Latin American Studies (required of majors)	3
L.Am. 499. Independent Study	1 to 3
P.Sc. 413. Latin American Political Systems	3
P.Sc. 477. Latin America in World Affairs	3
P.Sc. 512. Seminar: Politics of the Western Hemisphere	3
P.Sc. 513. Seminar: Latin American Politics	3
Port. 211, 212. Second-Year Reading and Conversation	6
Port. 311. Main Currents of Portuguese Literature and Civilization	3
Port. 312. Main Currents of Brazilian Literature and Civilization	3
Port. 403, 404. Introduction to Luso-Brazilian Civilization	6
Port. 411, 412. Survey of Brazilian Literature	6
Port. 415, 416. Survey of Portuguese Literature	6
Port. 451, 452. Contemporary Brazilian Prose Fiction	6
Port. 499. Independent Study	1 to 3
Soc. 481. Family Planning and Population Control	3
Span. 211, 212. Second-Year Spanish	6
Span. 334. Twentieth-Century Spanish-American Novel and Essay	3
Span. 335. Spanish-American Novel and Essay to the 20th Century	3
Span. 336. Spanish-American Poetry and Short Story	3
Span. 412. Women in Spanish-American Literature	3
Span. 420. Hispanic Culture	3
Span. 422. Mexican Literature	3
Span. 431. Spanish-American Literature: Independence through Romanticism	3
Span. 441. Modernism	3
Span. 451. Contemporary Spanish-American Novel	3
Span. 556. Spanish-American Theatre	2
Span. 650. Spanish-American Poetry from Modernism to the Present	3

Certificate in Latin American Studies

A certificate is awarded to students who have demonstrated strong preparation in Latin American studies accompanying a major in another area. Students who satisfy the following requirements are eligible for the certificate in Latin American studies:

1. A demonstrated proficiency in Spanish or Portuguese (successful completion of at least one upper division Spanish or Portuguese course.)

2. At least 24 hours in courses pertaining to Latin America with not more than 9 hours applicable from any one department.

3. L.Am. 495 or 498.

LINGUISTICS

Office in Woodbury Building, Room 403
Associate Professor Allan Taylor, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Majors in linguistics must complete certain specific courses in general linguistics and closely allied fields, plus a minimum number of additional hours in a language related area (or areas) of emphasis. Students should choose the area (or areas) of emphasis in consultation with the undergraduate adviser. A student may elect to work in any number of areas of emphasis. The intention of the areas of emphasis is to permit the student to sample the broad range of contemporary linguistics as well as to prepare for graduate study in a particular area of linguistics, if this is the student's wish. Note that the Department of Linguistics reserves the right to guide students as to electives and to refuse to certify programs which have not had prior approval.

Requirements

1. Satisfaction of the regular college requirements for the Bachelor Arts degree.
2. Completion of a minimum of 15 hours (excluding introductory courses) of study of a natural language which is not native to the student.
3. Completion of any courses which are prerequisite to courses in the area (or areas) of emphasis selected by the student.
4. General linguistics: completion of the following courses with a grade of C or better.

	<i>Semester Hours</i>
Ling. 300. Introduction to Linguistic Science	3
Ling. 330. Linguistic Analysis	3
Ling. 401. The Nature of Grammars	3
Ling. 424. Survey of the History of Linguistics	2
Ling. 440. Introduction to Transformational Generative Grammar	2
Ling. 493. Linguistic Phonetics	3
Ling. 497. Introduction to Diachronic Linguistics ¹	3
Ling. 498. Senior Seminar	2
	21

5. Areas of emphasis: completion with a grade of C or better of at least 9 hours selected from the following subject areas. Courses chosen by the student in the areas of emphasis must be approved *in advance* by the undergraduate adviser.

Anthropological linguistics	Mathematical linguistics
Applied linguistics	Philosophy of language
Biolinguistics	Phonetics
Comparative linguistics	Psycholinguistics
Computational linguistics	Semantics
Developmental linguistics	Sociolinguistics
Historical linguistics	Structures of specific languages
Linguistics of particular language families	

6. Total required hours (minimum): 45, of which at least 18 must be taken in the Department of Linguistics.

Language study and some courses in the major can be completed in university or university-affiliated

study abroad programs, and such study is recommended. Students interested in doing part of their major work in a study abroad program should discuss it with the undergraduate adviser prior to going abroad. For information on study abroad programs consult the Office of International Education.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in linguistics should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog and the departmental directives for the M.A. and Ph.D. degrees listed below.

Prerequisites. B.A. degree in linguistics or a B.A. or B.S. in other fields provided that the following prerequisites are satisfied.

1. Ling. 300 (Introduction to Linguistic Science) or the equivalent.

2. It is expected that an applicant will have considerable knowledge (e.g., college junior level proficiency) of and about one or more languages other than his native language. This knowledge may have been gained by formal study of the language(s), by residence in a country where the language(s) is (are) spoken, or by some other means. The Department of Linguistics reserves the right to require formal study of foreign languages by graduate students whenever their knowledge in this area is found to be deficient.

3. It is desirable, but not required, that an applicant have had some courses in disciplines, some of whose concerns are close to the concerns of linguistics; for example, in anthropology, sociology, psychology, phonetic sciences, communication disorders, mathematics, computer science, or philosophy.

4. Graduate Record Examinations. For foreign students, and American students residing abroad, the GRE may be waived or equivalent documentation may be substituted.

5. A 3.0 undergraduate grade-point average.

In any case, students must satisfy prerequisites 4 and 5.

Master's Degree

Completion of an M.A. degree will normally call for a *minimum* of three semesters of study.

The requirements for the M.A. degree are as follows:

Plan I

1. Language requirement:

- a. The student must demonstrate a reading knowledge of one language other than English.
- b. The other language must be French, German, or another language accepted by the graduate adviser. French is strongly recommended.
- c. Foreign students whose native language is not English may offer English as a foreign language for purposes of this requirement.

¹With prior approval, a course in the history of a particular language may be substituted for Ling. 497.

2. The following courses, or equivalents:

Semester Hours

Ling. 600. An Introduction to Linguistic Scholarship	2
Ling. 633. Phonological Analysis and Theory	3
Ling. 634. Methods of Grammatical Analysis	3

A student who has already taken any of these courses (or equivalents) as an undergraduate must earn an equal number of credits in other linguistics courses.

3. Additional work amounting to a minimum of 16 hours which will include (a) 4 to 6 thesis hours, (b) up to 6 hours of electives approved in advance by the graduate adviser, and (c) at least 6 hours of courses designated Ling. in this bulletin.

4. Successful performance in a comprehensive examination in *general* linguistics, based upon a *current* M.A. reading list prepared by the department. A section on a specialized area may be included if the student so desires.

5. Completion of a thesis (Ling. 700, for a minimum of 4 credit hours), acceptable to the student's committee. Although the thesis may be completed *in absentia* at least a draft of it must be available for discussion during the comprehensive examination.

Plan II

Plan II includes all items listed in Plan I except item 5. If the student is allowed by the department to choose Plan II, the course requirements are 30 hours of graduate work, distributed as follows: (a) a minimum of 24 hours of course work to be chosen from courses labeled Ling. (Ling. 600, 633, and 634 are included in these 24 hours); and (b) up to 6 hours of additional course work approved in advance by the graduate adviser.

Doctor's Degree

A student may plan to proceed directly to the doctoral degree without the M.A., but the department reserves the right to require any individual student to satisfy all the M.A. requirements through Plan I before accepting the student in the Ph.D. program. Students proceeding directly to the doctoral degree may apply for the M.A. degree upon passing the doctoral preliminary examination, providing that all M.A. requirements except the comprehensive examination have already been met.

A committee of three faculty members will be appointed at the beginning of the second year of full-time work. This committee will guide students as to their course work and foreign language requirements (see 1a below), and will determine other details of their programs as the need arises.

Preliminary Examination. A student previously admitted only to an M.A. program must apply for admission to a Ph.D. degree program whether the student receives the M.A. degree or not. Every student planning to pursue a Ph.D. program must take a preliminary examination. An M.A. degree will *not* substitute for the preliminary examination, which

will be offered once or twice a year, and will consist of language data problems and some general essay questions. A student may repeat the examination *only once*.

Requirements for the Ph.D. are the following (subject to reevaluation and readjustment by the student's committee):

1. *Language Reading Ability.* The student shall demonstrate ability to read linguistic literature in two of the following: French, German, Russian. All language examinations will be administered by the department. The student must pass all such examinations before proceeding to the comprehensive examination. Moreover, all Graduate School language requirements must also be satisfied before students are allowed to take their comprehensive examination.

2. *Knowledge of a Related Area.* All students will demonstrate more than superficial acquaintance with some field related to linguistics. The field may be anthropology, computer science, mathematics, sociology, psychology, phonetic sciences, or another field approved by the graduate adviser or the student's advisory committee. The requisite knowledge may be gained by taking at least 8 hours of non-introductory courses in that field, or it may be the result of work completed before entering the program. Demonstration of this knowledge may be in any one of these ways:

- The student will pass a four-hour (half-day) examination in which solutions to problems of linguistics are approached through the materials and methodology of the related field.
- The student may present a research paper on a problem approved by the advisory committee. This paper may not be merely a survey of those areas or problems which the related field has in common with linguistics.
- The student may present a master's degree in anthropology, psychology, sociology, mathematics, or computer science.
- The student may present for approval to the graduate adviser or committee some other evidence that he has the required knowledge. This option is appropriate for a student with a master's degree in a field not listed in "c," or with unusually advanced accomplishments. Under no circumstances will experience or independent reading alone substitute for formal course work as preparation for satisfying this requirement.

3. *Knowledge of Non-Native Language.* All students will demonstrate a thorough acquaintance with a non-native language, a language family, or a language area, equivalent to at least 8 hours of non-introductory courses. This knowledge may be demonstrated in one of the following ways:

- Students will pass a four-hour (half-day) examination in the structure and history of the language, family, or area they have chosen.

- b. Students may prepare a research paper demonstrating understanding of the structure or history of the language, family, or area of their choice.
- c. Students may present a master's degree in the language or literature of their choice.

Suggested preparatory courses for students not electing method "c" above include linguistics department offerings in African, American Indian, Romance, or Semitic studies. Courses in other departments must be approved in advance by the student's adviser.

4. The following courses, or equivalents: Ling. 600, 633, 634, 641, 642, 697.

5. Four courses selected from the following list. Any of these may be repeated for credit and offered as two separate courses for purposes of this requirement, unless otherwise specified by the student's adviser: Ling. 717, 724, 730, 738, 740, 741, 750, 771, 797.

6. Additional credits in linguistics or electives offered by the department or by other departments, as recommended by the student's committee. Some credit hours earned at linguistic institutes may be accepted on the recommendation of the committee.

7. The comprehensive examinations, usually conducted in English and at the conclusion of course work, in (a) general linguistics and (b) a specialization of the student's choice, e.g., African, Amerindian, Chinese, Classical, Germanic, Japanese, Romance, Slavic, etc., as well as applied linguistics, history of linguistics, mathematical linguistics, phonetic sciences, psycholinguistics, etc. Comprehensive examinations may be repeated once. They may also be passed conditionally, i.e., subject to specifically stated conditions.

8. A final examination and a dissertation suitable for publication. The dissertation committee reserves the right to suggest the language (normally English) and the style (usually that of the Linguistic Society of America) in which the dissertation must be written. Students who are working on their dissertations must be registered for thesis in the term or terms in which they are doing research and/or writing. For these hours a grade of *IP* is automatically awarded. After the submission of the dissertation and a successful final examination (defense of thesis), the grade of *IP* is changed to either A or B, as determined by the committee.

General Linguistics

All courses in the list of linguistics offerings are conducted in English. Elective courses may be conducted in English or another language at the discretion of the instructor. For a current list of electives and specializations students should consult their graduate adviser.

MATHEMATICS

*Office in Engineering Classroom Building, Room 2-38
Professor Wolfgang Schmidt, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

The Department of Mathematics offers degree programs leading to the B.A. degree in mathematics in the College of Arts and Sciences, the B.S. degree in applied mathematics in the College of Engineering and Applied Science, and the M.A., M.S., and Ph.D. degrees in mathematics and applied mathematics in the Graduate School.

The undergraduate degrees require the completion of at least 30 hours of mathematics for the B.A. (36 hours for the B.S.), all with a grade of *C* or better, and a 2.0 grade-point average or better in all courses in mathematics, including three semesters of calculus and 18 hours of mathematics courses numbered above 300. The 18 hours must include Math. 313 and 6 hours of mathematics courses numbered above 400.

Students seeking the B.A. degree may choose a program with emphasis on preparation for graduate work, one with a background in computer science, one with emphasis on preparation for secondary teaching, or one with emphasis on statistics.

Students seeking the B.S. degree in applied mathematics must complete 24 hours of social studies-humanities courses and a minimum of 18 hours of courses taught in the six departments in the College of Engineering and Applied Science, in addition to E.E. 201, EDEE 101, and Engr. 301.

Information on the various options for both the B.A. and B.S. degrees is available from the department.

Undergraduate students planning to do graduate work in mathematics should take Math. 314 and Math. 431-432, and should fulfill the language requirement in the College of Arts and Sciences with German, French, or Russian.

A student who is a candidate for a B.A. degree in mathematics from the College of Arts and Sciences must complete with a grade of *C* or better at least 9 hours of upper division mathematics courses in the college, Boulder Campus.

No student may obtain more than 12 hours credit in mathematics courses numbered below 130. College algebra and trigonometry do not count toward the B.S. degree.

GRADUATE DEGREE PROGRAMS

The prerequisite for graduate work in mathematics is at least 30 semester hours in mathematics, including a standard full course in calculus, two semesters of advanced calculus, a semester of linear algebra, and a semester of either higher algebra or differential equations. The prerequisite for a graduate level minor in mathematics is three semesters of calculus.

Students desiring the Ph.D. must demonstrate a reading knowledge of two of the following languages: French, German, and Russian. Only 500- and 600-level courses will receive graduate credit. The details of the degree requirements are available in the department office.

MEDIEVAL STUDIES

Office in Hellems Building, Room 101
Professor Donald C. Baker, Program Chairman

The Committee on Medieval Studies is founded on the conviction that the European Middle Ages represents a cultural unity in which the Roman church, the medieval Latin language, the concept of the Holy Roman Empire, and the polarity of East and West created institutions transcending the normal boundaries of nation, language, and scholarly discipline. Medieval Studies is therefore necessarily interdisciplinary; and the committee's function is to make possible and encourage such interdepartmental cooperation.

The following courses in various departments are available to those students whose area of specialization within a given department is the medieval period and who wish to broaden their knowledge of medieval culture. With the approval of the major department, a coherent group of these courses may be accepted as a related field of study and as part of the requirements for an advanced degree. For additional details concerning these courses, see departmental listings.

Medieval Culture

M.St. 501-3. Medieval Culture I.
M.St. 502-3. Medieval Culture II.
C.L. 542-3. Medieval Literature.
Engl. 550-3. Medieval Literature.
Engl. 650-3. English Literature of the 14th and 15th Centuries, Excluding Chaucer.
Engl. 651-3. Studies in Medieval Literature.
F.A. Hist. 578-3. Romanesque Art.
F.A. Hist. 579-3. Gothic Art.
F.A. Hist. 506-3. Art of Islam.
F.A. Hist. 507-3. Byzantine Art. (Clas. 520)
Fr. 525-3. Old French, Medieval, and Renaissance Readings.
Fr. 624-3. Medieval French Literature.
Ger. 524-3. Early German Literature.
Hist. 507-3. History of the Byzantine Empire. (Clas. 409)
Hist. 511-3. Social Foundations of European Civilization.
Hist. 512-3. Intellectual History of Medieval Europe.
Hist. 513-3. Constitutional and Legal History of England to 1485.
Hist. 515-3. History of Science From the Ancients to Sir Isaac Newton.
Hist. 588-3. The Medieval Middle East, 500-1600 A.D.
Hist. 621-3. Readings in Medieval History.
Hist. 721-3, 722-3. Problems in Medieval History.
Hist. 723-3, 724-3. Latin Paleography. (General Classics 723, 724.)
Hist. 730-3, 731-3. Intellectual History of Europe, 1100-1500.
Ital. 511-3. Dante: *La Vita Nuova and Inferno*.
Ital. 513-3. Medieval Italian Literature.
Ital. 570-3. Dante: *Purgatorio and Paradiso*.
Mus. 582-3. Medieval Music.
Phil. 500-3. Medieval Philosophy.
Phil. 591-3. Philosophy of St. Thomas.
Span. 614-3. Spanish Literature of the Middle Ages.

Medieval Languages

Engl. 680-3, 681-3. Anglo-Saxon.
Engl. 682-3. Middle English.
Fr. 603-3. History of the French Language to 1300.
Fr. 604-2. History of the French Language From 1300 to the Present.
Fr. 605-2. Provençal.
Ger. 518-3. Old Norse.
Ger. 519-3. Old High German.
Ger. 521-3. Introduction to Middle High German.

Ital. 505-3. Italian Historical Grammar.
Slavic 503-3. Old Church Slavonic.
Span. 705-3. Spanish Historical Grammar.

MUSEUM

Office in Henderson Building, Room 207
Professor Peter Robinson, Director

Although no undergraduate major is offered in museum studies, courses listed in the Course Description section may be taken with the approval of the student's major department.

In addition to the above courses, graduate training in anthropology, botany, zoology, and paleontology is provided under the direction of museum faculty in cooperation with the anthropology, biology, and geological sciences departments. Areas of study include archeological theory and interpretation, southwestern archeology and ethnology, and early man in North America (Wheat); plant taxonomy and phytogeography with specialties in lichenology and bryology (Weber); vertebrate paleontology and Cenozoic stratigraphy (Robinson); lower vertebrate paleontology, African Tertiary faunas and paleoenvironments (Van Couvering); biology of mollusks, taxonomy of annelids and crustacea (Wu); and taxonomy of insects of Rocky Mountain region (Lanham).

Museum assistantships, research support from the Walker Van Riper Fund, and other financial assistance are available to selected students. Students interested in working toward advanced degrees in the above areas under the direction of museum faculty should write the appropriate professor, University of Colorado Museum, Boulder, Colorado 80309.

Applicants accepted for graduate work by museum faculty must be admitted to the Graduate School and to the graduate program of the cognate department.

Courses offered by museum faculty through cooperating departments are listed below.

Anth. 499-variable credit. Independent Study.
Anth. 599-variable credit. Guided Study.
Anth. 699-variable credit. Independent Research.
Anth. 700-4 to 6. Master's Thesis.
Anth. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.
EPOB 499-1 to 3. Independent Study in Biology.
EPOB 700-4 to 6. Master's Thesis.
EPOB 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.
Geol. 499-variable credit. Independent Study in Geology.
Geol. 447/547-4. Paleontology of the Lower Vertebrates.
Geol. 448/548-4. Paleontology of the Higher Vertebrates.
Geol. 561-2. Mammalian Micropaleontology.
Geol. 562-5. Field Problems of Vertebrate Paleontology.
Geol. 599-variable credit. Independent Study.
Geol. 699-variable credit. Research.
Geol. 700-4 to 6. Master's Thesis.
Geol. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

ORIENTAL AND SLAVIC LANGUAGES AND LITERATURES

Office in McKenna Building

The department has as its primary objective instruction in Oriental and Slavic languages and literatures in general, and Chinese, Japanese and

Russian (each an undergraduate major program) in particular. Presently, Arabic or Hebrew is recommended for students majoring in African and Middle Eastern Studies, Chinese or Japanese is required for majors in East Asian Studies and recommended for Asian Studies, and Russian is recommended for majors in Central and East European Studies. Students majoring in those areas should consult the appropriate sections of this catalog. Students interested in East Asia are encouraged to consider a double major in (1) East Asian Studies and (2) Chinese or Japanese. This double major may be easily accomplished within the four years and 124 semester hours normally required for the B.A. degree. Students interested in Russian are encouraged to consider a double major combining Russian with any other field of interest to increase career options (a combination with another modern foreign language is particularly useful for secondary teaching).

BACHELOR'S DEGREE REQUIREMENTS

Chinese or Japanese

The major consists of 38 hours (all language courses plus one literature sequence) in either Chinese or Japanese. For further information the student should request the appropriate "major sheet" from the department.

Students who have completed a Level III high school foreign language course have automatically satisfied the college graduation requirement in foreign language. This requirement may also be satisfied by completion of course 211 in the foreign language or by demonstration of equivalent proficiency by placement test. Students who have studied an Oriental language in high school and wish to continue with the same language must consult the department for placement. A student may not receive credit for a course at a lower level than that into which he is placed.

Students interested in study abroad will find further information under the section on Special Educational Opportunities.

For comparative literature and linguistics courses, see those sections. Linguistics courses include Sanskrit, Far Eastern Linguistics, Semitic Linguistics, and Structure of Arabic.

All students planning a major in either Chinese or Japanese, and those interested in Arabic or Hebrew, are encouraged to consider study abroad in the appropriate country in order to improve their language ability. The University of Colorado offers year-long study abroad programs in Israel at the Hebrew University, in Japan in either Kobe or Tokyo, in Taipei, Taiwan, in India at Varanasi (Benares), Madurai, and Waltair, and the American University of Cairo in Egypt. For further information, contact the Office of International Education.

Russian

Two options are available: (1) Russian language and literature emphasis (the student will normally

complete 35 hours beyond the first year in courses offered by the department), and (2) area-studies emphasis (the student will normally complete at least 26 hours of Russian language and literature courses after the first year and 9 hours of course work in related fields, such as Russian history, political science, geography, etc.). For further information about major programs, students should request from the department its announcement, "B.A. Degree, Major in Russian." For information about courses in translation and other courses for non-majors, and about opportunities for improvement of Russian language skills outside the classroom, such as study programs in the USSR, or the Russian Floor of the Foreign Language House, request the departmental announcement, "Slavic Languages and Literatures: General Information."

Language Placement. One year of high school Russian is usually considered equivalent to one semester of college Russian. Thus a student with two years of high school Russian should enroll in Russ. 201 or 211. Students who think that they should be placed at a level different from the normal one should consult the department for advice.

Note: the preplacement coding on the advisement card is intended as a guide, and students may begin their college Russian at a level below the preplacement level without loss of credit, or above the preplacement level, if the department so recommends: thus it is very important to consult with the department before registering.

GRADUATE DEGREE PROGRAM

The department offers an M.A. program in Russian. Students who wish to enter the department's graduate degree program should consult not only the following description of requirements for the master's degree, but also the Graduate School section and the detailed announcements and reading lists published by the department.

Master's Degree

Prerequisites. Knowledge of the Russian language (in most cases this prerequisite is satisfied by four years of college Russian or its equivalent) and a general knowledge of Russian history and literature.

Course Requirements. In general, students working toward the M.A. degree in Slavic are advised to follow Plan II (see the Graduate School section of this catalog); however, with the permission of the department, a thesis program (Plan I) may be followed.

Plan II. Before admission to candidacy a student must complete at least 30 semester hours of course work distributed among either three major fields or two major and two minor fields.

A major field consists of not fewer than three courses in (1) 19th century Russian literature or (2) 20th century Russian literature or (3) Slavic and Russian linguistics.

A minor field is made up of two or more courses from a related field of study, such as Polish literature,

Russian or East European history, comparative literature, general linguistics, phonetic sciences, etc.

The choice of major and minor fields must be made in consultation with the department's graduate adviser.

Examination. A qualifying examination may be required during the first semester of resident study to determine whether the prerequisites have been satisfied.

After admission to candidacy, a student must pass a comprehensive examination, usually consisting of a written and an oral part. This examination will be conducted partly in Russian and will cover the reading list as well as course work.

Language Requirement. Before admission to candidacy, the M.A. student must demonstrate a reading knowledge of French or German. This requirement may be satisfied in any of the following ways:

1. By presenting three semesters of college-level credits in the language (or three units of high-school work).

2. By passing the Graduate School ETS Language Test.

3. By passing a departmental examination of comprehension of a text in linguistics or criticism of moderate difficulty in the language chosen. For details, ask for the departmental announcement on the Russian M.A. language requirement.

Courses in Translation

The Department of Oriental and Slavic Languages and Literatures offers a number of 400-level courses in translation. Advanced undergraduates and graduates seeking a minor in Slavic languages and literatures may find descriptions of these courses in the Course Description section. Some of these courses in Russian are also listed as 500 level (see below); only students who can do the reading in Russian may register for these double-listed courses on the 500 level. However, graduate students seeking a minor in Slavic may, with the approval of their department, receive graduate credit for any of the 400-level translation courses, as well as Russ. 499 (Independent Study) and Slav. 495 (Methods of Teaching Russian). Russ. 463 (Soviet and East European Science Fiction), Russ. 481 (Nineteenth-Century Russian Literature in English) and Russ. 482 (Twentieth-Century Russian Literature in English) are offered only in translation.

PHILOSOPHY

Office in Hellems Building, Room 169
Professor James P. Frank, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Students are cautioned to consult the current *Schedule of Courses* for the most accurate information on prerequisites since these sometimes vary with instructors.

Courses at the 100 level are open to all; courses at the 200 level are open to all who meet the prerequisites; courses at the 300 and 400 levels are recommended only for juniors and seniors; courses at the

500 and 600 level are recommended primarily for graduate students.

Courses may be taken in any order providing prerequisites, if any, are met.

A program for a departmental major must include History of Philosophy (Phil. 300, 301), a logic course (Phil. 244 or 444), Twentieth-Century Philosophy (Phil. 404), one course concerned with a single philosopher (or a substitute as approved by the student's adviser), and a two-semester sequence chosen from among the following: general major sequence, aesthetics, social and political philosophy, contemporary British and American philosophy, philosophy of science.

As an alternative philosophy major there are several topically oriented programs grounded in and coordinated by the Department of Philosophy which are interdisciplinary in nature. These currently include Law and Society, The Nature of Man, Dimensions of the Self, Philosophy and the Arts, and Political Ideas and Institutions. Two semesters in the history of philosophy are required for each of the topically oriented majors, as well as some 'core courses' varying according to the topical emphasis. *A student intending to complete a philosophy major in this fashion should see the appropriate adviser in the area or the department undergraduate adviser as early as possible.*

GRADUATE DEGREE PROGRAMS

Applicants for admission to the Graduate School for work toward a master's or doctor's degree with a major in philosophy are expected to have had 18 or more semester hours in undergraduate courses in the subject, including history of philosophy.

Students wishing to pursue graduate work in philosophy should note Requirements for Advanced Degrees in the Graduate School section of this catalog and should obtain from the department a copy of the *Graduate Program in Philosophy*. The Graduate Record Examination is not required.

Certain special M.A. programs exist in comparative East/West philosophy, and in history and philosophy of science, details of which may be had on request.

PHONETIC SCIENCES

Phonetic Sciences is an interdisciplinary program offering exposure to the broad field of phonetics. Contributing to the program are the Departments of Anthropology, Communication Disorders and Speech Science, English, French, Germanic Languages and Literatures, Italian Language and Literature, Linguistics, Psychology, Slavic Languages and Literatures, Spanish and Portuguese; the Black Studies Program; and the College of Music.

Phonetics pertains to the processing of speech and includes production, transmission, and perception.

Courses which have primary emphasis in phonetics are listed under the prefix Phon. and are offered in the Department of Communication Disorders and Speech

Science; other courses contributing to this program are listed by departmental designation.

A student wishing to specialize in the area of phonetics may either (a) enroll as a major in one of the departments in the College of Arts and Sciences listed above and develop an individualized program through consultation with department adviser or (b) pursue a Distributed Studies Program with the fields selected from the departments listed above.

More detailed information, including lists of such courses, may be obtained from the department of Communication Disorders and Speech Science.

PHYSICAL EDUCATION

Office in Temporary Building 1, Room 113
Professor Waldean A. Robichaux, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The Bachelor's degree in physical education is designed to provide course work and experience necessary for those students who wish to pursue professional careers in physical education. The curriculum is concerned with the study of exercise science and factors affecting human performance. Included in the curriculum are the following five tracks; teaching, teaching with coaching and athletic training, health education, special physical education, and physical education with emphasis in other related professional areas.

The professional teaching track emphasizes the knowledge, skills, and experiences necessary for teaching and coaching. Specializations are available for different levels of teaching (elementary, secondary, or both). The track emphasizing coaching and athletic training prepares students for work in the athletic programs of high schools. This track is usually combined with teacher certification. Students wishing to prepare for graduate work or for careers utilizing a strong background in physical education should choose the track emphasizing work in related areas. Courses related to this track may be chosen from anthropology, biology, business, communication, dance, fine arts, history, journalism, philosophy, psychology, recreation, and sociology. The student's program must be planned in consultation with a physical education adviser and an adviser in the related department. A double major is recommended.

Semester-hour and grade-point requirements for the degree Bachelor of Science in Physical Education are the same as those for the B.A. degree listed under Grade-Point Average Requirements, Scholastic Suspension, Total Credit Hour, and Grade-Point Requirements in the general College of Arts and Sciences section of this catalog. A maximum of 50 hours of credit in physical education may be counted toward the degree.

The specific courses that may be counted to meet these requirements are determined by the Department of Physical Education and Recreation and the dean of the College of Arts and Sciences.

Activity Program

In addition to the bachelor's degree program, the Department of Physical Education provides an activity program for the students of the University. A wide range of specific activity courses are offered in the general areas of conditioning and fitness, dance, individual sports, restricted exercises for those with medical limitations, swimming, and team sports. For further information, students should contact the department.

General Requirements

1. A total of 124 semester hours passed.
2. A 2.0 (C) grade-point average on all University of Colorado work. A 2.5 grade-point average is required for admission to the professional year in education.
3. A total of at least 16 semester hours of upper division courses in the major with a grade of C. A total of at least 30 semester hours in the major with a grade of C.
4. A total of 40 semester hours of upper division work (courses numbered in the 300s and 400s). Note that all courses transferred from junior colleges carry lower division credit. Exceptions to this rule require the approval of the dean of the college.
5. The last 30 hours in residence in the college.

Area Requirements

In each of the following areas, two two-semester course combinations are required. The College List which specifies the courses that will satisfy each of the requirements is printed in the *Schedule of Courses*, which is available when students register.

1. *Humanities* (e.g., English, philosophy, art history).
2. *Natural sciences* (e.g., chemistry, biology, geology, P.E. 354, and either P.E. 454 or 466).
3. *Social sciences* (e.g., economics, history, political science).

For specific courses required by the physical education department, see the departmental adviser.

REQUIRED COURSES FOR THE PHYSICAL EDUCATION MAJOR

Teaching Track

Physical Education Professional Activities. Ten courses are required from the following list. These courses must include at least four individual/dual sports and four team sports. The remaining courses may be chosen from:

1. Individual/dual or team sports.
2. Activities described under miscellaneous activities.

Students planning to take elementary certification or elementary/secondary should also take P.E. 260.

<i>Individual/Dual Sports</i>	<i>Semester Hours</i>
P.E. 235. Conditioning	1
P.E. 236. Fencing	1
P.E. 237. Golf	1
P.E. 238. Gymnastics	1
P.E. 239. Badminton	1

P.E. 240. Recreational Sports	1
P.E. 241. Tennis	1
P.E. 242. Track and Field	1
P.E. 243. Wrestling	1

Team Sports

P.E. 261. Baseball	1
P.E. 262. Basketball	1
P.E. 263. Field Hockey	1
P.E. 264. Flag Football/Speedway	1
P.E. 266. Soccer/Speedball	1
P.E. 267. Softball	1
P.E. 268. Volleyball	1

<i>Elementary Program</i>	<i>Semester Hours</i>
P.E. 260. Activities of Low Organization	1

Miscellaneous Activities comprised of any general physical education activity course at the 100 level not listed above.

P.E. 176. Life Saving	2
P.E. 177. Water Safety Instructor	2
P.E. 181. Basic Swimming Instructor	2
Dnce. 197. Recreational Dance Forms	1

Physical Education Core Courses

P.E. 290. Introduction to Physical Education—Orientation ¹	NC
P.E. 269. Applied Anatomy and Physiology	4
P.E. 350. Human Growth and Motor Development	3
P.E. 369. Sports Humanities ²	3
P.E. 371. Psychosocial Aspects of Sports and Physical Education ³	3
P.E. 372. Motor Learning	3
P.E. 454. Kinesiology	3
P.E. 466. Physiology of Human Performance	3

Physical Education Required Professional Courses

P.E. 402. Seminar: Teaching (Sophomore Year)	1
P.E. 413-2-4. Administration, Curriculum, and Evaluation in Physical Education	2
P.E. 417. Physical Education in the Elementary School and/or	
P.E. 458. Physical Education in Secondary Schools	3

Note: P.E. 417 and 458 should be taken during the junior year. P.E. 269 is a prerequisite for P.E. 454, 466.

Physical Education Elective Courses. Additional courses may be taken but not more than 50 hours of credit in physical education courses may be counted toward the degree. Suggested courses; coaching, health, adapted physical education, professional activities, prevention and treatment of athletic injuries, independent study, first aid, gerontology, and sports officiating.

Education Courses Required. Courses fulfilling college requirements as well as general electives are to be chosen in consultation with the student's adviser. In addition to those courses satisfying general college requirements, physical education majors who have been accepted into the teacher education program must take courses required for teacher certification. Close planning with an adviser is essential.

Students should plan their programs so they can complete all general college and most physical education major requirements prior to their final year. During this last year students would be enrolled in the professional year program of the School of Education.

The following education courses are required:

<i>Fall Semester</i>	<i>Semester Hours</i>
T.Ed. 410. Foundations of American Education	3
T.Ed. 411. Educational Psychology and Adolescent Development	3
T.Ed. 412. Principles and Methods of Secondary Education	3
T.Ed. 446. Teaching the Learning Disordered in the Regular Classroom	1-3
Comm. 230. Communication Principles in Instruction	2

<i>Spring Semester</i>	<i>Semester Hours</i>
For students planning to teach grades 7-12 only:	
T.Ed. 471. Secondary Student Teaching	8
T.Ed. 472. Elective Assignment, Secondary	4
For students planning to teach grades K-12:	
T.Ed. 470. Elementary Student Teaching	4
T.Ed. 471. Secondary Student Teaching	4
and either:	
T.Ed. 473. Elective Assignment, Elementary	4
or	
T.Ed. 472. Elective Assignment, Secondary	4
All students will take:	
T.Ed. 446. Teaching the Learning Disordered in the Regular Classroom (continued from fall)	1-3

During the junior year, students should check with their major adviser and the School of Education concerning the professional year program.

In order to enhance the student's placement opportunities, it is highly recommended that physical education majors take a minimum of 20 hours of credit in an academic area of emphasis outside the physical education department or consider taking another major.

Coaching Track (With Teaching Certificate)

The coaching track is the same as the teaching track with the following additional required courses:

P.E. 225. Advanced First Aid	2
P.E. 418. Theory of Athletic Coaching	2
P.E. 446. Prevention and Treatment of Athletic Injuries	2
Practicum in coaching (taken with student teaching)	
Coaching courses in specific sports	2 or more

Athletic Training Track (With Teaching Certificate)

Entry into this program is restricted. Students interested in this track must consult with the undergraduate coordinator before beginning course work.

The athletic training track is the same as the teaching track with the following additional required courses:

P.E. 225. Advanced First Aid	2
P.E. 293. Survey of Contemporary Health	3
P.E. 342. Nutrition and Health	3
P.E. 346. Adapted Physical Education	2
P.E. 446. Prevention and Treatment of Athletic Injuries	2
P.E. 499. Practicum in Athletic Training ⁴	6
P.E. 559. Advanced Techniques of Athletic Training	2

Health Track (With Teaching Certificate)

Physical Education Core Requirements: P.E. 269, 290, 350, and 466; two courses chosen from P.E. 369, 371, 372, 454; and three professional activity courses.

¹All incoming freshman and transfer students should take P.E. 290.

²Required.

³Prer., P.E. 269, 446, 454, 466.

⁴Recommended but not required.

A *Minimum of 15 Further Hours* to include P.E. 295, 342, 345, and 440 with the remaining hours chosen from P.E. 225, 293, 340, 346, 441, 445, 446, 448, 468, 546, and 547.

Additional Elective Physical Education Courses chosen from courses for physical education majors with a maximum of 50 hours in physical education to count toward the degree.

Professional Year in Education.

See Teaching Track.

Health Track (Nonteaching)

Physical Education Core Requirements. P.E. 269, 290, 350, and 466; two courses chosen from P.E. 369, 371, 372, 454; and three professional activity courses.

A *Minimum of 13 Further Hours* to include P.E. 293, 295, and 342 with the remaining hours chosen from the list under Health Teaching.

Additional Elective Physical Education Courses chosen from the list of courses for physical education majors with a maximum of 50 hours in physical education to count toward the degree.

Additional Non-Physical Education Courses chosen in consultation with an adviser from biology, anthropology, psychology, or sociology to complete the B.S.P.E. degree of 124 hours.

Special Physical Education Track (With Teaching Certificate)

The special physical education track is the same as the teaching track except for the following additional required courses:

	<i>Semester Hours</i>
P.E. 346. Adapted Physical Education	2
P.E. 347. Adapted Activities	2
P.E. 445. Disabilities and Motor Development	3
P.E. 449. Practicum in Special Physical Education	3-6

Suggested Additional Physical Education Elective Courses: P.E. 225, 293, 448, 468 (maximum of 50 hours in physical education to count toward the degree).

Note: If teaching certification is not desired students would be required to take three professional activities courses but would not be required to take P.E. required professional courses and the professional year in education. Additional non-physical education courses would be chosen in consultation with an adviser to complete the degree.

Related/Applied Areas

Physical Education Core Courses. The following courses are required: P.E. 269, 290, and three professional activities with four additional courses chosen from P.E. 350, 369, 371, 372, 454, and 466.

Additional Physical Education Electives. Courses may be chosen from the list of courses for physical education majors. Thirty-two hours in physical education is the minimum number of required hours.

Not more than 50 hours in physical education courses may count toward the degree.

Additional Non-Physical Education Requirements. A minimum of 18 hours in one area or related areas chosen (in consultation with a faculty adviser) from anthropology, biology, business, communications, fine arts, gerontology, history, journalism, philosophy, psychology, recreation, sociology, and theatre/dance.

GRADUATE DEGREE PROGRAM

To obtain materials for application and for any additional information, address inquiries to the graduate division coordinator of the Department of Physical Education and Recreation.

DEPARTMENTAL REQUIREMENTS

Students may follow a Plan I or Plan II for the degree. The minimum requirement for Plan I may be fulfilled by presenting 30 semester hours of approved graduate work including 4-6 semester hours of thesis. The minimum requirement for Plan II may be fulfilled by presenting 30 semester hours of approved graduate work including 2-3 semester hours for the research project.

Master of Science Degree (Physical Education)

Prerequisites. Entering graduate students must have an undergraduate preparation in physical education equivalent to an undergraduate major in physical education at the University of Colorado. The undergraduate preparation should include:

1. Proficiency in at least four activities with not more than two from any one of the general areas of aquatics, dance, gymnastics, individual and dual, or team.
2. Fifteen semester hours from the natural sciences and a minimum of two courses from the human behavior sciences.
3. At least 4 semester hours in anatomy and physiology and a minimum of two courses in at least two areas of professional physical education courses.

Satisfactory scores on the Graduate Record Examination tests are also required for admission to the Graduate School for regular degree or provisional degree status. These scores should be submitted at the time of application for admission to pursue a graduate degree.

Deficiencies. If an undergraduate minor is presented, the student may be allowed to pursue graduate study with the understanding that certain deficiencies must be made up. The nature and extent of these deficiencies will be determined by a committee of the departmental graduate faculty.

Deficiencies in any area of the undergraduate major may be met by completing approved course work in the subject or by satisfactory examination. Courses taken to meet deficiencies may not be counted toward the master's degree. If the course option is chosen, the student should register for the appropriate course the first time it is offered. Graduate courses taken before

removing deficiencies may be accepted for graduate degree credit only if prior approval of a graduate adviser has been granted.

Basic Requirements. The following are required of all students pursuing the Master of Science degree: A minimum of 30 semester hours of graduate-level courses, at least 15 of which must be in physical education. P.E. 690 (Methods of Research) and either P.E. 700 (Thesis) or P.E. 699 (Research Project). A minimum cumulative grade-point average of 3.0. Satisfactory performances on the comprehensive examination.

The *comprehensive examination* is composed of both written and oral parts. The written portion will cover all work in the major field presented for the degree including graduate work transferred. The oral portion of the comprehensive examination will be in defense of the thesis or research project.

In addition to the above requirements each student is expected to indicate some area of interest and complete the requirements specific to that area. The completion of the requirements should be planned with the help of an adviser.

PHYSICS AND ASTROPHYSICS

Office in Duane Building, Room E-032
Professor Chris Zafiratos, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Three curricula are available for students wishing to major in physics. *Plan 1* (45 hours of physics courses) is intended primarily for those students who plan to pursue graduate studies in a physical science. *Plan 2* (minimum of 36 hours of physics courses) is intended for students who desire a less intensive specialization in physics. This plan is appropriate for those wishing to combine a physics major with work in some other area such as applied mathematics, astrophysics, biophysics, chemical physics, environmental sciences, geophysics, philosophy and history of science, premedicine, etc. *Plan 3* (minimum of 26 hours of physics courses plus 20 hours of education courses) is a program designed specifically for students intending to become secondary school teachers. Professional opportunities in physics are available for students graduating at the bachelor's level in any of these plans. Better students in plans 2 or 3 who may wish to go on into advanced studies in physics can prepare themselves to start graduate work by taking more than the minimum number of courses listed for these plans. Moreover, it is possible at any stage of their college careers for students to transfer between plans, although junior or senior students transferring into Plan 1 may require an additional semester or two of studies beyond the normal four years.

These three curricula do not constitute all of the options open to the student; they have been the most popular ones in the past. In addition, the content of

courses and certain details of the requirements for the degree are changed from time to time. As far as possible, the department encourages students to pursue their own interests in setting up their curricula. The final responsibility for fulfilling the requirements for the degree rests with the student.

For these reasons, students who plan to major in physics should consult with their (departmental) advisers at least once per semester. Even if first-year students are only considering physics as a major, they are strongly encouraged to visit a departmental adviser and discuss the situation. Because most of the advanced physics courses have various prerequisites, failure to settle on an appropriate plan of study early in the college career can result in delay and complications later.

Eight hours of General Physics, Phys. 111 and 112, are required of students in all three plans, preferably in the freshman year for majors in Plan 1. It is possible, with the approval of the adviser, for a student who starts with Phys. 201 and then decides upon a physics major to go directly into Phys. 112. Similarly, it is not essential for students who have completed Phys. 202 to take Phys. 112 and 114 before continuing with the requirements listed below.

Students who have acquired the knowledge and skills equivalent to those taught in Phys. 111 and 112 may apply, following standard University procedure, for permission to take an advanced standing examination.

For graduation, Plan 1 physics majors must present credits in the following additional courses: 114, 213, 214, 215, 317, 318, 321, 322, 331, 332, 341, 491, 492, 495, 496; Chem. 202 or one year of general chemistry; Math. 130, 230, 240, and A.Math. 236 or Math. 313 and 443. Instead of Phys. 496, students may substitute Phys. 455 or a 3-hour physics elective course. Recommended upper division mathematics courses for Plan 1 majors include linear algebra, advanced calculus, complex variables, and partial differential equations. It is also recommended that Plan 1 majors take one or more semesters of a biological science. Students who intend to go on to do graduate work at the University of Colorado are advised to complete the fourth semester of a foreign language, inasmuch as this will fulfill the language requirement of the Graduate School.

For graduation, Plan 2 physics majors must present credits in the following additional courses: 114, 213, 214, 215, 317, 321, 322, 331, 332, 341; Chem. 202 or one year of general chemistry; Math. 130, 230, 240, and A. Math. 236 or Math. 313 and 443. In addition, a minimum of 3 hours of electives must be taken from the following courses: Phys. 318, 446, 451, 455, 461, 462, 491, 495, 501, 503, 504, 580, and 585. One or two credits of Phys. 500 may also be taken to satisfy part of the elective requirement.

A student in plan 2 is ordinarily required to satisfy an interdisciplinary requirement. The courses should be selected with the concurrence of the student's departmental adviser, usually *prior* to the junior year. These interdisciplinary courses must be approved by

the Departmental Arts and Sciences Advising Committee; *it is therefore imperative that students in Plan 2 be in close contact with their advisers.*

Plan 3 for physics majors is offered only with the 20-hours-in-education plan, and is provided for the convenience of students going into secondary school teaching. In addition to the 8 hours of general physics listed above, students electing this major must also present credits in the following additional courses: Phys. 115, 213, 214, 216, 317, 321, and 331; Chem. 202 or one year of general chemistry; and Math. 130, 230, 240, and A.Math. 236 or Math. 313 and 443. Recommended elective mathematics courses for students in this plan include Introduction to Abstract Mathematics, Math. 272; Theory of Numbers, Math. 311; and Higher Geometry, Math. 321.

GRADUATE DEGREE PROGRAMS

Graduate study and opportunities for basic research are offered in the areas of nuclear, solid state, high energy, and theoretical physics, magnetic resonance, spectroscopy, plasma physics, microwave spectroscopy, ultraviolet radiation, atomic physics, low temperature, and astrophysics. Research for the thesis for the M.S. or Ph.D. degree may be completed in any of these fields.

Doctoral programs in applied physics, astrophysics, chemical physics, geophysics, and mathematical physics are offered jointly with the Departments of Electrical Engineering, Astro-geophysics, Chemistry, Geology, and Mathematics, respectively. For information on these programs, see the respective listings in this catalog (e.g., for information on the doctoral program in chemical physics see Chemical Physics).

Departmental Requirements

Students wishing to pursue graduate work in physics leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. Following are special departmental requirements.

Master's Degree (M.S.)

Prerequisites. Entering graduate students must have a thorough undergraduate preparation in physics, equivalent to an undergraduate physics major at the University of Colorado. This preparation includes courses in general physics, analytical mechanics, electricity and magnetism, thermodynamics, quantum mechanics, and atomic and nuclear physics, as well as two semesters of general chemistry, and mathematics through differential equations and complex variables.

Language. The department has no foreign language requirement.

Course Requirements. There are two separate plans for obtaining the master's degree. Plan I includes a thesis (4 hours), Phys. 621 (Theoretical Mechanics), 625 (Introduction to Quantum Mechanics), 631 (Electromagnetic Theory), and 632 (Electromagnetic

Theory) along with electives (5 hours) and mathematics (3 hours). Plan II is without thesis with Phys. 621, 625, 631, 632, and 626 (Introduction to Quantum Mechanics) or 655 (Theory of Atomic Spectra) or 656 (Atomic and Molecular Spectra) along with mathematics (6 hours) and electives (9 hours). All courses must be graduate courses numbered 500 or above.

Qualifying Examination. The Graduate Record Examination aptitude tests and advanced test in physics are normally used in place of a qualifying examination, and this examination is normally taken before the time of entry into Graduate School.

Preliminary Examination. Each candidate for the master's degree, whether by Plan I or Plan II, must pass the preliminary examination. This examination is given each fall and spring semester. For details, see discussion under Doctor's Degree.

Comprehensive-Final Examination. After the other requirements for the master's degree are completed, each master's degree candidate must take a comprehensive-final examination. If the student is following Plan I, in which a thesis is included, the final examination will cover the thesis. The comprehensive-final examination will be oral.

Doctor's Degree (Ph.D.)

Prerequisites. Same as for master's degree, above.

Languages. The Department of Physics and Astrophysics strongly recommends that the Graduate School communication requirement be met by fourth-semester courses in a living language taken while the student is an undergraduate. The department has no tool requirement in foreign languages.

Qualifying Examination. Same as for master's degree, above.

Preliminary Examination. The preliminary examination consists of two three-hour parts. It will be given on one or two days of the registration period at the beginning of the fall semester. This examination will be a written examination on the material covered in the undergraduate courses leading to a B.A. or B.S. in physics at the University of Colorado, or comparable courses at other institutions. All incoming regular or provisional degree students in the department are required to take this examination in their first semester.

The preliminary examination is also given at the end of the spring semester and it must be taken and passed at this time by all students who failed it in the fall and wish to continue in a graduate degree program in the Department of Physics and Astrophysics.

Comprehensive Examination. On the first and second weekends of the spring semester, the written part of the comprehensive examination will be given. The examination will cover the material in the courses normally taken by all Ph.D. candidates in the first and second years of graduate study. The oral part will be given shortly after the written part. The performance on both written and oral exams will be the

basis for decision on passing or failure of the comprehensive examination.

Course Requirements. A minimum of 39 semester hours of graduate courses numbered 500 or above is required. The specific courses depend to a certain extent on the student's background and field of specialization. However, the following courses are required of all Ph.D. students in physics: Phys. 621, 625, 626, 627, 631, 632, and 644. In addition, 6 hours of graduate mathematics are required (usually met by Phys. 503, 504 or 603, 604) and 12 hours of graduate electives. All of these required courses are offered every year; most of the other courses listed in the Course Description section are offered every other year or when there is sufficient demand. Further information can be obtained by writing to the Department of Physics and Astrophysics.

Final Examination. The final examination is oral and covers the thesis.

POLITICAL SCIENCE

Office in Ketchum Building, Room 106
Professor Conrad L. McBride, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Students majoring in political science must complete a minimum of 36 semester hours in this department, of which 30 hours must be with a grade of C or better, and at least 21 semester hours must be in upper division courses. The major must be distributed among the primary fields under which political science courses are listed in this catalog, i.e., American government and politics, comparative politics, international relations, public administration, and political theory and public law. The major must include the following:

1. P.Sc. 100 (300 for junior or senior transfer students) and 110. The P.Sc. 101-102 sequence may be substituted for P.Sc. 110. Grade of C or better.

2. P.Sc. 440 and 441. Grade of C or better.

3. Econ. 201 and 202. Grade of C or better.

4. One upper division course in each of the primary fields of political science. The department, in addition, strongly recommends that all majors enroll for P.S. 201, 202, and 445.

Political science majors are not permitted the pass/fail option in the following courses: P.Sc. 100, 101, 102, 110, 201, 202, 440, and 441; also Econ. 201 and 202.

Public Service Option

For students interested in a career in public service (government or private public-policy-oriented organizations) the Department of Political Science offers a special program designed to prepare students for such careers. This program is oriented toward the American political system; however, with special counseling students may organize their studies to

emphasize another country or international organizations.

1. Each student must complete a minimum of 30 hours in political science with grades of C or better and a minimum of 21 upper division hours in political science.

2. The following specific courses are required: P.Sc. 100, 210 or 300; P.Sc. 110 or 101/102; P.Sc. 432; Econ. 201 and 202.

3. At least one upper division course is required in three of the following fields: American government and politics, comparative politics, international relations, and political theory.

4. At least five courses from the following list, including at least one course in urban politics, at least one in state government, and at least one in federal government.

<i>Urban</i>	<i>Semester Hours</i>
P.Sc. 407. Urban Politics	3
P.Sc. 408. Municipal Government and Administration	3
P.Sc. 409. Comparative Metropolitan Systems	3
P.Sc. 452. Urban Policy Analysis	3
 <i>State Government</i>	
P.Sc. 402. Legislatures and Legislation	3
P.Sc. 406. State Government and Administration	3
 <i>Federal</i>	
P.Sc. 400. Government Regulation of Business	3
P.Sc. 404. Advanced American Government	3
P.Sc. 434. National Security Organization and Policymaking	3
P.Sc. 435. Environment and Public Policy	3
P.Sc. 436. Politics of Expertise	3
P.Sc. 437. Public Priorities: Revenues and Program Expenditures	3
P.Sc. 456. Bureaucratic Power in American Politics	3
 <i>Law</i>	
P.Sc. 248. Introduction to the American Legal Process	3
P.Sc. 447. Constitutional Law I	3
P.Sc. 448. Constitutional Law II	3
P.Sc. 449. The Judicial System	3
 <i>Other Departments</i>	
Econ. 421. Public Finance I	3
Econ. 422. Public Finance II	3

5. A three-semester sequence must be completed in two of the following three areas:

Accounting — Acct. 200, 202, 322 or a comparable sequence approved by the department.

Computer Science — C.S. 210, 310, and 401 or a comparable sequence approved by the department.

Mathematics/Statistics — Math. 107, Math. 108, Econ. 381 or a comparable sequence approved by the department.

6. The courses required in numbers 2 through 5 above may not be taken pass/fail.

7. P.Sc. 110 or 101-102 should be considered a prerequisite to all upper division courses.

8. Students cannot receive credit for P.Sc. 110 if they have received credit for P.Sc. 101 and/or 102 (and vice versa). Students cannot receive credit for P.Sc.

201 if they have received credit for P.Sc. 211 and/or 212 (and vice versa).

9. Not more than 45 hours in political science will count toward the 124 hours the College of Arts and Sciences requires for graduation.

GRADUATE DEGREE PROGRAMS

The Master of Arts degree in political science, the Master of Arts degree in political science (international studies), and the Doctor of Philosophy degree in political science may be earned in the department. Students wishing to pursue graduate work toward one of these degrees should read carefully the Graduate School requirements for admission and degrees in this catalog. A contact person (temporary adviser) will be assigned to each student upon admission to the program. GRE aptitude scores are required of applicants.

The Plan II option for the Master of Arts degree is not offered in this department.

Departmental Admission Requirements

Students desiring a graduate major in political science must present 18 semester hours of work in the subject, 9 hours of which must be in upper division courses. Any deficiencies must be made up before the student will be admitted as a regular degree student, and the work involved will be in addition to the minimum requirements for the degree. Students wishing to minor in political science must present at least 9 semester hours in political science. The department may make exceptions to the above requirements in unusual cases.

Candidates wishing to pursue graduate degrees in political science should request the complete program requirements from the Department of Political Science.

Master of Arts in Political Science

The degree requirements consist of at least 25 semester hours of work at the 500 level or above, including 4 semester hours for the master's thesis, at least 9 hours of seminar work, i.e., one seminar in each of the three fields of concentration (P.Sc. 599 and 699 do not count as seminars), and additional credit to total the number of hours required by the student's adviser. The M.A. degree shall be awarded by the political science department upon the recommendation of an M.A. comprehensive examination committee of at least three faculty members who shall examine the candidate orally in three fields of concentration. The entire examination is approximately two hours long. The student must take courses from at least four members of the department. A minimum 3.0 grade-point average is required.

Master of Arts in Political Science (International Studies)

Students pursuing graduate work should read carefully the section Requirements for Academic Degrees in this catalog. In brief, the degree requirements consist of *at least* 25 semester hours of work at

the 500 level or above, including 4 semester hours for the M.A. thesis, at least 9 hours of seminar work, one of which shall be in international relations and one in comparative politics (P.Sc. 599 and 699 cannot be counted as seminars), and additional credit to total the number of hours required by the student's adviser. The M.A. degree shall be awarded by the political science department upon the recommendation of an M.A. comprehensive examination committee of at least three faculty members who shall examine the candidate orally in three fields of concentration, to include international relations, comparative politics, and one other. The entire examination is approximately two hours long. The student must take courses from at least four members of the department. A minimum 3.0 grade-point average is required.

All students in this program must pass a three-year proficiency test in a foreign language approved by their advisers. In exceptional cases the Committee on Graduate Studies may accept other evidence that the student has acquired a good working knowledge of a foreign language.

Doctor of Philosophy

An applicant must have a master's degree in political science or in a related field from this University or from another accredited institution before entering the Ph.D. program.

The Department of Political Science requires for the Ph.D. at least 42 hours of course work, with a grade of *A* or *B*, beyond the bachelor's degree. Except for 3 semester hours which may be taken at the senior undergraduate level in a cognate field at this University, all 42 hours must be at the 500 level or above. Not included in the 42 hours are dissertation and research hours, master's thesis hours, or those hours used to fulfill the language and statistics requirements. The 42 hours will include at least two seminars in each of the three fields which the candidate will present for the written comprehensive examination. Furthermore, each student's program shall include at least one seminar in each of the following three categories: (a) American (American government, public administration, law and politics); (b) International (comparative politics, international relations); (c) theory (political philosophy, empirical theory and methodology). Twenty-seven hours must be taken in political science. Of this 27, 24 must be in regularly scheduled seminars, not more than 6 hours of which may be transferred from another accredited institution. Not more than 6 hours of P.Sc. 599, Topics in Political Science, and not more than 15 hours in P.Sc. 599 and 699, Graduate Research Topics, combined will be allowed toward the degree. A student may petition the department's Graduate Admissions Committee to permit the transfer of a maximum of 15 semester hours of graduate credit earned at another accredited institution.

To be eligible for candidacy the student is required to pass a written preliminary examination in three fields at the beginning of the second semester in

residence. The department also requires evidence of competence in a foreign language, plus an examination or an approved sequence of courses in statistics. Further, the student is required to pass a written comprehensive examination, which shall cover three fields of concentration selected by the student; and an oral examination, which shall be a rigorous, comprehensive test of the student's knowledge of the major field of emphasis, including the location of that field in a broad comparative, philosophical, and methodological context. An Advisory Committee consisting of three faculty members, each representing one of the student's fields of concentration, will guide the student in his or her progress throughout the career as a graduate student. A dissertation based on original investigation and showing mature scholarship and critical judgment, as well as familiarity with tools and methods of research, is required.

Graduate Minor in Political Science

Graduate students who choose to minor in political science should consult the *College of Arts and Sciences* section for the descriptions of 400-level courses, since minors but not majors are eligible to receive credit for 400-level courses.

PSYCHOLOGY

Office in Muenzinger Building, Room 244
Professor Bruce R. Ekstrand, Chairman

BACHELOR'S DEGREE REQUIREMENTS

A major in psychology requires a minimum of 30 hours with grades of *C* or better. Required courses or courses to count in the 30 hours may not be taken pass/fail. *In addition*, the average of all work in psychology must be at least 2.0. A grade of *D* in a required psychology course will not fulfill the requirement although the college will accept the credit hours. Thus, a *D* grade in a required course means the student must either retake the course (*for zero hours credit* since credit hours were received for the *D*) or take an alternative course that meets the requirement with a grade of *C* or better.

Psychology majors must complete each of the following requirements:

1. Psy. 100.
2. Psy. 210 or 310.
3. At least one course from each of the following lists:
 - a. Psy. 414, 416, 420.
 - b. Psy. 431, 440, 445.
4. At least two courses from the following list:
Psy. 405 or 410 (but not both), 468, 485.
5. Psy. 400 or 451.

Transfer students must take at least one course from requirements 3a, 3b, and 4 in *this* department on the Boulder Campus.

Students intending to major in psychology are advised to include college algebra in their lower division schedules.

GRADUATE DEGREE PROGRAMS

Departmental Requirements

Students wishing to pursue graduate work in psychology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. The M.A. is considered as a step to the Ph.D., and students who do not intend to pursue the latter degree are not admitted. Following are special departmental requirements.

Requirements for Minors in Psychology

For the M.A. degree a minimum of 6 hours is required as a minor.

The prerequisite for a minor in psychology is 9 hours of undergraduate psychology.

Statistics cannot be included in either prerequisites or requirements for minors in psychology.

Doctor's Degree

Prerequisites. Students who wish to become candidates for the Ph.D. degree must show evidence of having covered the work equivalent to that required for a master's degree.

Language Requirements. No foreign language is needed for the Ph.D. beyond the one required by the Graduate School.

RECREATION

Office in Temporary Building 1
Professor Waldean Robichaux, Chairman

BACHELOR'S DEGREE REQUIREMENTS

1. A total of 124 semester hours passed.
2. A 2.0 (*C*) grade average on all University of Colorado work.
3. Forty semester hours of upper division work (courses numbered in the 300s and 400s.). Note that all courses transferred from junior colleges carry lower division credit. Exceptions to this require the approval of the dean of the college.
4. The last 30 hours in residence in the college.

Area Requirements

1. *Humanities.* Two two-semester course combinations (e.g., certain courses in English, philosophy, or art history).
2. *Natural sciences.* Two two-semester course combinations (e.g., biology, certain courses in psychology, and certain courses in physical education).
3. *Social sciences.* Two two-semester course combinations (e.g., certain courses in psychology, history, political science).

Note: There is no foreign language requirement for the Bachelor of Science in recreation.

Major Requirements

In addition to the general college requirements, students majoring in recreation must complete a minimum of 30 semester hours in the recreation area

of which at least 16 semester hours must be in upper division courses. Courses fulfilling the nonrecreation suggested emphasis in the option selected by the student and the nonrecreation requirements are to be chosen in consultation with a department adviser. Description of courses may be found under Physical Education.

Recreation Requirements (All Majors)

	<i>Semester Hours</i>
Rec. 201. History and Philosophy of Recreation and Leisure	3
Rec. 401. Program Planning in Recreation	3
Rec. 405. Organization and Evaluation in Recreation	3
A minimum of 2 semester hours of field work in the student's major option area (417, 427, 437 or 447)	2
Recreation internship in the student's major option area (418, 428, 438, or 448)	8
One course from the following:	
Rec. 310. Introduction to Community Recreation	3
Rec. 320. Introduction to Outdoor Recreation	3
Rec. 330. Introduction to Therapeutic Recreation	3
One course from the following:	
Rec. 410. Community Recreation Administration	3
Rec. 420. Management of Parks and Recreation	3
Rec. 430. Techniques in Therapeutic Recreation	3
Rec. 440. Financial Management of Recreation	3
Five hours from the following:	
Rec. 112. Recreational Activities	2
Rec. 213. Organization of Sports Programs	3
Rec. 222. Camp Leadership	2
Rec. 322. Wilderness Camping Practicum	2
Rec. 400. Senior Seminar	2
Rec. 419. Independent Study in Community Recreation ...	1-3
Rec. 429. Independent Study in Outdoor Recreation	1-3
Rec. 439. Independent Study in Therapeutic Recreation ...	1-3
Rec. 449. Independent Study in Commercial Recreation ...	1-3

Recreation Options

Semester Hours

Community Recreation Administration

Rec. 310. Introduction to Community Recreation	3
Rec. 410. Community Recreation Administration	3
Five nonrecreation requirements to be decided in consultation with major adviser. ¹ Suggested disciplines: black studies, communication, fine arts, philosophy, physical education, sociology, theatre and dance.	

Outdoor Recreation

Rec. 320. Introduction to Outdoor Recreation	3
Rec. 420. Management of Parks and Recreation	3
Five nonrecreation requirements to be decided in consultation with major adviser. ¹ Suggested disciplines: anthropology, biology, environmental design, geography, political science, sociology.	

Therapeutic Recreation

Rec. 330. Introduction to Therapeutic Recreation	3
Rec. 430. Techniques in Therapeutic Recreation	3
Five nonrecreation requirements to be decided in consultation with major adviser. ¹ Suggested disciplines: anthropology, biology, communications, education, fine arts, music, physical education, psychology, sociology, theatre and dance.	

Commercial Recreation

Rec. 340. Introduction to Commercial Recreation	3
Rec. 440. Financial Management of Recreation	3
Econ. 201:3 and 202:3. Principles of Economics	6
Acct. 200. Introduction to Accounting—Financial Aspects	3

Acct. 202. Introduction to Accounting—Management Aspects	3
Mk. 300. Principles of Marketing (plus one other marketing course)	3
Fin. 305. Basic Finance	3
Pr. Mg. 300. Products and Operation Management	3
Or. Mg. 330. Introduction to Management Organization	3
B. Law. 300. Business Law	3
B.Ad. 200. Business Information and the Computer	3
Q.M. 20. Business Statistics	3
(These two courses plus an examination and the 30 hours above are necessary requirements for entrance to the M.B.A. (Master of Business Administration, University of Colorado)	
Stat. 490. Business Operations Research	3
(This course may be taken in lieu of an examination)	

Note: Since requirements may change periodically, any student interested in fulfilling the prerequisites for a M.B.A. should contact the Graduate School of Business Administration, University of Colorado.

RELIGIOUS STUDIES

*Office in Woodbury Building, Room 202
Professor Robert Lester, Chairman*

Religious studies is a humanistic discipline, centrally concerned with the history and phenomenology of religions and religious experience. The study of religion is also undertaken from the perspective of other disciplines such as anthropology, classics, and philosophy. The religious studies major is ideally suited to those seeking a broad, liberal arts education pursuant to humanistically oriented vocations, such as secondary school teaching or social work, or to graduate work in religion, theology, and several areas of the humanities and sciences such as sociology, psychology, medicine, fine arts, law, and journalism.

BACHELOR'S DEGREE REQUIREMENTS

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.
2. At least 36 hours in courses on religion, including R.St. 162, 260, 262, and 495.
3. All schedules of students majoring in religious studies must be approved by a member of the advisory committee.
4. The specific courses that may be counted to meet the requirements in this program are determined by the Committee on Religious Studies and the dean of the College of Arts and Sciences.

SEMIOTICS

*Office in Old Main, Room 1
Professor Luigi Romeo, Chairman*

Semiotics is the study of signs: the rules governing their generation and production, transmission and exchange, reception and interpretation. It is a unifying discipline for the humanities and relates the humanities to a broad spectrum of the sciences, both social (e.g., anthropology and sociology) and natural (e.g., biology and computer science). Courses in

¹Nonrecreation requirements are upper division courses from five different disciplines selected jointly between the student and the student's major adviser.

semiotics are thus related to the study of natural and artificial languages and to problems of meaning and signification in human and nonhuman communication.

Introductory and upper division courses satisfy requirements in the humanities.

SOCIOLOGY

*Office in Hellems Building, Room 290
Professor E. Merle Adams, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

A minimum of 30 semester hours and maximum of 45 semester hours in sociology. All hours in sociology being counted toward the major must be with grades of C or better; at least 16 hours of these courses must be in upper division credit.

Courses required: a two-semester introduction to sociology course (Soc. 211 and 212); a two-semester sociological theory course, History of Sociological Thought I and II (Soc. 315 and 316); and a 6-hour course, Empirical Inquiry and Field Experience (Soc. 420). Please see the departmental office for further clarification of major requirements.

GRADUATE DEGREE PROGRAMS

Departmental Requirements

Students wishing to pursue graduate work in sociology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog.

The following are additional requirements for admission to the graduate degree programs of the department.

A combined grade-point average of at least 3.3 (3.0 = B) for all courses in sociology undertaken as an undergraduate or graduate student prior to admission.

Satisfactory scores (as determined by the department) on the Graduate Record Examination including both the verbal and quantitative sections and at least one advanced test. This examination may be taken at any location in the United States certified by the Educational Testing Service and the results may be sent to the department by the Educational Testing Service or the institution administering the examination.

Applicants to the graduate program in sociology must present at least 10 hours of undergraduate work in sociology. These hours must include an adequate course in introductory sociology and an upper division course in the discipline.

Master's Degree

The department offers the M.A. degree in two general types: (1) an "in transit" M.A. (usually Plan II, i.e., without thesis) for students in the Ph.D. program who have satisfied course requirements and passed the Ph.D. comprehensive examination, and (2)

an M.A. with a field of specialization in which the student must:

1. Complete at least 30 semester hours (24 hours if Plan I, i.e., with thesis, is elected) of approved graduate work.

2. Pass a comprehensive-final M.A. examination.

3. Satisfy the requirements of the student's specific program of specialization.

For information on the special programs currently available, contact the graduate secretary of the department and obtain the *Graduate Handbook* of the department.

Doctor's Degree

A detailed description of the Ph.D. program is given in the *Graduate Handbook* available from the graduate secretary of the department. The main requirements are:

1. Minimum of 54 semester hours of approved graduate work, at least 30 of which must be on the 500 level or above. At least 24 of the 54 hours must be taken in the sociology department of the University of Colorado.

2. The following required courses must be included in the 54 hours minimum: 6 semester hours of sociological theory (Soc. 505 and 506); 6 semester hours in methods and statistics (Soc. 507 and 508); 3 semester hours in field experience (Soc. 553 or 554 or 687 or 688).

3. Before students accumulate 24 hours of graduate credit, they must pass the preliminary examination.

4. Students must also pass the comprehensive examination. They become eligible for this examination only after they have satisfied requirements 1, 2, and 3 above, have written a Plan of Study, and have chosen three areas of specialization. (See the *Graduate Handbook* of the department for details.)

5. Students must demonstrate at least second-year college proficiency in a foreign language.

6. The student must write a Ph.D. dissertation. A student may not enroll for Soc. 800 (Doctor's Thesis) before the semester in which the comprehensive examination is passed.

7. Satisfying requirements 1-6, the student must pass the Ph.D. final examination.

All inquiries about the graduate programs of the department should be addressed to Chairman, Committee on the Graduate Program, Department of Sociology.

SPANISH AND PORTUGUESE

*Office in McKenna Building, Room 126
Associate Professor Ralph Kite, Chairman*

Students who have completed a Level III high school Spanish or Portuguese course have automatically satisfied the college graduation requirement in foreign language. This requirement may also be satisfied by completion of Span. or Port. 211 or by demonstration of equivalent proficiency by placement test. Students who have studied Spanish in high school and wish to continue with the language will be

placed according to their high school record and verbal SAT and/or ACT scores. A student may not receive credit for a course at a lower level than that into which he is placed.

BACHELOR'S DEGREE REQUIREMENTS

1. A total of 35 credit hours in Spanish courses (beyond Span. 105), including the following minimum distribution: (a) *at least* 9 hours in upper division courses primarily devoted to language theory and practice (Span. 301-302; 303-304; 305; 401-402; 403-404; 405; 495); (b) *at least* 8 hours in upper division literature courses including *at least* one course treating Spanish Peninsular literature and one treating Spanish American literature; (c) *at least* 12 hours in courses numbered 400 or above, taken on the Boulder Campus.

2. A total of no more than 6 hours from the following courses may apply to the Spanish major: Span. 211-212; 400; 421; 464; 491-492.

3. An additional 6 hours in courses from one or more of the following areas: (a) courses listed in the Latin American Studies program (e.g., history, art history, political science, etc.); (b) courses in Chicano studies; (c) linguistics; (d) upper division courses in another foreign language or comparative literature; (e) Port. 101-102.

4. A major with emphasis on commercial Spanish is offered with the same requirement as paragraph 1, except that 12 hours in commercial Spanish courses (303-304; 406-407) will be substituted for the literature courses. (See department for additional requirements from the College of Business and Administration and other required Spanish and area courses.)

Students planning to acquire certification for teaching at the secondary level should note that the School of Education will require Span. 495 (Methods of Teaching Spanish) and that the 3 credit hours earned in that course will count toward the major and will be subject to the 45-hour maximum from one department allowed by the College of Arts and Sciences for the B.A. degree. This means that students who begin the major program with Span. 101 and who intend to include secondary certification in their B.A. program *must* include Span. 495 in their electives in Spanish.

To be admitted to practice teaching of Spanish, majors must take the language-skills tests of the Modern Language Association Proficiency Tests for Teachers and Advanced Students of Spanish and make satisfactory scores.

Students must see a departmental adviser prior to registration for their final semester. Failure to do so may result in a delay of their graduation. Students considering entering graduate school for an advanced degree in Spanish, either at the University of Colorado or at any other institution, should see a departmental adviser as early as possible.

The department strongly recommends that all majors include some study in a Spanish-speaking country in their major programs. The University of

Colorado offers full-year and semester programs in San Jose, Costa Rica, Xalapa, Mexico and Seville, Spain; a year-long program in Lima, Peru, and an intensive language program also in Xalapa, Mexico. For students who have completed through Port. 212 or demonstrated equivalent proficiency, a semester program in Rio de Janeiro is available. Credit earned will normally count toward satisfaction of the major requirements, but the student should see an adviser before enrolling in a foreign program to assure full transfer of credit. Credit for work done in special programs offered by foreign universities will be evaluated on an individual basis. It should be noted that courses taken abroad and designated as Spanish will also be subject to the 45-hour maximum rule of the College of Arts and Sciences.

Students interested in study abroad will find further information under Special Educational Opportunities. A Spanish Language Floor program located in the Williams Village Dormitories is available for students who wish to acquire conversational practice. Entrance requirements are three years of Spanish in high school, three semesters in college, or equivalent fluency. For further information please see Housing section.

Students who present transfer work to satisfy major requirements will be expected to complete their last 12 credits, including at least 6 at the 400 level, on the Boulder Campus.

For comparative literature, Chicano studies, Latin American studies, and linguistics courses see those sections.

GRADUATE DEGREE PROGRAMS

Departmental Requirements

Students wishing to pursue graduate work in Spanish leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the Graduate School section of this catalog. Application for admission should include official statements of the Graduate Record Examinations. Students with exceptional educational backgrounds and recommendations who have not had an opportunity to take these tests may be admitted with the understanding that they will take them at the earliest opportunity.

Master's Degree

Prerequisites. The following are required for graduate study in Spanish:

1. Competency in speaking, understanding, reading, and writing Spanish.
2. A general knowledge of Hispanic literature and civilization.

Language Requirement. The student will demonstrate as early as possible, but at least one full semester before taking comprehensive examinations, a communications knowledge (as defined by the Graduate School) of a foreign language other than Spanish.

Areas of Concentration. The Master of Arts in Spanish is offered in three areas of concentration; one with an emphasis on literature, one with an emphasis on language and linguistics, and one in advanced teaching methodology.

Minor Fields. For the major in Spanish, the student may elect two courses (4-6 hours) in a minor field. The following fields of minor concentration are recommended: comparative literature, anthropology, linguistics, English, education, Latin American studies, fine arts, philosophy, history, methodology, Greek, Latin, music or another language or literature.

Required Courses. Span. 610 (History of the Spanish Language) is a required course for all areas of the M.A. degree. For the literature emphasis, 614 (Spanish Literature of the Middle Ages) is an additional required course. For the M.A. with an emphasis on language and linguistics required courses in addition to the above are Span. 505 (Structure of Modern Spanish), 605 (Spanish Phonology), 606 (Spanish Syntax), and 695 (Seminar: Language and Language Learning).

The department should be consulted regarding required courses in the area of teaching methodology.

Examinations. A comprehensive final examination both written and oral will be given during the student's last semester of residence.

Doctor's Degree

Prerequisites. Fluency in speaking, understanding, reading, and writing Spanish; a general knowledge of Hispanic literature and civilization.

Residence Requirement. Ph.D. students must complete a minimum of one academic year in residence on the Boulder Campus (excluding summer) within the four years immediately preceding the date on which they present themselves for the Ph.D. comprehensive examinations.

Language Requirement. The student will demonstrate as early as possible, but at least one full semester before taking comprehensive examinations, a communication knowledge (as defined by the Graduate School) of one foreign language and a reading knowledge of a second language in addition to Spanish. The languages will be chosen by the student in consultation with the advisory committee.

Areas of Concentration. The Ph.D. in Spanish is offered in three areas of concentration: 1) Spanish peninsular literature; 2) Spanish-American literature; 3) Spanish language and linguistics.

Required Courses. Students in all areas of concentration are required to take Span. 705 (Spanish Historical Grammar).

THEATRE AND DANCE

Office in Theatre Building, Room 201
Professor Martin T. Cobin, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Majors are available for the B.A. degree in dance and theatre. An emphasis in interpretation is also

available. Students are urged to consult with an undergraduate adviser in the appropriate field to obtain both advice and the most current information concerning program opportunities and expectations.

Dance

Students majoring in dance must complete a minimum of 40 hours in the dance area. Courses fulfilling college requirements as well as general electives are to be chosen in consultation with and approved by a department adviser. The following are *required* for the dance major:

	<i>Semester Hours</i>
Dnce. 183 to 186. Dance Techniques: Ballet	2
Dnce. 193 to 196. Dance Techniques: Modern	12
Dnce. 197. Recreational Dance Forms	1
Dnce. 214. Improvisation	2
Dnce. 290. Beginning Composition	3
Dnce. 392. Musical Accompaniment for Dance	3
Dnce. 413. Children's Dance	
or	
Dnce. 415. Methods of Teaching Dance	3
Dnce. 390. Intermediate Dance Composition	
or	
Dnce. 490. Advanced Dance Composition	3
Dnce. 491. History and Philosophy of Dance	3
Dnce. 493. Performance Events	2
Dnce. 494. Dance in the 20th Century	3
	37

A minimum of 3 credits are to be selected from additional dance theory and/or technique courses:

Dnce. 314. Movement Analysis Practicum	3
Dnce. 479. Dance Practicum	1-3
Dnce. 495. Dance Repertory	3
Dnce. 499. Independent Study	1-3
Dnce. 598. Studio Concert	1-3

A minimum of 6 credits in theatre are to be selected from the following:

Thtr. 270. Introduction to Theatre	3
Thtr. 273/373. Acting	3
Thtr. 276. Stagecraft	3
Thtr. 377. Costuming	3
Thtr. 474. Directing	3
Thtr. 486. Lighting Design	3

A Bachelor of Science degree with emphasis in dance is offered in cooperation with the Department of Physical Education and the School of Education. All dance courses are taught by the faculty of the Department of Theatre and Dance. It is essential that students wishing to pursue Bachelor of Science degrees plan their programs in consultation with an academic adviser in the Dance Division.

Theatre

Majors must complete a minimum of 45 semester credits, as follows:

	<i>Semester Hours</i>
Thtr. 270. Introduction to Theatre	3
Thtr. 273. Acting I	3
Thtr. 276. Stagecraft	3
or	
Thtr. 377. Costuming	3
Thtr. 471. History of Theatre I	3

Thtr. 481. History of Theatre II	3
Thtr. 321. Practicum in Costuming	1
Thtr. 322. Practicum in Technical Theatre	1
Thtr. 323. Practicum in Management	1
Thtr. 324. Practicum in Acting	1
Electives in theatre	11
Electives in dance and/or interpretation	9
Electives in dramatic literature	6

Students wishing to qualify for teaching certification must complete the major theatre requirements (Thtr. 490, Comm. 435) as well as the professional education requirements. See School of Education.

Bachelor of Fine Arts Degree

The Bachelor of Fine Arts degree is offered in dance (performance or dance production) and in theatre (acting or technical theatre). These degrees meet the needs of highly talented students with professional objectives who desire and can profit from considerable specialization at the undergraduate level. Such a program is not in the best interests of all students and the departmental capacity to provide the program is necessarily limited. Formal application for admission should be made in the sophomore year and those with real or potential interest in applying should identify themselves to the B.F.A. advisers as early in their college studies as possible. For further information, contact the departmental office.

GRADUATE DEGREE PROGRAMS

Departmental Requirements

Students wishing to pursue graduate work in theatre and dance for advanced degrees should read carefully both Requirements for Advanced Degrees in the Graduate School section and the following departmental requirements. Students should note that departmental requirements are sometimes more comprehensive than those minimums established by the Graduate School.

Prerequisites. Applicants are admitted to the graduate program in theatre and dance on the basis of their academic records and recommendations. Students admitted who are unable to offer a substantial number of semester hours of work in the area of their intended specialization or allied fields must expect that a significant number of additional courses and semester hours will be required of them in order to make up deficiencies.

Qualifying Examination. Every student must take a diagnostic examination before completing 9 semester hours. This examination and all other information available are employed to design the best possible course of study for the student. The results of this examination might prompt the faculty to recommend that the student withdraw from the program.

Adviser and Graduate Committee. For every student who declares an intention to work toward an advanced degree, an adviser and committee will be selected not later than the beginning of the student's

second semester (or second summer session) in residence.

All candidates for a degree have the responsibility of making certain that the appropriate persons or committees have been appointed to supervise the various steps in their graduate programs. Detailed instructions are available from the department.

Master's Degree

Course Requirements. All master's degree candidates are required to complete Th.Dn. 601 or its equivalent. At least two courses (4 to 8 hours) must be taken outside the department or outside the departmental area of concentration.

Depending upon the qualifications and ultimate goals of the candidate one of the two plans of study must be chosen with the consent of the adviser.

Plan I With Thesis. After any undergraduate deficiencies have been removed, students under Plan I must normally earn 27 semester hours, all of which must be at the 500 level or above; a minimum of 16 must be in one major area. Four to 6 thesis credit hours may be counted toward the 27-hour requirement.

Plan II With Project. After any undergraduate deficiencies have been removed, students under Plan II must normally earn 30 semester hours, all of which must be at the 500 level or above; a minimum of 20 must be in one major area. Credits earned in relation to the project (if any) must be in excess of the 30-hour minimum.

Doctor's Degree

All doctoral candidates in theatre and dance will normally be expected to earn 40 semester hours of course work beyond the master's degree, all of which must be at the 500 level or above. Candidates will be required to complete Th.Dn. 601 or its equivalent. Candidates are also required to take at least four courses outside the department or area of concentration.

A doctoral candidate, with the approval of his committee, may count toward the Graduate School requirement of 30 semester hours at the 500 level or above up to 10 hours earned prior to starting his doctoral program. Such transfer credits, however, may not be used to satisfy the departmental expectation of 40 hours beyond the master's degree unless they were earned in excess of the master's degree requirements. The reason for allowing the transfer of such credits is simply to provide greater latitude to the student in choosing courses at the 500 level.

Specific requirements will be determined by the candidate's advisory committee within the framework of Graduate School and departmental requirements and policies.

The Graduate School requires a fourth-semester proficiency in a foreign language or passing the GSFLT.

WOMEN STUDIES

The University of Colorado offers a Women Studies Program, the purpose of which is to provide an interdisciplinary approach to the study of women in society. The program offers core interdisciplinary courses and promotes the development of women studies courses in other departments and programs. Students should consult the *Schedule of Courses* or the Women Studies brochure for a complete listing of classes in women studies and related academic courses. Although a B.A. is not offered by the program, there are two options available to students interested in concentrating on women studies. The rules of the College of Arts and Sciences provide that a student may develop an Individually Structured Major with a faculty advisory committee and approval of the Dean of Arts and Sciences. The program also offers a Certificate Program in Women Studies which requires a minimum of 21 hours in women studies: 9 hours in women studies core courses, 6 hours in related humanities courses, and 6 hours in related social sciences courses. The women studies director should be consulted in developing either option. The program offers research materials, a library for student and faculty use, and publishes *Frontiers: A Journal of Women Studies*.

PREHEALTH SCIENCES

Students with vocational interest in a health field apply to that professional program after completion of one to three years of college work, which must include specific preprofessional courses. Most University of Colorado professional health programs are offered at the Medical Center in Denver. Preprofessional work can be completed on the Boulder Campus, where preprofessional advising is available.

Each student must recognize that admission to a preprofessional program on the Boulder Campus does not guarantee later admission to the professional program. At the time of actual application to the professional program, the students will be judged on several factors, including performance in undergraduate courses. For this reason, no required course may be taken on a pass/fail basis. Some fields require specific preprofessional examinations before application. For most fields, interviews are an essential part of the application process. In all cases, admissions committees will be concerned with the student's personal qualities, including: compassion, coping abilities, decision making, interprofessional relations, realistic self-appraisal, sensitivity in interpersonal relations, and staying power (physical and motivational). In addition to formal course work, it is suggested that students gain experience in people-related activities (including medical activities), so that they can be certain of their motivations for health careers.

Most of the professional programs at the University of Colorado have strong preference for, or are restricted to, Colorado residents. Students from other

states usually can obtain at Boulder the preprofessional courses required by their state schools but should check with those schools in advance. Students are encouraged to apply to both state and private professional schools to increase their chances of gaining acceptance to the professional program of their choice.

During the preprofessional years, personal intellectual development will cause many students to change professional goals. On a national basis, there are approximately three to four candidates for every available position in the professional health programs. Therefore, many additional students will be forced to change goals because of nonacceptance to the field of their choice. Under these circumstances, wise students will plan college programs to give themselves the greatest flexibility in considering alternate vocational goals.

Most students in certain fields (dentistry, health administration, medicine) will complete an undergraduate degree before entering the professional program. Others (child health associate, dental hygiene, medical technology, nursing, pharmacy, physical therapy, etc.) do not require an undergraduate degree, although this can be a major factor in gaining acceptance to a professional program. Students actually entering these latter programs are not required to satisfy degree requirements on the Boulder Campus. However, wise students will, while working to satisfy preprofessional requirements, also protect themselves by satisfying requirements for an undergraduate degree at Boulder. Care in selection of courses will permit the same courses to be used to satisfy several sets of requirements. Selection of the proper level of chemistry is especially critical. Chem. 101-102 will satisfy minimal requirements for such fields as child health associate, dental hygiene, nursing, and physical therapy, but will not be accepted for the other health fields. On the other hand, Chem. 103, 106, and 331 will permit the student to apply to any health program and will also satisfy degree requirements for any major requiring chemistry.

None of the professional programs specify the college or academic department within which preprofessional courses must be taken. Generally, there is no advantage of one college or academic major over another. For example, premedical students can be found majoring in both science and nonscience departments of the College of Arts and Sciences, as well as in such colleges as engineering, business, and music. Therefore, students would be well advised to examine their academic strengths and weaknesses, as well as interests and vocational alternatives, in planning a program of study. Students are urged to consult with advisers in their possible major departments as well as with advisers in the prehealth fields.

A summary of preprofessional requirements for the University of Colorado programs follows, together with the number of openings in the program and information on the time the student normally applies. More detailed information on the programs and admission requirements can be obtained from the

Health Sciences Advising Office, Room 303, Chemistry Building, from the specific prehealth adviser listed, or from the program office at the Medical Center. Two advising courses, A.S. 198, Preparation for a Career in the Health Sciences, and P.E. 198, Introduction to Physical Therapy I, provide students with information essential for career planning. There are other medical fields which are not specifically available at the University of Colorado. Check with the Health Sciences Advising Office for details.

CHILD HEALTH ASSOCIATE

Minimum 60 semester hours.

<i>Required:</i>	<i>Semesters</i>
Chemistry, general (Chem. 101, 102)	2
Biology (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	2
Psychology	2

Suggested: Behavioral and child psychology, cultural anthropology, English, humanities, sociology.

Application deadline November 15. 20 positions. Many applicants will have much more than minimal college requirements.

DENTAL HYGIENE

Minimum 60 semester hours.

<i>Required:</i>	<i>Semesters</i>
Expository writing	2
Mathematics (College Algebra, Math. 101)	1
Psychology	1
Speech (Comm. 102)	1
Sociology	1
Chemistry, general, with laboratory, (Chem. 101, 102)	2
Biology, general, with laboratory, (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	2

Requirements subject to change.

Application normally at beginning of sophomore year, deadline December 15, 16 positions open. Dental Hygiene Aptitude Test required.

DENTISTRY

Minimum 90 semester hours; undergraduate degree normally obtained before entrance.

<i>Required:</i>	<i>Semesters</i>
Chemistry, general (Chem. 103, 106 ¹)	2
Chemistry, organic (Chem. 331, 332 ²)	2
Biology, general (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	2
Physics, general (with laboratory)	2
Mathematics (minimum college algebra and trigonometry)	2
Genetics	1
Literature	2
Expository writing	1

Application normally between junior and senior years with deadline December 15. 25 positions open. Dental Admission Test required.

HEALTH ADMINISTRATION

Requires baccalaureate or advanced degree, with a well-balanced undergraduate program which might include courses in biology, economics, mathematics, sociology, psychology, business administration, and political science.

Application normally in senior year with deadline December 1. Graduate Record Examination required. 25 positions open.

MEDICINE

Most applicants will enter medical school with a baccalaureate degree or at least 120 hours.

<i>Required:</i>	<i>Semesters</i>
Chemistry, general (Chem. 103, 106 ¹)	2
Chemistry, organic (Chem. 331, 332 ²)	2
Biology, general, (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	2
Physics, general (with laboratory)	2
Mathematics (minimum college algebra and trigonometry)	2
Literature	2
Expository writing	1

Normal application between junior and senior years with application deadline November 1. Students will take Medical College Admissions Test in spring of junior year and should be completing science requirements at that time. 125 positions open. Only students from Colorado and the four WICHE states (Alaska, Idaho, Montana, and Wyoming) are eligible.

MEDICAL TECHNOLOGY

Minimum 90 semester hours required.

<i>Required:</i>	<i>Semester Hours</i>
Chemistry (with laboratory), usually general chemistry (Chem. 103, 106) and organic (Chem. 331, 332)	16
Biology (with laboratory). Must include microbiology (EPOB 301). Remaining credits from general biology (EPOB 101 and 110, 102 and 111 or MCDB 105, 106), physiology, anatomy, histology, or embryology.	16
Mathematics. College algebra; familiarity with the principles of calculus is desirable.	5-10

Strongly recommended:

Physics (with laboratory), usually Phys. 201.	5-10
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Recommended:

Biochemistry, physical chemistry, English, speech or communications, social sciences, physical education, foreign language, introduction to statistics.

Normal application in fall of junior year with application deadline February 1. Interviews only after submission of application and fee. Before December 20 any applicant can make interview arrangements; after December 20 interviews by invitation only. University of Colorado students who are Colorado residents have priority for the program. Minimum science GPA 2.75. 20 positions open. Students must meet clinical training prerequisites established by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists and the American Society of Medical Technology. Program leads to degree of Bachelor of Science in Medical Technology.

NURSING

Minimum 60 semester hours.

<i>Required:</i>	<i>Minimum Semester Hours³</i>
Biology, general, as prer. for microbiology and physiology (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	3
Microbiology (EPOB 301)	3
Human anatomy (EPOB 307)	3
Chemistry (Chem. 101-102, Chem. 103-104, or Chem. 103, 106, 331)	8

¹For especially qualified students, Chem. 107, 108 may be substituted.

²For chemistry majors, Chem. 335, 338 will be substituted.

³Because of Boulder Campus course differences, number of hours do not agree exactly with School of Nursing publications.

Physiology (EPOB 322)	6
Sociology, general	3
Psychology (Psy. 100, 264, 230, or 468)	9
Statistics	3
Anthropology (Anth. 104)	3
Expository writing	3
Humanities (two-semester sequence in literature, philosophy, art, music, foreign language, dance, fine art, theater, humanities, political science, or history	6

The remainder of the 60 semester hours may be selected from any academic discipline with the exception of commercial and vocational courses and doctrinal courses in religion. Because of the number of science prerequisite courses, the beginning prenursing student has two choices: (1) take both chemistry and biology during the freshman year, or (2) take one of these courses, preferably biology, during the summer session either preceding or following the freshman year. Application during November of sophomore year with February 1 deadline. 125 positions open.

PHARMACY

Although the School of Pharmacy is located on the Boulder Campus, two academic years of preprofessional study are required before admission to the professional program, including the following courses or their equivalent with a grade of C or better.

<i>Required:</i>	<i>Semesters</i>
Chemistry, general (Chem. 103, 106)	2
Chemistry, organic (Chem. 331, 332)	2
Biology, general (with laboratory) (EPOB 101 and 110, 102 and 111 or MCDB 105, 106)	2
Mathematics (college algebra and trigonometry or calculus)	1 or 2
Physics, general (with laboratory) (Phys. 201, 202)	2
Economics (Econ. 201, 202)	2
Expository writing, English literature, or foreign language	2
Electives, minimum of 10 hours	2

Electives are not required for admission. However, students should plan to complete at least 10 semester hours of elective credit prior to enrollment in the School of Pharmacy. An applicant must have attained a cumulative grade-point average of at least 2.0 computed on

all courses attempted. However, a 2.0 average is a minimal requirement only and does not assure admission; each year the Committee on Pharmacy Admissions will establish the grade-point average for acceptance.

Applications, normally during the sophomore year, are considered only for the fall semester and must be submitted by March 1 of the year for which admission is desired. The Pharmacy College Admissions Test (PCAT) is required for all applicants and must be completed not later than February of the year for which admission is desired. For prepharmacy advising, consult the School of Pharmacy, Ekeley Building, West 181.

PHYSICAL THERAPY

Minimum 90 semester hours required. The professional program at the Medical Center constitutes the senior year.

<i>Required:</i>	<i>Semester Hours</i>
Biological sciences	14
General biology (EPOB 101 & 110, 102 & 111, or MCDB 105, 106)	
Anatomy (human preferred—EPOB 307 or P.E. 354, Applied Physiology and Anatomy. Can be used as anatomy, but not physiology.)	
Physiology (human preferred—EPOB 322) (prer., one year of chemistry)	
Humanities (including expository writing)	12
Psychology	6
Social science	6
Kinesiology (P.E. 454)	2
Physics, general (recommended content to include mechanics, heat, and electricity—usually Phys. 201)	3
Chemistry, general (Chem. 101-2)	8

Only Colorado and WICHE students are eligible for the program. Application during the sophomore year after completion of at least 45 hours and the majority of the prerequisite courses; filing dates from January 1 to March 1 when all applications must be returned. 32 positions available. Minimum GPA 2.5. Selection of applicants is made 1½ years prior to admission. Applications submitted during filing period January 1, 1979 to March 1, 1979, will be considered for class matriculating at the Medical Center in September 1980. For advising, consult Dr. John W. Hall III, Department of Physical Education.

College of Business and Administration and Graduate School of Business Administration

William H. Baughn, Dean

INFORMATION ABOUT THE COLLEGE

History and Purpose

The College of Business and Administration and Graduate School of Business Administration serve the need for competent and responsible administrative personnel, for continued education of those already in such positions, and for research.

The college was admitted to membership in the American Assembly of Collegiate Schools of Business in 1938.

The college participates on a continuing basis in the Executive Program for the Gas Industry, the Institute for Organization Management, the Colorado School of Banking, the National Installment Banking School, the School of Bank Marketing, the School for International Banking, and many activities of the Center for Management and Technical Programs. The college also assists in the presentation throughout Colorado of a Certificate Program in Real Estate. The faculty also participate in many continuing education, government, and company educational programs.

The Executive-in-Residence program provides business leaders in residence to work with students and faculty during the school year.

The Business Alumni Advisory Council serves as a direct link with the business community to promote understanding, cooperation, and mutual gain in a variety of education-industry activities.

Career Opportunities

Graduates occupy positions and perform widely varied functions in:

Advertising
Banking
Information systems
Consumer credit and mortgage financing
Credit administration
Financial management

Marketing research
Minerals land management
Office management
Operations research
Personnel management
Production management

Industrial selling and purchasing
Insurance
International business
Investments
Management accounting
Management consulting
Marketing management
Public accounting
Real estate
Retailing
Selling and sales management
Traffic management
Transportation
Wholesaling

Others hold positions of responsibility in fields as diverse as business journalism, public relations, city planning, chamber of commerce and trade association management, college administration, and government.

Facilities and Research Activities

The Business Building is a total educational environment designed for the specific needs of business students. The facilities include computer terminals, the William White Business Library, organizational laboratories, lounges, varied classrooms, all faculty and administrative offices, and the Business Research Division.

The college offers its undergraduate and M.B.A. programs on the Denver and Colorado Springs campuses also.

The Business Research Division provides facilities and trained personnel for research on business and economic problems. Established in 1915, the unit serves as the research arm of the college. The division serves Colorado and the surrounding region to improve the general economic welfare of the area and to gather and disseminate business and economic information; encourages research by faculty members and graduate students; and develops closer relationships between students, faculty, and businessmen.

Through its monthly publication, *The Colorado Business Review*, the division provides basic business information concerning Colorado. Other publications include compilations of business and economic data, industry surveys, studies of special problems in business management, and regional community studies.

Honors Program

Upon recommendation of the faculty, students who demonstrate superior scholarship are given special recognition at graduation.

Students must achieve an overall grade-point average of 3.3 and a grade-point average of 3.5 in all business courses taken at the University of Colorado to be considered for *cum laude*.

Those who achieve an overall grade-point average of 3.5 and a grade-point average of 3.7 in all business courses taken at the University of Colorado will be considered for *magna cum laude*.

Student Organizations

Opportunity for association in activities to stimulate professional interests and to gain recognition of scholastic attainment is provided by the following student organizations:

AIESEC, international business association.

Beta Alpha Psi, national honorary and professional accounting fraternity.

Beta Gamma Sigma, national honorary scholastic fraternity in business.

Beta Sigma, coeducation professional business fraternity.

Black Business Student Coalition

B.R.E.C., Buffalo Real Estate Club.

CBSA, *Chicano Business Students Association*.

CSPA, *Colorado Society for Personnel Administration (Student Chapter)*, for students interested in personnel or industrial relations.

CUAMA, student chapter of the American Marketing Association.

Delta Phi Epsilon, honorary graduate fraternity in business education.

Delta Sigma Pi, professional business fraternity.

DBA Association, for doctoral students in business.

MBA Association, for master's students in business.

MEIS, *Minority Employment Information Service*, nonprofit student organization to locate minority jobs.

Phi Chi Theta, professional business and economics fraternity.

Sigma Iota Epsilon, professional and honorary management fraternity.

S.A.M.L., Student Association of Minerals Landmen.

The Student Board represents students in planning and administration of the school's activities. The board of 12 members is elected annually.

Awards Banquet

Each spring, the dean's office and the Student Board sponsor a banquet honoring top students in the graduating class. Scholastic honors from outside companies and memorials are given at this time, as well as honors from the dean's office and other departmental offices. Both graduate and undergraduate awards are distributed, including recognition of those students graduating *cum laude* and *magna cum laude*.

Graduating students also honor the outstanding teacher of the year.

ACADEMIC POLICIES—UNDERGRADUATE

Each student is responsible for knowing and complying with the academic requirements and regulations established for the college and for classes. Upon admission the Office of Undergraduate Studies can advise on the academic program. The student is responsible for knowing his status at all times.

Attendance Regulations

Classroom attendance is left to the discretion of the instructor. Students are responsible for determining each instructor's policy on attendance.

Standards of Performance

Students are held to basic standards of performance established for their classes with respect to attendance, active participation in course work, promptness in completion of assignments, correct English usage both in writing and in speech, accuracy in calculations, and general quality of scholastic workmanship.

In general, examinations are required in all courses and for all students, including seniors.

To be in good standing, students must have an overall grade-point average of not less than 2.0 ($C = 2.0$) for all course work attempted and a 2.0 for all business courses attempted. This applies to work taken at all University campuses. Physical education activity courses and remedial course work are not included in the overall average.

When semester grades become available, students below the acceptable standard will be notified of (1) probationary status or (2) suspension. College rules governing probation and suspension are as follows:

1. Any student whose overall grade average or business course average is less than a 2.0 shall be placed on probation immediately. A student may be removed from probation when the overall average and the business average have been raised to 2.0.

2. A student shall remain on probation as long as the student maintains normal degree progress each semester as determined by the college and obtains no grade below a *C*; such probationary status may continue for a maximum of four regular semesters, provided these provisions have been met. Failure to meet these provisions will result in indefinite suspension.

3. Indefinitely suspended students may attend the University of Colorado summer school in order to improve their grade average in the area of deficiency, but may not attend any division of the University for at least two *regular* (fall and spring) semesters.

4. A student who has been under indefinite suspension for two semesters may apply for readmission to the College of Business and Administration. If the student is readmitted, that readmission will be on a probationary status. After being readmitted under

such probationary status, any student who fails to comply with the requirements of the probation will be subject to permanent suspension.

5. Any student who is placed on suspension more than once will be permanently suspended from the College of Business.

6. Any student earning all failing grades or no academic credit for the semester will not be permitted to register without the dean's approval.

7. Official combined-degree students are required to maintain the same standard of performance as College of Business students in order to be continued in the combined business program.

Credit

To receive credit, the student must have all courses listed on his registration in the Office of Admissions. Credit is then evaluated by the College of Business to determine degree acceptability.

Courses completed at any University of Colorado campus are credited toward degree requirements, if appropriate to the degree program.

TRANSFER CREDIT

Credits in business subjects transferred from other institutions will be limited to the number of credit hours given for equivalent work in the regular offerings of the University. Transfer work from regionally unaccredited institutions will not apply. In general, the college will limit transfer credit for business courses taken at a lower division level to such courses as the college offers at that level. All courses in the area of emphasis must be taken at the University of Colorado unless written approval is given by the appropriate division head. Transfer students must take 30 hours of degree requirements in residency after admission to the College of Business. For a detailed explanation of transfer credit, see the General Information section.

CORRESPONDENCE CREDIT

Only 30 semester hours of credit, 9 of which may be in business, taken through correspondence study will be counted toward the B.S. degree in business. Required business courses and area of emphasis courses cannot be taken by correspondence. All correspondence courses are evaluated to determine their acceptability.

CREDIT BY EXAMINATION

Advanced Placement (CEEB). For students who make scores of 3, 4, or 5, college credit will be given where appropriate.

College Level Examination credits (CLEP) are acceptable toward degree requirements up to 30 hours. Specific information is available in the Office of the Dean, Room 230.

CLEP credit will be applied in the same manner as transfer credits. For credit, students must rank in the 66.7 percentile based on national available norms. Generally, CLEP credit is only appropriate for (a)

prebusiness requirements and (b) nonbusiness electives. A maximum of 6 hours of credit in any one course area is allowed. CLEP may not be used in course areas where credit has already been allowed. General Examinations are not acceptable.

Credit for CLEP subject examinations in business course areas must have prior approval in writing by the Office of Undergraduate Studies and by the appropriate division head.

ROTC CREDIT

Students who are enrolled in and complete the ROTC program may apply a maximum of 12 semester hours of advanced ROTC credit toward nonbusiness elective requirements and toward the 120-semester hour total degree requirement for the B.S. degree in business. No credit toward degree requirements is granted for basic (freshman and sophomore) ROTC courses. The ROTC adviser can provide more detailed information.

SPECIAL SOURCES OF CREDIT

Up to 6 hours of experimental studies or independent study programs can be accepted toward graduation. A maximum of 3 hours of this type of credit may be taken in any one semester.

Independent Study Credit. Junior or senior business students desiring to work beyond regular business course coverage may take variable credit courses (1-3 semester hours) under the direction of an instructor who approves the project, but the student must have prior approval.

Information and request forms are available in the Office of Undergraduate Studies.

To receive credit for nonbusiness independent study courses, students should obtain the dean's approval prior to registering for the course. Further information and forms are available in the Office of Undergraduate Studies.

No credit is given for work experience or cooperative education programs.

STUDY-ABROAD CREDIT

Transfer credit from study-abroad programs is applied as nonbusiness elective credit. Students planning to attend study abroad programs should meet with a College of Business adviser, Business Building Room 230 and have their selections of classes approved before leaving campus. Information on the various study abroad programs is available at the Office of International Education.

Adding and Dropping Courses

See the General Information section for University-wide Drop/Add policy.

Administrative Drop. Instructors may recommend to the Office of Undergraduate Studies that students who fail to meet expected course attendance be dropped without discredit during the first ten weeks of the semester.

Withdrawal

Students may withdraw without discredit at any time *prior* to the start of the final examination period.

Students who leave the University before the end of the semester should obtain a Withdrawal Form from the dean's office and follow the instructions on the form. The completed form must be turned in to the Office of Admissions, Regent Administrative Center.

Students who withdraw during the semester are not assured admission the following semester but will be considered on an individual basis, according to the space available.

Registration for Business Courses

Students may register only for those courses for which they have the stated prerequisite training. Junior standing is required for all business courses numbered 300-499. Priority is given to students officially in the business program.

Scholastic Load

The normal scholastic load of an undergraduate in business is 15 semester hours, with 12 hours as the permissible minimum and 19 hours the maximum. Hours carried concurrently in the Division of Continuing Education, whether in classes or through correspondence, are included in the student's load.

Students with a grade-point average of 3.0 or higher for the most recent semester in which they completed at least 15 semester hours, with the approval of the dean, may register for a load exceeding 19 semester hours.

Grading and Point System

See the General Information section for University-wide grading system and pass/fail policy.

Pass/fail. For business majors, pass/fail courses *may not be included* in required business courses or in the area of emphasis; but may be in other required areas (mathematics, communications, political science, psychology, sociology, and economics). Pass/fail determination must be made within the posted deadline and is *irreversible*.

Failed courses may be repeated, but the *F* will be included in the grade-point average.

UNDERGRADUATE DEGREE PROGRAMS

Admission of Freshman Students

See General Information section for information and application procedures.

Prospective students in business are encouraged to pursue a broad college preparatory program in high school, with particular emphasis on English, mathematics, the social sciences, and speech.

Candidates for the Bachelor of Science (Business) degree normally enter as freshmen.

The college expects entering freshmen to present 15 units of the secondary course work.

Intrauniversity Transfer

Students who wish to transfer to business from another college or school of the University must formally apply at the dean's office (Room 230). A minimum University of Colorado grade-point average is established by the College of Business and is required for consideration.

Students desiring admission to official combined programs must apply and be accepted by the College of Business. Minimum grade-point averages are also established for these jointly enrolled students.

Combined Programs and Double Majors

Official combined programs are available only in conjunction with the College of Engineering, the College of Environmental Design, the School of Journalism, and the School of Pharmacy. Students may earn a degree from the College of Business and Administration for a degree from the College of Arts and Sciences by completing all degree requirements for both colleges. Combined and double degree programs require approval of the deans of both colleges. Before a combined degree student will be admitted to courses in the College of Business, the student must obtain permission and complete an application for admission form from the College of Business. Failure to do so may preclude the student from taking any business course. Students enrolled in other colleges which require business courses as a part of their curricula will be admitted to business classes on a space available basis.

Requirements for the B.S. (Business Degree)

The student alone is responsible for the fulfillment of these requirements. Questions concerning graduation should be directed to the College Office of Undergraduate Studies (Room 230).

Students *must file* an Intent to Graduate Form with the dean's office *before registering for their last semester*.

GENERAL REQUIREMENTS

The Bachelor of Science (Business) degree requires:

1. *Total Credits.* A minimum of 120 acceptable semester hours of credit, of which at least 51 hours must be in nonbusiness courses (including 9 hours of upper division work) and at least 51 hours in business courses. The remaining 18 hours may be in either.

This credit cannot include remedial work, repetition of courses, courses failed, activity physical education, recreation, and dance courses. However, a maximum 6 hours of theory physical education, recreation, and/or dance may be used. Advanced ROTC work is acceptable only if the ROTC program is completed.

A maximum of 60 semester hours taken at junior colleges may be applied toward the B.S. degree in business.

The student is responsible for having *incomplete* grades removed four weeks prior to graduation.

2. *Residence.* Completion of at least 30 semester hours of Business, usually in the senior year, after admission to the College of Business, and to include the 12 hours in the area of emphasis.

3. *Grade Average.* A minimum scholastic grade average of 2.0 (C) for all courses attempted at the University acceptable toward the B.S. (Business) degree, 2.0 for all business courses, and 2.0 in the area of emphasis.

4. *Courses.* Completion of all the following required courses:

	<i>Semester Hours</i>
Area of emphasis	12
College algebra and calculus	6
Communication and composition	6
Core requirements (basic courses in accounting, business law, business statistics, business and society, marketing, finance, organization management, production and operations management, business policy) .	30
Electives	
Business	9
Nonbusiness (to include 9 hours upper division work) . . .	15
Free electives	18
General psychology	6
Introductory sociology or cultural anthropology	3
Natural science (astro-geophysics, biology, chemistry, geography, geological sciences, and physics)	3
Political science	6
Principles of economics	6
	120

Upon reaching senior status, the student *must contact* the Office of Undergraduate Studies for a complete academic evaluation *prior to* registering for the last term on campus.

MODEL DEGREE PROGRAM

The following sequence of courses is a guide to registration.

<i>Freshman Year</i>	<i>Semester Hours</i>
A.S. 100. Expository Writing	3
Comm. 102 or 210. Basic Communication	3
Math. 107. College Algebra	3
Math. 108. College Calculus	3
P.Sc. 100. Introduction to Political Science	3
P.Sc. 110. American National Government	3
Soc. 211. Introduction to Sociology or Cultural Anthropology .	3
B.Ad. 100. Introduction to Business or an elective	3
Natural science	3
Nonbusiness electives	3
	30

<i>Sophomore Year</i>	<i>Semester Hours</i>
Econ. 201, 202. Principles of Economics (macro/micro)	6
Psy. 100. Principles and one other behavioral psychology course	6
B.Ad. 200. Business Information and the Computer	3
Q.M. 201. Business Statistics	3
Acct. 200. Introduction to Financial Accounting	3
Nonbusiness electives	9
	30

<i>Junior Year</i>	<i>Semester Hours</i>
B.Law 300. Business Law	3
Mk. 300. Principles of Marketing	3
Fin. 305. Basic Finance	3
Or.Mg. 330. Introduction to Management and Organization	3
Pr.Mg. 300. Production and Operations Management	3
Nonbusiness electives	3

Business electives	6
Either business or nonbusiness electives	6
	30

Senior Year

B.Ad. 450, 451, or 452. Business Policy	3
B.Ad. 411. Business and Society or B.Ad. 410. Business and Government	3
Area of emphasis	12
Business electives	3
Either business or nonbusiness electives	9
	30

AREA OF EMPHASIS

Each candidate for the B.S. (Business) degree must complete the prescribed courses in an area of emphasis comprising 12 semester hours taken at the University of Colorado.

Although only one area of emphasis will be listed on the student's official records, students so desiring may accomplish the effect of a dual area of emphasis by careful selection of courses.

Accounting

Accounting courses are offered in several fields of professional accountancy at the intermediate, advanced, and graduate levels. They provide preparation for practice in one or more of the following fields:

Financial accounting	Tax accounting
Auditing	Data processing and control systems
Managerial accounting	Teaching and research

In all of these fields a thorough knowledge of the social, legal, economic, and political environment is needed. A high degree of analytical ability and communication skill is indispensable.

The undergraduate area of emphasis in accounting consists of 12 hours beyond Acct. 200 and 202:

<i>Required Courses</i>	<i>Semester Hours</i>
Acct. 322. Intermediate Financial Accounting I	3
Acct. 323. Intermediate Financial Accounting II	3
Acct. 332. Cost Accounting	3
Acct. elective	3
	12

Students planning to pursue accounting as a career usually take more than the required 12 hours. Many students take a total of about 30 hours of accounting, often taking two courses each semester in their junior and senior years. Students should work closely with accounting faculty in planning their accounting programs.

Students planning to take the CPA examination should take about 30 hours of accounting and also be well prepared in statistics, business law, finance, and economics.

Graduate study in accounting is receiving increasing emphasis by professional organizations and employers. Students meeting admission requirements should consider continuing their education at the graduate level.

Business Education

With a bachelor's degree, the business education student is prepared to teach in secondary or junior high schools in both skills and general knowledge areas. With completion of the master's degree in business education or office administration, career opportunities are extended to the junior college and community college levels. Upon completion of the business education program, the state certification requirements are met. Students may choose an area of emphasis in either a general business concentration or a secretarial concentration. The general business concentration is provided for those who wish to prepare for teaching general and basic business, bookkeeping, business mathematics, office management, and related subjects. The secretarial concentration is intended for students who wish to include stenographic subjects in their teaching fields. A 2.5 overall grade-point average is required for admission into the student teaching program.

Students in business education must follow the prescribed curriculum of the School of Education for the professional year (see the School of Education section of this catalog) which includes: fall semester—T.Ed. 410, 411, 412, 446, and Comm. 230; spring semester—T.Ed. 446, 471, and 472.

In addition to the requirements of the professional year, the following courses are required:

	<i>Semester Hour</i>
B.Ed. 230. Principles of Business Education	3
B.Ed. 410. Methods in Business Education	3
B.Ed. 411. Methods in Business Education	3
O.Ad. 421. Office Procedures	3
O.Ad. 440. Principles of Office Management	3
O.Ad. 300. Office Machines	1
O.Ad. 301. Office Machines II	1
O.Ad. 441. Problems in Office Management	2
or	
O.Ad. 420. Secretarial Procedures	3

Students programming elective hours in a general business concentration will register for O.Ad. 441. Those studying in a secretarial concentration will complete O.Ad. 420 together with any needed prerequisites.

Students who plan to enter the curriculum in business education are advised to select courses in their freshman and sophomore years that will provide a minimum of 18 semester hours in a second teaching field, such as social science, mathematics, English, etc., since beginning teachers are frequently required to teach in more than one field. As sophomores they should also register for B.Ed. 230. Business education majors may substitute Educ. 480 for the business core requirement, Q.M. 201.

Finance

The principal areas of study in finance are financial management, monetary policy, banking, investments, and insurance.

Finance is intended to give understanding of fundamental theory pertaining to finance and to develop ability to make practical applications of the principles

and techniques of sound financial management in business affairs. Every endeavor is made to train students to think logically about financial problems and to formulate sound financial decisions and policies.

It is necessary to understand the importance of finance in the economy and the functions and purposes of monetary systems, credit, prices, money markets, and financial institutions. Emphasis is placed on financial policy, management, control, analysis, and decision making. Numerous opportunities are to be found with financial institutions and in the field of business finance.

Acct. 202 is a prerequisite for this area.

<i>Required Courses</i>	<i>Semester Hours</i>
Fin. 401. Business Finance I	3
Fin. 402. Business Finance II	3
Fin. 433. Investment and Portfolio Management	3
Fin. 455. Monetary and Fiscal Policy	3

Recommended Elective Courses

Fin. 440. International Financial Management	3
Fin. 434. Security Analysis	3
Fin. 453. Bank Management	3
R.Es. 454. Real Estate Finance	3
Ins. 484. Principles of Insurance	3

Information Science

The information science area is designed for those who wish to prepare themselves for careers as professional administrative data processing managers in business and government. The student develops those technical skills and administrative insights required for the analysis of information systems, the design and implementation of systems, and the management of data processing operations. The emphasis is on management information systems—systems for the collection, organization, accessing, and analysis of information for the planning and control of operations. The automation of data processing is also studied extensively.

The undergraduate area of emphasis consists of 12 hours beyond B.Ad. 200 plus Q.M. 201 and I.S. 215.

<i>Required Core: (12 Hours)</i>	<i>Semester Hours</i>
I.S. 350. Database and Information Systems	3
I.S. 465. Systems Analysis and Design	3
Q.M. 300. Intermediate Statistics	3
Q.M. 330. Operations Research	3

International Business

In recent years, companies have completely reoriented their thinking, planning, and operations to capitalize on the opportunities offered in the world marketplace. Every phase of business operation is affected by this reorientation, and individuals who offer the appropriate skills, training, and orientation are in great demand.

The program reflects the basic principle that effectiveness in international business is based on a thorough training in business administration. The international business program provides the opportunity to build on these skills.

Other courses emphasizing international affairs may be elected from the following departments: anthropology, economics, geography, history, political science, psychology, and sociology.

<i>Required Courses</i>	<i>Semester Hours</i>
Econ. 441. International Trade	3
plus three of the following courses:	
B.Ad. 440. International Business Seminar	3
Fin. 440. International Financial Management	3
Or.Mg. 458. International Transportation	3
Mk. 490. International Marketing	3

A second area of emphasis in business is highly recommended. The course requirements for the second area can be included as part of the business and free elective hours. Foreign language study is also recommended.

It is important for students who expect to be involved in international business to have an understanding of international relations, which may be gained in study abroad programs. Information on study abroad programs may be obtained from the Office of International Education. The College of Business will evaluate credit earned in such programs and determine degree acceptability.

Marketing

Marketing is concerned with analyzing the market for a product or service, planning and developing that product, determining the most appropriate distribution channels, pricing the product, and promoting it. The administrative policies and practices of any well-managed firm should be marketing-oriented toward the consumer.

The career opportunities in marketing reflect the businessman's awareness of the importance of this field. Today many individuals are rising to top executive positions by the marketing route. There are more executive and other job opportunities for women in the marketing field than in any other single area outside teaching or secretarial work. One out of every four people gainfully employed in this country is in a marketing position.

Career opportunities abound in personal selling, advertising, sales management, marketing research, retailing, wholesaling, marketing by manufacturers, international marketing, etc.

<i>Required Courses</i>	<i>Semester Hours</i>
Mk. 330. Marketing Research	3
Marketing electives (beyond Mk. 300)	9

Students should note that the required course, Mk. 330, is taught only during the academic year and is not offered during the summer session.

Minerals Land Management

A student who plans to complete an area of emphasis in minerals land management should comply with the following outline in regard to courses, hours, restrictions, and options. These are in addition to the required core courses and nonbusiness courses. Except as specifically stated, no 300- or 400-level

course (business or nonbusiness) may be taken pass/fail.

<i>Specific Required Courses</i>	<i>Semester Hours</i>
Geol. 101. Introduction to Geology	4
Chem. 101 or 103. General Chemistry	4
Econ. 453. Natural Resource Economics	
or	
Econ. 454. Environmental Economics	3

Course Options in Geology and Geography

A minimum of 7 hours of the following geology or geography courses taken in conjunction with the courses listed above.

Geol. 153. Geological Development of Colorado and the West	4
Geol. 370. Environmental Geology	3
Geol. 404. Geohydrology	3
Geol. 463. Principles of Geomorphology	4
Geol. 493. Introduction to Geophysical Prospecting	4
Geol. 494. Mineral Resources and World Affairs	3
Geog. 306. Map Interpretation	3
Geog. 406. Geographic Interpretation of Aerial Photos	3

College of Business Courses

R.Es. 300. Principles of Real Estate	3
Acct. 202. Managerial Accounting	3
The above two courses may be taken pass/fail if appropriate.	

Area of Emphasis Courses—College of Business

The following courses comprise the area of emphasis. These may not be taken pass/fail.

Fin. 401. Business Finance I	3
Acct. 441. Income Tax Accounting	3
M.L.M. 485. Minerals Landman Administration	3
M.L.M. 495. Oil-Gas and Mineral Law	3

Minerals Landman Administration and Oil-Gas and Mineral Law are given only once a year. These two courses are to be taken after all lower division requirements have been completed and the completion of 75 semester hours of work toward the M.L.M. major. These courses are open only to students who are regularly enrolled in the College of Business and Administration.

R.Es. 430. Residential and Income Property Appraising	3
R.Es. 473. Legal Aspects of Real Estate Transactions	3
Econ. 476, 478. Economics	6
B.Law 412. Business Law	3

Production and Operations Management

The area of emphasis in production and operations management is designed to prepare students for professional careers in production, planning and control, inventory management, and purchasing, in both manufacturing and service organizations.

Emphasis in the program is placed upon current practices in these professional fields and upon the knowledge and skills required for entry-level jobs.

Students choosing this area of study may be asked to participate in live case research and consulting projects with local organizations under the direction of their instructor; encouraged to participate in the newly chartered student chapter of the American Production and Inventory Control Society; and encouraged to seriously consider preparing for and taking the five-part certification examinations given semi-annually by APICS.

Students whose major area of emphasis is information systems or transportation and traffic management will find the Pr.Mg. 400-level courses to be particularly well related to their courses of study.

Required Courses *Semester Hours*

(The following three courses)

Pr.Mg. 440. Planning and Control Systems in Production and Operations Management	3
Pr.Mg. 447. Policy Analysis in Production and Operations Management	3
Pr.Mg. 460. Purchasing and Materials Management	3

(One of the following courses)

Pr.Mg. 444. Work Design and Measurement	3
Q.M. 330. Operations Research	3
I.S. 215. Data Processing	3
Mk. 485. Physical Distribution	3

Recommended Electives

I.S. 350. Database and Information Systems	3
Or.Mg. 335. Managing Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3
Ps.Mg. 434. Labor Relations: Policy and Practice	3
Ps.Mg. 438. Personnel Management: Policy and Practice	3
Tr.Mg. 450. Transportation Operation and Management	3
Acct. 332. Cost Accounting	3
Q.M. 300. Intermediate Statistics	3

Students planning to take the APICS (American Production and Inventory Control Society) certification examinations should consult with an adviser to determine which elective courses should be taken.

Office Administration

A career in office administration includes responsibilities for developing and maintaining effective information flow within an organization as well as between the organization and the public. A professional in office administration plays a vital role in the communications system of the organization.

Competent management of the information flow system is needed by every organization whether it is a business, government, or philanthropic group.

The program is designed to provide communications tools and skills, techniques and methods of information management, and an analytical frame of reference for evaluating the system, spotting possible problem areas, and generating modifications in response to changes in the internal and external environments of the organization.

Specific professional career positions include office and administrative managers, executive and private secretaries, administrative assistants, records managers, and forms control managers.

Required Courses *Semester Hours*

O.Ad. 300. Office Machines I	1
O.Ad. 301. Office Machines II	1
O.Ad. 420. Secretarial Procedures	3
O.Ad. 421. Office Procedures	3
O.Ad. 440. Principles of Office Management	3
O.Ad. 441. Problems in Office Management	2

With the approval of the adviser, advanced accounting courses may be submitted for O.Ad. 420 (Secretarial Procedures).

Organization Management

Organization management offers opportunities to develop understanding and skill in managing human resources in organizations. The curriculum provides the foundation for supervisory and general management careers.

Required Courses *Semester Hours*

(The following two courses)

Or.Mg. 335. Managing Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3

(At least one of the following)

Ps.Mgt. 434. Labor Relations: Policy and Practice	3
Ps.Mgt. 438. Personnel Management: Policy and Practice	3

Recommended Electives

Ps.Mg. 439. Personnel Management: Legal and Social Issues	3
Pr. Mg. 444. Work Design and Measurement	3
Pr.Mg. 447. Policy Analysis in Production and Operations Management	3
Tr.Mg. 450. Transportation Operation and Management	3
Pr.Mg. 460. Purchasing and Materials Management	3
B.Ad. 470. Small Business—Management and Operation	3

Personnel Management

Personnel management offers opportunities for students to develop professional competence in the areas of personnel administration and labor relations. Students develop understanding and skill in developing and implementing personnel systems including recruitment, selection, evaluation, training, and motivation of employees, and union-management relations.

Required Courses *Semester Hours*

(The following three courses)

Ps.Mg. 434. Labor Relations: Policy and Practice	3
Ps.Mg. 438. Personnel Management: Policy and Practice	3
Ps.Mg. 439. Personnel Management: Legal and Social Issues	3
Elective	3

Recommended Electives

Or.Mg. 335. Managing Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3
Pr.Mg. 440. Planning and Control Systems in Production and Operations Management	3
Pr.Mg. 444. Work Design and Measurement	3
Pr.Mg. 447. Policy Analysis in Production and Operations Management	3
Tr.Mg. 450. Transportation Operation and Management	3
B.Ad. 452. Small Business Strategy, Policy and Entrepreneurship	3
O.Ad. 440. Principles of Office Management	3
Econ. 461. Labor Economics	3
Psych. 485. Principles of Psychological Testing	3
Psych. 487. Personality Assessment	3
Soc. 479. Industrial Sociology	3

Public Agency Administration

Public agency administration is designed for a career in management of governmental or other non-profit service organizations. The curriculum in public agency administration provides a foundation of core courses upon which the student can construct an area

of emphasis which will focus on the type of service organization he desires to enter upon graduation.

<i>Required Courses</i>	<i>Semester Hours</i>
Acct. 480. Business and Governmental Budgeting and Control	3
Ps.Mg. 438. Personnel Administration	3
O.Ad. 440. Principles of Office Management	3
Q.M. 330. Operations Research	3

Real Estate

Real estate requires knowledge of real estate investments, urban land economics, real estate law, appraising, finance, taxes, management, sales, and accounting. Real estate is one segment of the economy where it is still possible for persons to be their own boss whether brokers, appraisers, developers, syndicators, or property managers.

<i>Required Courses</i>	<i>Semester Hours</i>
R.E. 300. Principles of Real Estate Practice	3
R.E. 430. Real Estate and Income Property Appraising (formerly Real Estate Appraising)	3
R.E. 454. Real Estate Finance	3
R.E. 473. Legal Aspects of Real Estate Transactions	3
R.E. 401. Urban Land Analysis or R.E. 433 Real Estate Investments	3

It is strongly recommended that any student planning to sit for the Colorado broker's examination take all six of the real estate courses. Additional preparatory courses for a real estate career are:

	<i>Semester Hours</i>
Arch E. 240. Building Construction	3
M.L.M. 485. Minerals Landman Administration	3
Fin. 455. Monetary and Fiscal Policy	3
Acct. 441. Income Tax Accounting	3
Fin. 433. Investment and Portfolio Management	3
Mk. 310. Salesmanship	3
Mk. 320. Consumer Behavior	3
Mk. 470. Sales Management	3
B.Ad. 470. Small Business Management and Operation	3
Ins. 484. Principles of Insurance	3

Students should not take Arch. E. 240 until checking that the required percentage of their courses are in business.

Small Business Management and Entrepreneurship

Small business management provides understanding, knowledge, and skills in organizing and managing small business. The emphasis is on the managerial aspects of the wide range of activities required of the entrepreneur.

A second area of emphasis in business is highly recommended. The course requirements for the second area can be included as part of business or free electives.

It is recommended that students take B.Ad. 452 (Small Business Strategy, Policy and Entrepreneurship) in satisfying their business policy requirement. Additional courses in management, finance, accounting, and marketing should be planned in consultation with the adviser to serve individual career needs.

Required Courses

Semester Hours

B.Ad. 470. Small Business—Management and Operation	3
(Two or three of the following four courses)	
Fin. 401. Business Finance I	3
Acct. 332. Cost Accounting	3
Ps.Mg. 438. Personnel Management: Policy and Practice	3
Mk. 480. Marketing Policies and Strategies	3

Recommended Electives

The fourth course may be selected from the following.

Ps.Mg. 434. Labor Relations: Policy and Practice	3
Pr.Mg. 440. Planning and Control Systems in Production and Operations Management	3
Pr.Mg. 447. Policy Analysis in Production and Operations Management	3
Tr.Mg. 450. Transportation Operation and Management	3
Pr.Mg. 460. Purchasing and Materials Management	3
Mk. 485. Physical Distribution Management	3
O.Ad. 440. Principles of Office Management	3
Fin. 402. Business Finance II	3

Transportation and Traffic Management

The curriculum in transportation management includes the role of transportation in society and the problems of traffic management within specific industries as well as the management of firms in the transportation industry, such as airlines, urban transit firms, trucking firms, and railroads. International transportation management problems and policies are analyzed.

One of the recommended elective courses may be substituted with permission of the adviser for one of the required courses if there is a schedule conflict, if the course is not available, or if a student demonstrates a career need for such a course.

Required Courses

Semester Hours

(Any four of the following six courses)

Tr.Mg. 450. Transportation Operation and Management	3
Tr.Mg. 452. Problems in Traffic Management	3
Tr.Mg. 456. Air Transportation	3
Tr.Mg. 457. Urban Transportation	3
Tr.Mg. 458. International Transportation	3
Mk. 485. Physical Distribution Management	3

Recommended Electives

Ps.Mg. 434. Labor Relations: Policy and Practice	3
Ps.Mg. 438. Personnel Management: Policy and Practice	3
Tr.Mg. 451. Survey of Transportation	3
Pr.Mg. 460. Purchasing and Materials Management	3
B.Ad. 470. Small Business—Management and Operation	3
O.Ad. 440. Principles of Office Management	3

Combined Programs

Numerous career opportunities exist for persons trained in both a specialized field and management. For this reason students may be interested in combined programs of study leading to completion of degree requirements concurrently in two fields. Such combined programs have been arranged for engineering and business, pharmacy and business, environmental design and business and may be arranged for other professional combinations as well.

The two programs of study proceed concurrently, terminating together with the awarding of two

degrees. Generally, at least five years will be needed for such combined programs. No substitutions are allowed on this program.

For students in combined programs, the requirements for the degree in business are as follows:

1. An application for admission to the combined program must be filed with the College of Business and approved by the deans of both colleges. Completion of at least 48 semester credits in business and economics, to include Econ. 201 and 202 (6 semester hours), required courses in business (30 semester hours), and a business area of emphasis (12 semester hours).

2. Completion of at least 30 of these semester hours at the University of Colorado while concurrently enrolled in the College of Business.

3. Completion of nonbusiness requirements in mathematics, communications, and the social and behavioral sciences in a degree program approved in advance by the College of Business. In addition, for some courses and areas of emphasis, there are prerequisite requirements which must be met.

4. At least a 2.0 grade average must be earned in all courses undertaken in the College of Business, the area of emphasis, and the University of Colorado.

5. Any combined degree student who does not make reasonable progress toward the completion of the business degree requirements, as determined by the College of Business, may be dropped from the program.

6. The number of students accepted in any combined degree program may be numerically limited and is dependent upon existing demand each semester.

Shown below is the combined engineering-business program. For other combinations, students must consult with the business dean's office.

The requirements for all combined business and engineering programs are as follows:

<i>Courses</i>	<i>Semester Hours</i>
Econ. 201 and 202. Principles of Economics. (Should be completed during the student's sophomore or junior year.)	6
Acct. 200. Introduction to Financial Accounting	3
B.Ad. 200. Business Information and the Computer	3
Q.M. 201. Business Statistics	3
Mk. 300. Principles of Marketing	3
Fin. 305. Basic Finance	3
Pr.Mg. 300. Production and Operations Management	3
Or.Mg. 330. Introduction to Management and Organization	3
B.Law 300. Business Law	3
B.Ad. 410. Business and Government; or B.Ad. 411, Business and Society	3
B.Ad. 450. Business Policy (Cases and Concepts in Business Policy); or B.Ad. 451. (Management Games and Cases on Business Policy); or B.Ad. 452. (Small Business Strategy, Policy and Entrepreneurship)	3

Specified courses in an area of emphasis in one of the following fields: accounting, information systems, finance, international business, marketing, mineral land management, office administration, production operations management, organizational behavior, personnel management, public agency administration, real estate, small business management, or transportation management. All

work in the area of emphasis must be taken at the University of Colorado College of Business.

Areas of emphasis 12
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GRADUATE DEGREE PROGRAMS

The graduate programs leading to the Master of Business Administration degree are offered through the faculty of the Graduate School of Business Administration. Graduate programs leading to the Doctor of Business Administration, Master of Science, and Master of Business Education are offered through the University's Graduate School. Master's degree programs in business are accredited by the American Assembly of Collegiate Schools of Business. Daytime M.B.A. courses are offered in Boulder. Evening M.B.A. courses are offered in Denver and Colorado Springs.

Requirements for Admission— Master's Programs

Admission to the master's programs will be determined by the following criteria:

1. The applicant's academic record.
2. The applicant's scores on the Graduate Management Admission Test (GMAT). This test is given four times each year at numerous centers throughout the world. For information and to make application for the test, write to the Educational Testing Service, P.O. Box 966, Princeton, New Jersey 08540.

Because of the large number of applications which must be processed, the deadlines set below are strictly adhered to, and applicants should be careful to observe them. Personal interviews are not required or encouraged.

In general, students failing to meet minimum standards are not admitted on provisional status. Seniors in this University who have satisfied the undergraduate residence requirements and who need not more than 6 semester hours of advanced subjects and 12 credit points to meet their requirements for bachelor's degrees may be admitted to the Graduate School of Business Administration by special permission of the director of graduate studies.

Completed applications, including GMAT scores, transcripts, and a \$20 nonrefundable application fee should be in the Office of Graduate Studies, Graduate School of Business Administration, by March 1 for summer session, by April 1 for fall admission, and by October 1 for spring admission, or until available space is filled.

BACKGROUND REQUIREMENTS

Students applying for graduate programs in business do not need to have an undergraduate degree in business; however, they must acquire an adequate background preparation in:

Accounting	Computer programming
Business finance	Economics, macro and micro
Business law	Financial institutions
College algebra and differential calculus	Logistics management
	Management science

Marketing
Organization Management

Production and operations
management
Statistics

Statistics, management science, and production management are not required for candidates for the Master of Business Education degree.

An undergraduate degree program in business administration usually provides the minimal necessary background in most of these fields. At the University of Colorado a student who has had the following courses will be considered to have the minimal necessary background:

Acct. 200. Introductory Accounting—Financial Aspects
Acct. 202. Introductory Accounting—Managerial Aspects
B.Law 300. Business Law
Econ. 201 and 202. Principles of Economics
Fin. 305. Basic Finance
Pr.Mg. 300. Production and Operations Management
Or.Mg. 330. Introduction to Management and Organization
Mkt. 300. Principles of Marketing and one additional 3-hour marketing course approved by adviser
Q.M. 201. Business Statistics (note exception below)
Q.M. 330. Business Operations Research
B.Ad. 200. Business Information and the Computer
Math. 108. College Calculus

For students lacking such preparation graduate fundamentals courses are offered in each of the background fields: B.Ad. 501 (Acct.), B.Ad. 502 (Stat.), B.Ad. 503 (Mk.), B.Ad. 504 (Or.Mg.), B.Ad. 505 (Fin.), B.Ad. 506 (Law), and B.Ad. 507 (Mg.Sc.). These fundamentals courses do not carry graduate business degree credit, nor may they be used to satisfy requirements for the bachelor's degree in business. They are open only to admitted graduate students. Remedial work is required of all applicants accepted for the M.B.A. and M.S. programs who do not have the mathematical and programming skills. Noncredit work in these skills is available through the Graduate School of Business.

Students entering any of the graduate programs (except Master of Business Education) are required to take either B.Ad. 502 (Fundamentals of Business Statistics) or to pass satisfactorily a qualifying examination covering this subject matter. In addition, all graduate students are required to take either B.Ad. 500 (Sources of Information and Research Methods) or to pass satisfactorily a qualifying examination covering this subject matter.

General Information—Master's Programs

The M.B.A. program is a two-year curriculum with the possibility of waiver, for properly prepared students, of all or part of the first year. The student must request course exemption and should be prepared to support the request for waiver. Up to 25 credit hours (first-year program) of course work may be waived.

Advising. All graduate students should report first to the graduate student adviser in the Office of Graduate Studies for the purpose of ascertaining deficiencies and principal field of interest. The division heads of each area serve as faculty advisers.

During the first term of residence, each student should prepare a degree plan. This plan, with appro-

priate signatures, should be filed in the Office of Graduate Studies.

Qualifying Examinations. Satisfactory performance on the Graduate Management Admission Test and admission into a master's program with the status of a regular degree student will constitute the qualifying examination for graduate study.

Course Load. The normal course load for graduate students is 12-15 semester hours.

Minimum Hours Required. A candidate for a master's degree in business must complete a minimum of 30 semester hours of graduate work plus any deficiencies. A maximum of 6 semester hours of graduate work can be transferred from another AACSB accredited master's program.

Comprehensive Examination. Each candidate for a Master of Science or Master of Business Education degree is required to take a comprehensive-final examination after the other requirements for the degree have been completed. This examination is given near the end of the candidate's last semester of residence. Students must be registered when they take this examination. Comprehensive examinations are given in November, April, and July. A comprehensive examination is not required for students pursuing the Master of Business Administration degree program.

Students must file an Application for Admission to Candidacy with the Office of Graduate Studies during the first month of the final term of their residency.

Minimum Grade-Point Average. A minimum cumulative grade-point average of 3.0 must be achieved in courses taken after the student's admission to the graduate program. Effective fall semester 1974 all courses taken as a special student at the University of Colorado count towards the overall grade-point average for students who are later admitted to any graduate program in business. If the cumulative grade-point average falls below 3.0, a student will be placed on academic probation and given one regular semester (summer terms excluded) in which to achieve the required 3.0 cumulative average. Failure to achieve the required average within the allotted time period will result in dismissal.

Work receiving the lowest passing grade, *D*, may not be counted toward a degree, nor may it be accepted for the removal of deficiencies. A student may repeat a course once for which he or she has received a grade of *C*, *D*, or *F*. Both the original grade and the grade for the repeated course count in the computation of the grade-point average.

To earn a grade of *W* (withdrawal) in a course, a student must be earning a grade of *C* or better in that course. Students will not be permitted to withdraw from courses after the tenth week of the semester.

An *IF* grade shall be a valid grade only until the end of the regular semester (summer terms excluded) following that in which the grade of *IF* is given. By the end of that interval, the instructor concerned shall have turned in a final grade of *A*, *B*, *C*, *D*, or *F*. If no reports are received from the instructor within the allotted time the *IF* shall be converted to an *F*.

Time Limit. All work, including the comprehensive-final examination should be completed

within five years or six successive summers. Work done earlier will not be accepted for the degree unless validated by a special examination. Candidates for the master's degree are expected to complete their work with reasonable continuity.

Master of Business Administration

The Master of Business Administration program is devoted to the concepts, analytical tools, and communication skills required for competent and responsible administration. The administration of an enterprise is viewed in its entirety and within its social, political, and economic environment.

In addition to the background requirements for a master's degree listed above, the candidate for the M.B.A. degree must complete the specific requirements of the M.B.A. curriculum (30 semester hours) as follows:

CORE REQUIREMENTS	<i>Semester Hours</i>
a. <i>Functional Courses</i>	
Two of the following four functional courses are required: Fin. 601, Mk. 600, Pr.Mg. 640 (Logistics), and I.S. 645. At least one of these shall be either Fin. 601 or Mk. 600. Candidates with either marketing or finance undergraduate or graduate majors shall not take the corresponding functional course to fulfill this requirement	
b. <i>Business and Its Environment</i>	6
B.Ad. 610. Business, Government, and Society	
c. <i>Analysis and Control</i>	
B.Ad. 615. Business and Economic Analysis	
B.Ad. 620. Administrative Controls (Accounting students should substitute Acct. 533)	
d. <i>Human Factors</i>	3
B.Ad. 640. Organizational Behavior	
e. <i>Planning and Policy</i>	3
B.Ad. 650. Administrative Policy	
AREA OF EMPHASIS	9
Total	30

Areas of emphasis include accounting, finance, management science, marketing, office administration, organization management, personnel management, production and operations management, and transportation management.

For students taking an area of emphasis in accounting, Acct. 322, 323, and 332 or their equivalent are prerequisites for all graduate-level accounting courses. Acct. 533 is substituted for B.Ad. 620. Acct. 628 and two other graduate-level accounting courses are required in the area of emphasis. B.Ad. 630 is a required elective for an accounting area of emphasis.

Requirements for an area of emphasis in finance are Fin. 601, 602, and either Fin. 633 or 655.

Requirements for an area of emphasis in marketing are Mk. 600, 605, and one additional graduate marketing course. Candidates pursuing their area of emphasis in management science must elect either a decision science option or an information science option. Those electing the decision science option will be required to take Mg.Sc. 601, 602, and Q.M. 620. Those electing the information science option will be required to take I.S. 645, 650, and 665.

Students taking other areas of emphasis should consult the division head concerning the requirements.

No thesis is required in the M.B.A. program. In the total program there must be a minimum of 30 semester hours of graduate course work and a minimum of 24 semester hours of course work at the 600 level. Independent study course 699 is normally not acceptable for credit in the final 30 semester hours of the M.B.A. program.

Master of Science

The Master of Science degree affords opportunity for specialization and depth of training within a particular major field and a related minor field.

MAJOR FIELDS

For detailed information concerning requirements and recommended programs for each of the major fields, students should consult the following professors:

Accounting	Professor G. White
Finance	Professor Melicher
Management Science	Professor Plane
Marketing	Professor Goeldner
Management and Organization	Professor Hendrick

MINOR FIELDS

With the approval of the student's adviser and the director of graduate studies, minor fields may be chosen from business subjects, or from other graduate departments.

Fields available in the College of Business for selection as a minor are:

Accounting	Organization management
Business education	Personnel management
Finance	Production and operations management
Management science	Real estate
Marketing	Transportation management
Office administration	

MINIMUM REQUIREMENTS

The minimum requirements for the M.S. degree, after all undergraduate background deficiencies have been removed, may be met by Plan I, or Plan II.

The student's degree program should have approval in advance by the advisory committee and the director of graduate studies.

Plan I. The requirement is 30 semester hours of graduate credit including a thesis (4 to 6 hours credit) based upon original research by the candidate. A minimum of 21 semester hours credit, including B.Ad. 630 (Business Research) is required of all candidates and, including the thesis, must be earned in a major field. Not fewer than three courses, normally 9 semester hours but not fewer than 6, must be completed in a minor field.

Plan II. A minimum of 30 semester hours of graduate-level course work must be completed. Requirements must be met in both a major and a minor field. No thesis is required. Of the 30 semester hours of

graduate-level course work, a minimum of 16 hours must be at the 600 level.

All M.S. students must pass written comprehensive examinations covering major and minor fields. The candidate's committee may require an oral final comprehensive examination subsequent to the written examination.

Master of Business Education

The Master of Business Education program provides preparation for careers in secondary school and college teaching of business subjects.

SPECIFIC PREREQUISITES

For advanced work in business education, the candidate must possess a bachelor's degree, or its equivalent, from an approved institution, and also must present the following background courses or their equivalents:

Econ. 201 and 202. Principles of Economics
Acct. 200. Introductory Accounting—Financial Aspects
Fin. 305. Basic Finance
Mk. 300. Principles of Marketing
B.Law 300. Business Law
Or.Mg. 330. Introduction to Management and Organization
Education courses—12 semester hours of credit. (Not a prerequisite for a degree with a community college teaching emphasis.)

Deficiencies in accounting, finance, marketing, business law, and organizational behavior may be fulfilled by taking the fundamental courses in the respective areas [B.Ad. 501 (Acct.), B.Ad. 503 (Mk.), B.Ad. 504 (Or.Mg.), B.Ad. 505 (Fin.), B.Ad. 506 (Law)].

Courses from the subject-matter fields in business are included in the business education major. Also, certain courses in vocational guidance and educational statistics in the School of Education will receive business education credit. Students electing this degree may not receive credit toward degree requirements for 600-level courses with B.Ad. prefix, except B.Ad. 630, Business Research.

A community college teaching emphasis in the Master of Business Education degree may be elected. Two plans are available. Plan I is designed primarily for those persons who have completed an undergraduate teacher education program in business. Plan II is designed for those students who have an undergraduate degree in business but who have not completed a teacher education program. (Plan II will not lead to teacher certification.) The program is distributed among three areas: 12-14 semester hours in professional business education courses; 6-8 hours in the field of higher education as offered in the School of Education; and 8-12 hours in a specific functional business area selected from accounting, finance, organizational behavior, management science, marketing, or office administration.

The minimum requirements for this degree, after all undergraduate deficiencies have been removed, may be met according to one of the following plans:

Plan I. Requirement is 30 semester hours of graduate credit including a thesis (4 to 6 hours credit) based upon original research by the candidate.

Plan II. Minimum of 30 semester hours of graduate credit must be completed. Candidates pursuing this plan will not write a thesis but will be required to prepare an extended report. This plan is not a free option. A candidate intending to pursue this plan must first obtain the approval of his advisory committee through petition.

For both Plan I and Plan II there will be written comprehensive examinations. The candidate's committee may require an oral final examination subsequent to the written examination.

Minors Without Majors in Fields of Business

Graduate students majoring in other divisions of the University may elect as a minor some field of study within the College of Business and Administration. Acceptable fields are:

Accounting	Organization management
Business education	Personnel management
Finance	Production and operations management
Management science	Transportation management
Marketing	
Office administration	

As background preparation in the particular field, the student must complete two preparatory fundamental courses, or their equivalent. These two courses will be selected in consultation with a College of Business and Administration adviser. Validation of background preparation may be required through examination, either written or oral, or both.

To complete a minor at the graduate level on one of the fields within the college, the student must present not fewer than two graduate courses, and not fewer than 6 semester hours (at the 500 or 600 level). Courses taken to apply on a minor must form a logical sequence or unit and should be approved in advance by a representative of the subject field from which the courses are selected.

Doctor of Business Administration

The highest level of formal study available in business administration is afforded by the Doctor of Business Administration (D.B.A.) program. It is intended to develop both the breadth and depth of comprehension, the understanding of related disciplines, and the command of research methodology required for the high-level staff positions, for graduate and undergraduate university teaching, and for extension of knowledge in these fields. The positions for which a D.B.A. program helps prepare the student demand the highest level of excellence in intellectual attainment. The requirements of the program are therefore severe and the standards exacting.

Field requirements for the D.B.A. degree at the University of Colorado are therefore broadly conceived and are designed to encourage study in the cognate disciplines. It is intended that the D.B.A.

candidate's educational experience be highly individualized. Candidates' degree programs are prepared in detail only after a careful review of their career objectives and a thorough appraisal of their preparation.

REQUIREMENTS FOR ADMISSION—D.B.A. PROGRAM

To preserve the individualized character of the D.B.A. program and its quality goals, the number of candidates is closely limited, and candidates are admitted only after careful screening.

The graduate committee of the school, in reviewing applications, will consider:

1. The applicant's undergraduate and graduate academic records.

2. Recommendations from not fewer than three persons qualified to advise the committee concerning the applicant's capacity for doctoral study and research.

3. Information obtained from the applicant concerning his or her career objectives.

4. The applicant's scores on the Graduate Management Admission Test. For information and to make application for the test, write to the Educational Testing Service, P.O. Box 966, Princeton, New Jersey 08540.

REQUIREMENTS FOR DEGREE—D.B.A. PROGRAM

Students in the doctoral degree program must fulfill the following requirements.

Prerequisites. Completion, or evidence thereof, of the graduate fundamentals courses for the M.B.A. program as outlined in this catalog.

Advising. The newly accepted D.B.A. student should report to the Office of Graduate Studies for initial advising. As soon as the fields of specialization have been chosen, it is the responsibility of the student to establish an advisory committee consisting of at least three members. The committee shall include two members from the student's dissertation field and at least one member from each other field of specialization. The student will request one faculty member, normally from the dissertation field, to act as chairman of the Advisory Committee. The student shall obtain the signatures of the members of the committee (thereby signifying their willingness to act) on the appropriate forms, one copy to be given to the chairman of the Advisory Committee, and the other to the Office of Graduate Studies. Any change in the membership of the Advisory Committee is to be similarly reported.

At the end of the first term of residency, each student should prepare, with the approval of the Advisory Committee, a degree plan. The signatures of the division (department) heads of the dissertation field and other field(s) will be required on all degree plans and applications for candidacy for D.B.A. students. The signature of the division head of the dissertation field signifies the approval of the entire degree plan. The plan with appropriate signatures should be filed in the Office of Graduate Studies.

Fields of Study. Preparation in two or more fields of study, including:

1. One of the following fields in business, which must be the dissertation area:

Accounting	Management science
Administrative policy	Marketing
Finance	Organization management

2. One or more other fields, which may be in the above business fields or an approved and related field outside the College of Business and Administration.

Analytical and Conceptual Tools. Demonstration of the required level of competence in:

1. Quantitative analysis for business decisions. Students must demonstrate competence in mathematical and statistical processes as applied to business decision making. Minimum competence in quantitative analysis will normally be gained by completing B.Ad. 502, B.Ad. 507, and Q.M. 620.

2. Microeconomic and macroeconomic theory: at least one course each in intermediate microeconomic and macroeconomic theory (Econ. 407 and 408), one graduate-level course in economics to be approved by the student's advisory committee, and a course in business conditions (B.Ad. 660).

Credit by Transfer. Resident graduate work of high quality earned in another institution of approved standing will not be accepted for transfer to apply on the doctorate until after the student has established in the Graduate School a satisfactory record in residence. However, such credit must be transferred before the student makes application for admission to candidacy for the degree. Such transfer will not reduce the minimum residence requirement at this University, but it may reduce the amount of work to be done in formal courses.

Requests for transfer of credit to be applied toward an advanced degree must be made on the form specified for this purpose and submitted to the Graduate School.

The maximum amount of work which may be transferred to this University for the D.B.A. degree is 10 semester hours.

Residence. The minimum residence requirement is six semesters of scholarly work beyond the attainment of an acceptable bachelor's degree. As the word is used here, residence is not limited to, or defined as, mere attendance in campus classes. Residence may be earned for course work completed with distinction, for participation in seminars, and for scholarly research performed on campus or elsewhere under the auspices of the University of Colorado.

Not more than two semesters of residence credit toward a D.B.A. degree may be allowed for an acceptable master's degree.

Not fewer than four semesters of residence credit, at least two of which must be in one academic year, must be earned at this University. The last two semesters of residence requirement must be earned while enrolled at this University except in unusual circumstances. A portion of the residence requirement may be met during summer terms.

Course Load. During each semester in one academic year a student must carry a minimum course load of 8 semester hours. Each semester's work must include at least three courses on the Boulder Campus. (This academic year normally will satisfy two full semesters of residence credit.) During this academic year the student's total nonstudy work load of any kind, on-campus or off-campus, must not exceed half time.

Minimum Grade-Point Average. It is expected that high standards of academic excellence (a minimum grade-point average of 3.3) will be maintained in all work undertaken.

To drop a course without discredit a graduate student must be earning a grade of *C* or better in that course.

Admission to Degree Candidacy. A student must make formal application for admission to candidacy for the D.B.A. degree on forms supplied by the Office of Graduate Studies in the first month of the semester in which the comprehensive examination is to be attempted.

Comprehensive Examination. Before admission to candidacy for the D.B.A. degree, the student must pass a comprehensive examination in the dissertation field and the other field(s) of specialization. This examination may be oral, written, or both, and will test the student's mastery of a broad field of knowledge, not merely the formal course work he has completed. The oral part of the examination is open to any member of the faculty.

The written part of the examination will be evaluated by the Advisory Committee and by such other faculty members as determined by the division or department in which the field is undertaken.

The oral part of the examination shall be conducted by an examining board consisting of at least five members, and shall follow the written exam as soon as practicable. The board shall include the student's Advisory Committee and additional faculty members (selected by the director of graduate studies) necessary to bring the total to a minimum of five. A successful candidate must receive affirmative votes from the majority of the members of the examining board. In case of failure, the examination may be attempted once more with the approval of and after a period of time determined by the examining board.

Comprehensive examinations for the D.B.A. degree will be given three times a year: in November, April, and September. A student may attempt the examination during the last semester of residency while still taking required courses for the degree provided satisfactory progress is being made in those courses. Students choosing the September date must have completed *all* course requirements. It is strongly recommended that adequate time for review be allowed. Therefore, a student might be well advised to consider taking the comprehensives during the semester following completion of all course work.

All field examinations must be attempted during one examination period and the student must be registered at the time of the examination.

Dissertation. A dissertation based upon original investigation and showing mature scholarship and critical judgment as well as competence in the use of methods and tools of research, must be written on a subject approved by the candidate's dissertation committee. The Dissertation Committee shall consist of at least three members (normally two from the dissertation field and one from the other field(s) of specialization). The student will request one member, normally from the dissertation field, to act as chairman of the Dissertation Committee. The student shall obtain the signatures of the members of the committee (thereby signifying their willingness to act) on the appropriate forms, one copy to be given to the chairman of the Advisory Committee, and the other to the Office of Graduate Studies. Any change in the membership of the Dissertation Committee is to be similarly reported. Membership of the Dissertation Committee may be the same as, or different from, the membership of the student's Advisory Committee.

A student must register for a total of at least 16 semester hours but not more than 24 semester hours of doctoral dissertation credit with up to 8 credits in any one semester. The specific number must be approved by the student's adviser. Not more than 8 of these credits may be obtained before the student has been approved as a candidate for the doctorate.

Dissertation credit does not apply toward the 30 semester hours of required credit specified in Article VII, Section 2, of the Rules of the Graduate School, and will not be included in calculating the student's grade-point average.

One formally approved, printed or typewritten copy of the dissertation and two original abstracts must be filed in the Graduate School Office at least two weeks before the date on which the degree is to be conferred. A second formally approved, printed or typewritten copy of the dissertation must be filed in the Office of Graduate Studies, Graduate School of Business Administration.

Final Examination. After the dissertation has been accepted by the Dissertation Committee, a final examination on the dissertation and related topics will be conducted. This examination will be wholly or partly oral. The oral portion will be open to anyone. The examination will be conducted by a committee of at least five members. It will consist of the candidate's Dissertation Committee and two members selected by the director of graduate studies after consultation with the chairman of the Dissertation Committee and the candidate. One person, who must be a member of the graduate faculty, shall come from the University at large. More than one dissenting vote from the Dissertation Committee will disqualify the candidate in the final examination.

Arrangements for the final examination must be made in the Office of Graduate Studies at least two weeks in advance. The examination must be scheduled no later than two weeks before the date on which the degree is to be conferred. The student must be registered at the time he attempts the final examination.

Time Limit. All work for the degree must be completed within seven years after the student is admitted to the Graduate School for the D.B.A. program. If a student fails to complete all requirements for the degree within four years of the date on which the preliminary comprehensive examination was passed, a second examination similar in extent to the first will

be required before the candidate may take the final comprehensive examination. If this second examination is failed, it may be attempted once more after a period of time determined by the examining board.

Foreign Language. There is no foreign language requirement for the Doctor of Business Administration degree.

School of Education

Richard L. Turner, Dean

INFORMATION ABOUT THE SCHOOL

Purpose

The School of Education provides study and research opportunities for persons involved in teaching and the study of education. Through its graduate and undergraduate programs, it prepares teachers, administrators, educational specialists, and researchers for all levels of education. Its faculty and students participate in research efforts which develop new knowledge and understanding of the educational process. An extensive in-service program helps teachers stay abreast of new developments in the field.

Career Opportunities

In recent years, even though national trends seem to show a substantial over-supply of teachers, University of Colorado graduates prepared as teachers, administrators, and professors have consistently been employed in appropriate positions.

Scholarships, Awards, and Prizes

The School of Education has some scholarships and awards for its students administered through the school. Graduate students in education are eligible to compete for the Graduate School Fellowships, and both graduate and undergraduate students are eligible to apply for University-wide financial assistance. The following are available exclusively to students in education:

The Elizabeth Anne Wilson Memorial Scholarship. Awarded each year to an outstanding female graduate student in Elementary Education.

The Phi Delta Kappa Scholarship. This scholarship is awarded each year by the University of Colorado chapter of Phi Delta Kappa to an outstanding graduate student in education.

Colorado Summer Teacher Fellowships. Tuition and fees fellowships are awarded each year to Colorado teachers studying at the University of Colorado during the summer term. Applications are available from the graduate office in the School of Education. Completed applications are due by April 15 each year in the Office of the Associate Dean for Instruction.

Delta Kappa Gamma Prizes. These prizes are given to students with outstanding qualifications for teaching.

The Harry M. Barrett Memorial Scholarship. Granted by Kappa Delta Pi and limited to seniors preparing to teach, the scholarship varies in amount from \$25 to \$50 per year.

Applications for these awards should be made on forms available from the Office of the Dean, Education 124, prior to March 1 of each year for the summer or academic year following that date.

Student Organizations

The Associated Students in Education is an organization which represents the undergraduate student body. Its officers are elected each spring, and they serve as liaison between the students in education and the Associated Students of the University of Colorado. The organization also performs vital advising and student assistance functions.

The Association of Graduate Students in Education is a similar organization for graduate students. Its officers are elected in the fall.

Advising

Graduate students are assigned individual advisers and are required to submit a formal program of studies, approved by those advisers, before the end of the first full term of study. (Graduate students may obtain program information from the Graduate Office, Education 130, or from their advisers.)

Undergraduate students may obtain program and adviser information in Education 246 (director of teacher education) or Education 247 (Office of Field Experience).

Degree Programs

Teacher education at the University of Colorado, while administered by the School of Education, is an all-University function. Many academic departments provide course work which supports the varied options available to the teacher in training.

Underlying the University's program of teacher education is the assumption that all teachers should:

1. Possess professional competencies;
2. Possess personal qualities essential to effective teaching;
3. Have a liberal education; and
4. Know well the subjects they teach.

The objectives of the University relative to teacher education are the following:

1. To provide programs of undergraduate and graduate studies designed to develop competent teachers, administrators, supervisors, and guidance counselors; college teachers and administrators; and researchers.

2. To conduct and direct educational research and to engage in writing and related creative endeavors.

3. To identify and attract into the teacher education program students who possess the intellectual abilities and personal qualities essential for effective teaching.

4. To cooperate with other state, regional, and federal agencies to improve educational programs.

Accreditation

The teacher education program, both undergraduate and graduate, is fully accredited by the North Central Association of Colleges and Secondary Schools, by the National Council for the Accreditation of Teacher Education, and by the Colorado Department of Education.

BASIC TEACHER EDUCATION PROGRAMS

General Admission Requirements

This section applies to all students (with or without baccalaureate degrees) pursuing the teacher education program. Students who transfer into the University from other collegiate institutions must meet the requirements for admission to the University as outlined in the General Information section of this catalog as well as the requirements stated below.

Degree students normally apply for admission to the School of Education in the spring semester of their sophomore year (or at least one semester before they wish to begin their professional education work). Advising and other orientation activities begin with entering freshmen, and members of the faculty assist with these activities. Students planning to seek a degree in the School of Education normally enroll as freshmen in the College of Arts and Sciences or complete their freshman and sophomore years at some other collegiate institution.

The teacher preparation program at both elementary and secondary levels includes a "professional year." This is a year of intensive, full-time activity which involves a significant amount of work in various schools and is normally the final year of undergraduate study. Courses that are part of the professional year are restricted to those students admitted to the professional year. Applications for the professional year must be made between March 1 and March 15 for the elementary program and between February 1 and February 15 for the secondary program prior to the fall semester in which the student will enroll for the professional year. Application forms are available in Education 247.

It is important that applicants for the Teacher Education Program know that quotas have been established for each discipline and not all students who meet the minimum requirements can be guaranteed admission. Only those students with exceptional

qualifications can be expected to gain admission to this program. An interview is often required prior to an admission decision. Elementary education students are required to pass an admissions examination covering some areas of academic preparation.

All students are expected to complete their general education requirements prior to their final year of study.

TRANSFER STUDENTS

Students who wish to transfer to the School of Education at the University of Colorado from another accredited collegiate institution may apply for admission through normal University channels. A maximum of 72 semester hours may be transferred from a junior college. Under every circumstance, the last 30 hours of course work must be taken while an officially admitted student in the School of Education.

FORMER STUDENTS

Former students may reenter the University according to general University policies. However, they must apply for entry into the Teacher Education Program, and, even if they have been admitted previously, there is no guarantee of their automatic acceptance.

Teacher Certification

Each state has requirements for certificating or licensing teachers. These requirements vary from state to state and are changed from time to time. It is important that students wishing to teach in various states familiarize themselves with the pertinent state requirements. In the light of this knowledge they may plan more appropriate degree programs than otherwise would be done.

UNDERGRADUATE PROGRAMS FOR STUDENTS WITH DEGREES

Students with degrees who had not originally prepared to teach frequently wish to qualify to instruct in elementary or secondary schools. The same programs, requirements, and procedures pertaining to undergraduates apply to these students. Students desiring institutional approval for certification must complete at least 30 semester hours of work at the University of Colorado; at least 40 semester hours probably will be necessary. *College work more than 10 years old may not count or may require updating, especially in the teaching field.*

There are no abbreviated, accelerated, or special programs of teacher education available. A *minimum* of 30 semester hours of course work, including the professional year, is required in residence. *Information may be obtained from the School of Education, Education 247. No graduate credit is given for teacher certification course work.*

Once students are in a teacher education program, they are expected to remain enrolled continuously until certification requirements are met.

REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE IN EDUCATION

The Bachelor of Science degree in education is granted to majors in elementary education and to majors in the distributed studies program who plan to teach on the secondary school level. Students pursuing these majors must seek this degree in the School of Education.

Of the 124 semester hours required for graduation, at least 40 must be in upper division work, and other requirements as cited later must be met. A minimum grade-point average of 2.5 must be earned for all work attempted.

No professional courses may be taken by correspondence.

Residence Requirements

Of the 124 semester hours required for graduation, at least 56 must be completed in residence at the University of Colorado. The last 30 hours of the required 124 semester hours must be completed while the student is registered in the School of Education. Students pursuing the professional year program must complete all of the professional education sequence through *regular* classwork at the University of Colorado.

Students who are enrolled in the College of Arts and Sciences may receive their degrees through that college and be certified as teachers in the secondary schools by taking the professional program offered through the School of Education. The same is true for College of Music, College of Business and Administration, and College of Engineering students. These students will meet the requirements for the degree in their subject areas and complete the professional program in education for teacher preparation. In many fields, additional course work in the major subject and/or supporting fields will be required.

Admission to Teacher Education

For admission to teacher education, students will meet the following minimum expectations:

1. Applicants are expected to be in good physical and mental health and to have appropriate personal traits, such as the ability to deal constructively with reality, the capacity to adapt to change, and the capacity to relate well to others.

2. Applicants should have the ability to command the respect of others and direct their learning activities and should exhibit behavior consistent with moral values and legal requirements expected of teachers.

3. Work experience involving interpersonal relations (such as teacher's aides, camp counselors, etc.) is considered important to prospective teachers and is recommended highly before application to most programs.

Elementary Education Majors

ADMISSION

Degree students wishing to major in elementary education normally apply for admission to the School of Education during the second semester of their sophomore year. Such students must have earned (or have in progress) a minimum of 56 semester hours of course work, at least 14 of which must be taken at the University of Colorado. At the time of admission, students must provide evidence that they have taken or are taking course work to fulfill the following *minimum portion of the general education requirements*: Mathematics—3 semester hours; English—6 semester hours; social sciences—6 semester hours; science—6 semester hours in biology and 6 semester hours in physical science.

REQUIREMENTS FOR THE B.S. DEGREE IN ELEMENTARY EDUCATION

General Education

The minimum general education requirements for the elementary major are as follows:

1. Mathematics: 6 semester hours. Recommended: Math. 103 and Math. 121 for students with little mathematics background. (Math. 100 does not satisfy any portion of this requirement).

2. English: 11 semester hours.

a. Comm. 230-2 required.

b. A minimum of 9 hours in English with at least 3 hours in English language and 3 hours in children's literature, or 6 hours in the second year of a foreign language.

3. Social sciences: 12 semester hours. At least 6 hours distributed in two of the following: economics, cultural geography, or American history.

4. Science: 11 semester hours. Distributed in biological and physical science, including a laboratory in each area.

5. Expressive arts: 6 semester hours including course work in each of the following:

Art for Elementary Teachers

Music for Classroom Teachers

Physical Education in the Elementary School

Students admitted to the University of Colorado (coded Major Code 115) beginning in September 1979 must complete the above program.

Specific Requirements

(For the elementary major, courses in mathematics, philosophy, and speech and drama will not count toward the humanities requirement. Majors must complete two semesters in biology with laboratory and two semesters in physical sciences with laboratory. Anthropology, mathematics, and psychology do not count as physical science.)

Subject Specialization

The student majoring in elementary education must complete one of two plans of specialization as follows:

1. *Single Subject Specialization.* A minimum of 18 semester hours in any subject offering a major at the University, approved in advance by the student's adviser in the School of Education and including at least 6 semester hours of upper division (300- and 400-level) courses.

or

2. *Broad Fields Specialization.* A minimum of 24 semester hours (at least 6 semester hours at the 300 or 400 level) in one of the broad fields below, approved in advance by the student's adviser in the School of Education and including 6 semester hours in each of three of the disciplines listed.

Social Science and History

Sociology
Social anthropology
Political science
Economics
History
Cultural geography
Integrated studies social science

Humanities

Literature
Classics
Foreign language (beyond first year)
Fine arts
Music
Philosophy

Creative Arts

Children's literature and dramatics
Dance
Physical education
Fine arts
Music

Communication Arts

English language
Speech and/or radio and TV (not education courses)
Drama
Journalism

Science

Biology
Biological sciences (in integrated studies)
Physics or astronomy
Physical science (in integrated studies)
Chemistry
Physical geography
Geology

Bilingual-Bicultural (Hispanic)

Spanish competence
Literature-linguistics
Mexican-American culture
Methods and materials in bilingual studies

Environmental Sciences

Biology
Principles of ecology
A physical science
Elementary population studies
Human ecology
Contemporary social issues
Environmental quality and human choice
Conservation practice
Conservation thought

Honors courses approved in advance by the student's adviser in education may be counted in the appropriate single subject or broad fields specialization. Appropriate courses used to meet the general education requirement may also be used in meeting the single subject or broad fields specialization.

Specific courses in creative arts must be selected from the above areas and must be related to the needs of children or the teaching of children. For specific courses in environmental sciences and bilingual-bicultural studies, students should see an adviser.

Professional Year (Elementary Education)

Students must apply for the required professional year program between March 1 and March 15. The professional year is a full-year program involving a combination of educational experiences at the University and in cooperating public schools. Students are required to pay an instructional materials fee while in this program in lieu of books and materials. Students will not be expected to purchase instructional materials during their professional year.

In order to qualify for application to the professional year the following criteria must be met:

1. Grade-point average:

- A 2.5 overall average as well as 2.5 on University of Colorado work alone.
- A 2.5 average in the major teaching field.
- A 2.5 average in the prerequisite sequence of education courses: T.Ed. 309, 310, 311, 375, 376, 446. Only a grade of C or better gives credit. Students desiring to student teach in kindergarten should have completed T.Ed. 435.

2. Completion of all general education requirements.

3. Completion of at least 93 hours (including Comm. 230) of University work with passing grades.

4. Passing screening examinations in prescribed areas.

Ultimate selection for admission to the Teacher Education Program will be based on procedures formulated by the School of Education. Since admission quotas have been established, all who meet minimum criteria may not be admitted.

Admissions will be based on the professional judgment of the faculty, acting according to the School of Education policy.

All students pursuing a teaching credential on the Boulder Campus of the University of Colorado will be expected to complete the professional year. Course work in education at this or other institutions *may not* be applied to reduce the professional year requirement; student teaching completed through another institution will not excuse the student of the requirement to complete the entire professional year program including its field requirements. No work which is a part of the professional year may be taken in summers.

The professional year is normally taken by continuing students during the senior year.

Students are reminded that all electives and requirements (except those which are part of the professional year) must be completed by the beginning of the professional year.

The fall semester of the senior year is a series of experiences in instructional laboratories.

T.Ed. 400. Educational Media Laboratory	1
T.Ed. 420. Methods in Elementary Language Arts	2
T.Ed. 421. Methods in Elementary Mathematics	2
T.Ed. 422. Methods in Elementary Reading	1
T.Ed. 423. Methods in Elementary Science	2
T.Ed. 424. Methods in Elementary Social Studies	2
T.Ed. 460. Instructional Assistant — Elementary	5

The spring semester of the senior year includes the following:

T.Ed. 470. Elementary Student Teaching	8
T.Ed. 473. Elementary Elective Assignment	6
T.Ed. 479. Seminar: Elementary School	1

The professional year is a sequence and must be taken during one academic year beginning in the fall; no courses may be taken during the professional year except those prescribed as a part of the professional year.

Secondary Education Majors

ADMISSION

Degree students wishing to major in secondary education normally apply for admission to the School of Education during the second semester of their sophomore year. The student must have completed at least 60 semester hours of acceptable college work with an overall grade-point average of 2.5 or higher for all courses attempted at the University of Colorado.

The student must have completed or have in progress the following *minimum* portion of the general education requirement:

<i>Subject</i>	<i>Semester Hours</i>
Humanities	} One two-semester course combination in each field, no combination to yield fewer than 6 semester hours.
Natural science	
Social science	

Before entering the professional education program, students must complete an additional two-semester sequence in each of the above three areas (no one combination to yield fewer than 6 semester hours). Combinations listed in the *Schedule of Courses* under Course Combinations for College Requirements in the College of Arts and Sciences should be followed, unless special permission is obtained through the director of Teacher Education.

REQUIREMENTS FOR THE B.S. DEGREE WITH A DISTRIBUTED MAJOR (SECONDARY SCHOOL LEVEL)

Students planning to pursue a distributed major and to teach on the secondary school level normally spend the first two years of their residence in the College of Arts and Sciences or a junior college. Before the professional year, they should complete the general

education requirements and other requirements toward graduation.

Those students who are applying for admission to the distributed major program in the School of Education must meet the following criteria: overall grade-point average of 2.5 or higher, experience in working with youth, interview with faculty member or members, and ability to commit the equivalent of one full academic year to teacher preparation. Quotas are imposed on the number of students admitted to the secondary teacher education program; consequently, all who apply for admission may not be admitted.

General Education

The minimum general education requirements for distributed majors are as follows:

<i>Subject</i>	<i>Semester Hours</i>
Humanities	} At least 12 semester hours credit (i.e., four semesters) in each of these three fields, to include two two-course sequences.
Natural science	
Social science	

Majors in the Distributed Studies

The major programs which follow are planned to integrate experiences in related subjects and fields appropriate to the preparation of teachers at the secondary school level. These programs consist of not fewer than 60 semester hours in one of the following broad field patterns:

1. *Social Studies*. Not fewer than 18 semester hours of history must be taken, including 9 hours of history of the United States and 9 hours of history of other areas. The program must include a minimum of 9 semester hours in each of two other social science subjects: economics, political science, social geography, psychology, anthropology or sociology. Additional hours necessary for the completion of the 60 semester hours in the social sciences may be elected from the above-named fields or the integrated studies courses in social sciences. Students are encouraged to enroll in Econ. 311 and 312 (T.Ed. 301 and 302).

See a social studies education adviser for specific course requirements.

2. *Science*. At least 20 semester hours must be taken in one field and not fewer than 12 hours in each of three of the following four fields: physics, chemistry, biological science, and geology-physical geography. Students are encouraged to enroll in Phys. Sci. 201-202 and Nat. Sci. 401-402.

The student should consult a science education adviser for specific course requirements in each field.

3. *English*. The requirements for this program are 60 hours in English and English-related subjects including communications, language, literature, journalism, etc. A minimum of 36 hours is required in English of which 18 hours must be upper division (300 and 400 level). See an English education adviser for specific course requirements.

4. *Foreign Language*. Not fewer than 20 semester hours shall be in one language and not fewer than 16

hours shall be in a second language, both beyond the first-year college course or its equivalent. Credits earned in first-year college foreign language courses may count toward the 60 semester hours required in the broad field.

5. *Biology, Chemistry, Geology, Mathematics, Physics.* Not fewer than 25 semester hours shall be in one field and at least 10 hours shall be taken in each of two other fields. The other 15 hours shall be distributed in any of these fields at the discretion of the student and the student's adviser. See a mathematics or science education adviser for specific course requirements.

6. *Earth Science.* Not fewer than 24 semester hours shall be in geology-physical geography, including work in each of the following: mineralogy, paleontology, geomorphology, field geology, and conservation. At least 8 semester hours shall be in astrophysics and 8 semester hours of the following: biology, chemistry, and physics (excluding astrophysics). See a science education adviser for specific course requirements.

Professional Education Program (Secondary)

Students must apply for the required professional year program not later than February 15 of the spring prior to the time for which they desire admission. The professional education program involves a combination of educational experiences at the University and in cooperating public schools. Students are required to pay an instructional materials fee while in this program.

In order to qualify for application to the professional year the following criteria must be met:

1. Grade-point average:
 - a. A 2.5 overall average as well as 2.5 on University of Colorado work alone.
 - b. A 2.5 average in the major teaching field.
 - c. A 2.5 average in the prerequisite sequence of education courses.
2. Completion of all general education requirements.
3. Completion of at least 80 hours of University work with passing grades.
4. Satisfactory work experience involving interpersonal relationships, such as teacher's aide, camp counselor, etc. (secondary only.)

Ultimate selection for admission to the Teacher Education Program will be based on procedures formulated by the School of Education. Since admission quotas have been established, all who meet minimum criteria may not be admitted. Admissions will be based on the professional judgment of the faculty, acting according to the School of Education policy. When all factors are equal the date of application will determine admittance.

The professional education program is the equivalent of one academic year.

Professional education requirements include:

<i>First Semester</i>	<i>Semester Hours</i>
T.Ed. 410. Foundations of American Education	3
T.Ed. 411. Educational Psychology and Adolescent Development	3
T.Ed. 412. Principles and Methods of Secondary Education	3
T.Ed. 441. Teaching Reading and Writing in Content Areas	3
T.Ed. 446. Teaching the Learning Disordered in the Regular Classroom	2
T.Ed. 471. Secondary Student teaching	4 or 8
T.Ed. 472. Secondary Elective Assignment	4
Comm. 230. Communication Skills for Teachers	2
Special Methods in Teaching Field	3

Student teachers in art, music, and physical education may enroll in elementary and secondary student teaching and elective assignments.

Certain content emphasis areas require other specific course work during the professional year. Students should check with an adviser in their area for specific additional requirements.

Because of the intensive demands made by the professional program, students will not be permitted to register for other courses unless they have official permission.

Requirements for Degrees Other Than B.S. In Education

Professional education requirements for *secondary teachers* seeking degrees other than the B.S. in education are the same as those prescribed in the preceding section dealing with requirements under the B.S. degree with distributed studies plan.

Not all majors are suitable preparation for teaching in the secondary schools since many such schools do not offer them as high school subjects. Students interested in a particular major should consult with advisers in the School of Education about typical teaching combinations.

Professional Courses in Education. Students securing a degree in the College of Arts and Sciences and planning to teach on the secondary school level must complete the professional education program as outlined for distributed studies majors earlier in this section of the catalog. Educational policies, rules, and prerequisites of the School of Education apply to these students also. Note that for prospective teachers the required grade-point average of 2.5 is higher than that required for nonteaching graduates of the College of Arts and Sciences. Admission to the Teacher Education Program is prerequisite to enrollment in the professional program of studies in education.

COLLEGE OF BUSINESS AND ADMINISTRATION

Students interested in the business education program should consult the College of Business and Administration section of this catalog.

COLLEGE OF MUSIC

The College of Music is a four-year college that admits students as freshmen. Two undergraduate degrees are offered. One of these, the Bachelor of Music Education degree, is designed for prospective

teachers. Details can be found in the College of Music section.

COLLEGE OF ARTS AND SCIENCES

The College of Arts and Sciences is a four-year college that admits students as freshmen. Several undergraduate degrees are offered and may be pursued by students wishing to complete the typical major plan to teach on the secondary school level.

Requirements for the bachelor's degree in the College of Arts and Sciences vary somewhat, depending on the degree sought; therefore students are urged to study carefully the College of Arts and Sciences section to determine the requirements applicable to the particular degree they seek.

ACADEMIC POLICIES

Scholastic Standards

Any student registered in the School of Education who fails to maintain a 2.5 grade-point average may be placed on probation or may be suspended for a period of one academic year. Readmission is then subject to conditions determined by the dean. The same conditions apply to students in other colleges and schools who have been admitted to the teacher education program.

Course Load

The normal scholastic load of an undergraduate student in the School of Education is 31 semester hours per year. The maximum number of hours per semester for which a student may register, except with permission of the divisional chairman, is 19; the minimum number of hours per semester is 12. A student desiring to register for more than 19 or fewer than 12 semester hours should address a written petition requesting such permission.

Credit for ROTC

Students completing the requirements for a commission and meeting all prescribed requirements for the B.S. degree in education may count ROTC credit as elective hours without limitation. No ROTC credit may be counted unless the requirements for a commission are met.

GRADUATE STUDY IN EDUCATION

Graduate study in education at the University of Colorado is administered through the Office of the Associate Dean for Instruction, and all inquiries regarding programs should be directed to the following address:

Associate Dean for Instruction
School of Education
University of Colorado
Boulder, Colorado 80309

A wide range of professional and academic interests is served by these programs. The programs of study are as follows:

Administration and supervision—master's, specialist, doctorate¹
Guidance and counseling—master's, specialist, doctorate
Curriculum—master's, specialist, doctorate
Educational psychology—master's, doctorate
Elementary education—master's, specialist, doctorate
Library media—master's, specialist, doctorate
Reading—master's, specialist, doctorate
Research and evaluation methodology—doctorate
School psychology—master's, specialist
Secondary education—master's, specialist, doctorate
Social foundations—master's, doctorate
Special education—master's

Graduate Programs at Three Levels

Graduate study in education is offered at three levels: Master of Arts (M.A.) and Master of Education (M.Ed.) degrees, Specialist in Education (Ed.S.) degree, and Doctor of Education and Doctor of Philosophy degrees (Ed.D. and Ph.D.). Each level is discussed in the following pages. For many programs special advisory leaflets have been prepared which are available upon request from the School of Education Graduate Office.

Application for Admission

Prospective students who believe that they may qualify for admission to a graduate degree program should request application forms from the Graduate Office. The completed form should be returned to the Graduate Office, School of Education. Prospective graduate students should also read the graduate portion of the catalog for additional information. *Application papers and all supporting documents (including GRE scores, see below) must be in the Graduate Office at least six months before the opening of the term for which the student is applying.*

Applicants should request the Educational Testing Service to send their scores on the Aptitude Test (verbal and quantitative) of the Graduate Record Examination (GRE) to the Graduate Office. An applicant who has not taken the GRE should arrange to do so.

Maximum Load and Part-Time Study

A maximum of 15 semester hours in any one semester can be applied toward degree requirements, 10 semester hours in a full summer session, and 6 hours in a five-week summer term. During the academic year, students will be regarded as having a full load if they are registered for not less than 5 semester hours in courses numbered 500 or above, or for thesis, and are not engaged in other employment more than half time.

Quality of Work

For all master's degrees, the Ed.S., and the Ed.D., an average of *B* or better is required in all work taken for the degree. Transferred credits are not included in calculating an average.

Any graduate course in which a mark of *D* or *F* is reported is failed and must be repeated and passed if it is required in a student's degree program.

¹Includes work in community college administration.

Students who do not maintain a *B* average or better may be suspended by the dean of the Graduate School upon the recommendation of the associate dean. Students may also be suspended from the Graduate School for continued failure to maintain satisfactory progress toward the degree sought.

Experience Requirement

With exceptions noted below, at least one year of teaching experience or an internship is ordinarily a prerequisite for admission to the master's or Ed.S. degree programs. However, teaching experience may sometimes be obtained during the period in which a student is studying for the degree. Graduate programs in elementary and secondary guidance require completion of at least two years of teaching as a prerequisite to admission.

On the doctoral level, prior or concurrent experience appropriate to the field of specialization is required, except for degree programs which include an internship.

Teaching experience is not required as a condition of admission to programs in higher education, college student personnel work, counseling in agency settings, educational research and statistics, educational media-library administration, and social foundations of education. However, experience appropriate to these professional fields of specialization may be and usually is required in lieu of teaching.

Master's Degrees In Education

Two Master of Arts degree plans and a Master of Education plan are available, each comprising one academic year or more of graduate work beyond the bachelor's degree. The minimum residence requirement for any master's degree is one academic year or the equivalent, and it may be satisfied by two semesters in residence, or three full summer sessions, or any combination equal to two semesters. (For part-time credit toward meeting the residence requirement, see the Graduate School section of this catalog).

Most program areas have outlined a recommended or required program of studies, and students pursuing a degree are expected to follow the appropriate program unless they have appropriate substitutions arranged in advance with their advisers. (Note: The master's program in guidance and counseling is designed to start in the summer only. The special education program starts only at the beginning of the fall semester.) Pamphlets outlining the programs of studies in education are available from faculty or the Office of the Associate Dean for Instruction.

In the final term of study (at least 10 weeks prior to graduation) each student must submit an Application for Admission to Candidacy for an Advanced Degree form. These forms are available in the Education Graduate Office. If a minor is included, the forms must first be signed by a representative of the student's minor department or program area. The forms

must be signed by the student's adviser and submitted to the associate dean and then to the Graduate School for final approval.

Education as a Minor Field

In M.A. programs providing for majors outside the School of Education, students may include education as a minor if both their major department and the associate dean for instruction in the School of Education approve. For master's degrees, a minor in education consists of at least 6 hours of study in related courses. Not more than 2 semester hours may be transferred from another institution.

Students who propose to minor in education must have had sufficient undergraduate work in education to prepare them for graduate study in the field. Appraisal of undergraduate preparation will be made by the associate dean.

Specialist In Education (Ed.S.)

The Ed.S. degree program affords opportunities for graduate study extending one year beyond a master's degree. The program is intended to serve the needs and interests of a variety of career people in education who want specialized and up-to-date preparation beyond the master's degree but who do not plan to study for a doctorate.

PREREQUISITES FOR ADMISSION

Applicants for admission are required to have an acceptable master's degree and an undergraduate record which gives evidence of a good general education. The master's degree should be in a field which provides an appropriate foundation for the additional year of graduate study.

An undergraduate grade-point average of 2.75 or better on a 4.0 scale is required, and/or an average of 3.0 or better for the master's degree. Satisfactory scores on the Aptitude Test of the Graduate Record Examination are required as part of the application. At least one year or more of teaching or other appropriate experience is also required.

PROGRAM OF STUDY AND RESIDENCE

When applicants are admitted, they are notified of the appointment of a faculty adviser. The student and adviser formulate a program of study providing for 30 semester hours or more of course work. At least four semester hours must be at the 600 level.

Most program areas have outlined a program of studies appropriate for individuals pursuing Ed.S. study in their areas, and students are expected to follow those programs unless they have arranged appropriate substitutions in advance with their advisers. Pamphlets outlining the recommended programs of studies for the programs in education are available from faculty or the Graduate Office.

In the final term of study (at least ten weeks prior to graduation) each student must submit an Application for Admission to Candidacy for an Advanced Degree. These forms are available in the Graduate Office. If a

minor is included, the forms must first be signed by a representative of the student's minor department or program area. Then the forms must be signed by the student's adviser and submitted to the associate dean and the Graduate School for final approval.

The Specialist in Education degree requires no thesis, but a final written comprehensive examination consisting of three four-hour sessions is required. The examination is typically given during the student's last term of study. However, it may be postponed until a later term providing the student registers for it and pays the required fee. A student who fails the comprehensive examination may request to be examined again after three months. Only one reexamination is permitted.

Two semesters, three full summers of study, or a combination equivalent to two semesters in residence are required.

TRANSFER OF CREDIT AND TIME LIMITS

The same regulations governing transfer of credit and time limits apply to the Specialist in Education as indicated for the master's degree except that transfer institutions where the work was taken must offer the Specialist in Education or an equivalent or higher degree in order for credit to be applied to this degree.

Doctoral Study in Education

In addition to the information included here, the student is referred to the Graduate School section of this catalog.

Two types of doctoral degree programs in education are offered under the auspices of the Graduate School and the School of Education. Prospective doctoral students may apply for admission to either program, the choice depending chiefly on their professional or career objectives. The Doctor of Education degree (Ed.D.) is intended primarily to meet the needs of career people in education for advanced study, e.g., teachers in schools, school or college administrators, guidance counselors and student personnel directors, and college or university professors of education. For one who plans to teach in an academic subject matter department and not to be involved in teacher education, a Ph.D. in the major subject field would be preferable. The Ph.D. is also appropriate for one who plans a career as a university professor of education or as a director of educational research in a state or city school system.

Doctoral programs require a period of study and research of two academic years (four semesters) or more beyond a master's degree (or in the case of some Ph.D. students three years beyond a bachelor's degree). At least two semesters of full-time study in residence during one academic year are required; the remainder of the residence requirement may be satisfied by any combination of study in academic years or summer terms, subject to the definition of full load stated earlier. For an Ed.D. student whose program calls for certain specialized study at some other university, residence credit for one semester

may be earned elsewhere and counted toward meeting the minimum residence requirement, if the adviser and the associate dean approve.

Since the Ed.D. and Ph.D. programs differ only in certain aspects of content and not in procedures, they are discussed together in the following sections. Such differences as currently pertain are clearly pointed out.

ADMISSION REQUIREMENTS

Applicants for admission to doctoral study are expected to have a good liberal arts background, approximately 18 semester hours of undergraduate credit in education (same as for master's applicants except as noted earlier), or a master's degree in education, and an undergraduate average of 2.75 or better on a 4.0 scale. An average of 3.0 or better is expected on all graduate work completed. Ed.D. applicants must have an appropriate master's degree, preferably in the field of their proposed doctoral studies or closely related. Ph.D. applicants are not in all cases required to have a master's degree, although it is generally deemed preferable. The decision rests with the program. At least two years of professional experience relevant to the applicant's proposed study is required for most programs.

Satisfactory Graduate Record Examination scores (Aptitude Test) are a required part of the application for admission. An interview with a faculty admissions committee may be required.

DEGREE REQUIREMENTS

Doctoral students in some programs are expected to have had a course in statistical methods, a basic course in educational research, a graduate course in psychological foundations of education, and a graduate course in social foundations of education. If they have not had such courses, advisers may require one or more of them in addition to the courses approved for the degree sought. All doctoral students must include an intermediate statistics course (REM 603). All Ph.D. students must also include at least one course in experimental design and analysis (REM 604), and this is required in some Ed.D. programs. Graduate courses in other departments may be included in any degree program if they are approved by the student's adviser and committee.

Most program areas have outlined a program of studies appropriate for individuals pursuing study in their areas, and students are expected to follow that program unless they have arranged appropriate substitutions in advance with their advisers. Pamphlets outlining the recommended programs of studies for the programs in education are available from faculty or the Education Graduate Office.

Approximately 40 semester hours of course work beyond the master's degree is the normal requirement for either the Ed.D. or Ph.D. Ph.D. applicants who are admitted without a master's degree can expect to

have about 70 semester hours of course work in their programs.

Prior to taking the comprehensive examination, each student must submit an Application for Admission to Candidacy for an Advanced Degree. Application forms are available in the School of Education Graduate Office.

Near the end of the term when students complete their course work and if their advisers approve, they write a comprehensive examination. This 12-hour written examination is conducted by a committee nominated by the associate dean for instruction and appointed by the dean of the Graduate School. An oral examination may also be held if a student's committee requests it. The examination is focused chiefly on the student's area of specialization, conceived rather broadly. Students who fail the comprehensive examination may repeat it once, at a time to be determined by the examining committee.

In addition to the course work, a doctoral thesis for 16 to 24 semester hours of credit is required of each student. A student registers for 800 (Thesis) for the Ph.D., and 801 for the Ed.D., for two or more terms, but not more than 8 semester hours in any term; not more than 8 semester hours may be taken prior to the successful completion of the comprehensive examination. During the research for and the writing of a thesis, grades of *IP* (in progress) are reported; if the thesis is completed and accepted as satisfactory, a grade is reported for the student's record. When a student and the chairman of the advisory committee agree on a subject for the thesis, the student prepares a detailed prospectus and arranges for a meeting with the committee. (As a rule the advisory committee constitutes the thesis committee, but additional faculty in education and other departments may be asked to serve also.) When the committee approves the prospectus, the student may proceed with the research. Research involving human subjects must also have the approval of the University Committee on Human Research.

No continuing education work is permitted on either the Ed.D. or Ph.D.

TIME LIMITS

Ed.D. students are expected to complete their work and receive the degree within seven years beginning with the term of their first registration for doctoral courses. The time may be extended to ten years upon approval by the student's adviser and the associate dean for instruction, but credits more than seven years old must be validated by special examination. Transferred credit which becomes more than seven years old cannot be validated and hence cannot be counted toward meeting degree requirements. Ed.D. students who do not complete their programs and receive the degree within four years of passing their comprehensive examination must retake that examination and pass it before they can take their final oral examination. See the Graduate School section for Ph.D. time limits.

When students have passed the comprehensive examination they are required to register each semester until the degree they seek is attained, and pay the standard fee as announced by the Graduate School.

CHECKING ON PROGRESS TOWARD A DEGREE

Doctoral study entails a long period of scholarly endeavor. Students are urged to confer with their advisers and with the associate dean for instruction in the School of Education about the various deadlines they are obligated to meet.

OPPORTUNITIES FOR ASSISTANTSHIPS

The School of Education has a limited number of assistantships which are administered by the dean of the School of Education on the recommendations of chairmen of the divisions. Some assistantships involve the supervision of student teachers; others involve helping professors in their teaching or research. Stipends (not tax-free) in amounts set by the University are paid for all assistantships. Appointments are usually made in terms of one-fourth time (ten hours a week) or one-half time (20 hours a week). Inquiries should be directed to the Associate Dean, School of Education.

College of Engineering and Applied Science

William Pieterpol, Dean

INFORMATION ABOUT THE COLLEGE

Office in Engineering Center AD-1

George J. Maler, Associate Dean for Undergraduate and Service Programs

Klaus D. Timmerhaus, Associate Dean for Graduate and Research Programs; Executive Director of the Engineering research Center.

The College of Engineering and Applied Science was established by the Board of Regents in 1893.

Through engineering the resources of nature are used for the benefit of humanity and the environment. Engineers today are expected not only to be competent planners and designers of technical systems, but significant contributors to the betterment of their environment in the social and humanistic sense as well. It is no longer sufficient to build more powerful machines, more useful devices, and more effective controlling systems if the total effect is to deplete man's resources, damage the environment, or contribute to the destruction of the economy.

An engineering career demands hard work, and so does an engineering education. In return engineers have excellent opportunities to work in various places, meet new challenges, or move upward in management. The engineer is generally well paid and usually in demand; in the rare times when there is a surplus of certain kinds of engineers, individuals usually have little difficulty finding attractive opportunities in other fields.

Currently, registration is required in all states for the legal right to practice professional engineering. Although there are variations in the state laws, graduation from an accredited curriculum in engineering, subscription to a code of ethics, and four years of qualifying experience are required. In addition, two days of examinations covering the engineering sciences and the applicant's practical experience are required in most states. Those who cannot qualify for registration are expected to work under experienced registered engineers.

The following programs in the college are now accredited by the Engineers' Council for Professional Development: aerospace engineering sciences, architectural engineering, chemical engineering, civil

engineering, electrical engineering, engineering design and economic evaluation, and mechanical engineering. The college also offers degrees in electrical engineering and computer science and, through the Department of Mathematics and the Department of Physics and Astrophysics in the College of Arts and Sciences, in applied mathematics and in engineering physics. Accreditation by the Engineers' Council for Professional Development has not been sought for the programs in applied mathematics and engineering physics in order to afford maximum flexibility in course electives.

Within most departments several options are offered (for example, mechanics in mechanical engineering and construction engineering in architectural engineering), and most departments offer options emphasizing computer aspects, bioengineering and premedicine. Some options are oriented toward graduate study, others toward engineering practice.

A listing of the fields in which engineers work would have many hundreds of entries. The following list by departments gives only a brief summary.

The aerospace engineering sciences prepare engineers for an industry that encompasses the design and construction of both commercial and military aircraft and the development and fabrication of space vehicles. Advances in this technology have permitted the industry to enter also the fields of urban mass transit, undersea exploration, bioengineering, nuclear engineering, laser technology, and many other emerging high technology fields. An aerospace engineer often works at the forefront of engineering with scientists in the fields of mathematics, physics, chemistry, biology, etc.

Applied mathematics meets the need of modern research, which is dependent upon advanced mathematical concepts. Almost all concerns that are engaged in industrial and scientific research today need applied mathematicians, as do organizations involved in computational work, statistical analysis, or stochastics.

Architectural engineering prepares students for careers in the building industry and for research at the graduate level on building-related topics. This course

of study fulfills the academic requirements for registration as a professional engineer.

The architectural engineering curriculum is recommended for those wishing to specialize within the building industry in engineering design, construction and contracting, or sales engineering. The architectural engineering student may select any of three areas of specialization offered: construction engineering, environmental engineering, or structural engineering.

Chemical engineers convert natural resources into industrial and consumer products in facilities that include refineries and gasification plants. Among their products are many that often are not identified with chemical engineering—oils, metals, glass, plastics, rubber, paints, soaps and detergents, foods, beverages, synthetic and natural fibers, nuclear and exotic fuels, medicines, and many others.

The department has recently revised and upgraded its bioengineering/premedical engineering program. It is very much interested in research directed toward ecologically sound development of chemical processes. It is also working hard on energy problems and is stressing in its instructional program problems of energy conversion.

Civil and environmental engineering offers an interesting and challenging career to the student interested in the design and construction of buildings, bridges, dams, aqueducts, and other structures; in transportation systems including highways, canals, pipelines, airports, rapid transit lines, railroads, and harbor facilities; in the transmission of water and the control of rivers; in the development of water resources for urban use, industry, and land reclamation; in the control of water quality through water purification and proper waste treatment; in the construction and contracting industry; and in the problems concerned with man's physical environment and the growth of cities.

Electrical engineering offers professional possibilities that include teaching and research in a university; research in development of new electrical or electronic devices, instruments, or products; design of equipment or systems; production and quality-control of electrical products for private industry or government; and sales or management for a private firm or branch of government. There are numerous specialties within electrical engineering. Among them are the design of computer interfaces and computer software; electromagnetic fields, which are basic to radio, television, and related systems; communication theory and signal processing; electrical machinery; solid-state, integrated-circuit, and electron devices, energy and power, control systems and others.

The electrical engineering and computer science program is designed to provide entrance into the profession for students who wish to work in computer engineering. This includes design and construction of efficient software systems as well as an introduction to hardware design. Present interest is in the application of microprocessors.

Engineering design and economic evaluation graduates are primarily concerned with the design, improvement, and installation of integrated systems of men, materials, and equipment. Assignments such as operations management design and analysis for engineering or manufacturing, and consulting in industry and small business are typical. In the fall of 1978, the Engineering Design and Economic Evaluation (EDEE) program was merged with that of the Department of Mechanical Engineering. The EDEE degree is not offered to new engineering students, but the core of the program is continuing and new students wishing to pursue a program emphasizing design and economic evaluation should enroll in mechanical engineering. A special committee to coordinate the curriculum is available to advise students having this interest.

The engineering physicist works where new kinds of engineering are being born, or where many fields are being used jointly. General knowledge of the diverse fields of physics provides the ability to deal with industrial problems that cannot be solved by a standardized procedure in a specialized field. The training prepares the student for a career in physics where there are many and varied opportunities in development work and industrial research. It is also basic for graduate work in physics and for specialized training in research.

Mechanical engineering is very broad in scope, not identified with or restricted to a particular technology, vehicle, device, or system but concerned with all such subjects, both individually and collectively. The objective of the undergraduate program is to prepare the student to meet and anticipate change, and to work with technologies as yet unknown. Typical starting assignments for the graduating senior include positions with oil, construction, and automotive industries.

Resource systems engineering (offered at the Colorado Springs Campus only) is a curriculum in systems engineering with a focus on resource development. It equips students to design or operate the large systems whose complexity has outgrown the intuitive and informal methods that served in the past. Engineers with this capability are needed in both industry and government. (See the *University of Colorado at Colorado Springs Bulletin*).

Educational Opportunities

Students have an opportunity to study engineering with many teachers who have national and international reputations and to work with superior facilities of the University of Colorado Engineering Center and Engineering Research Center. Recent years have seen the development of new instrumentation, integrated circuits, and solid state laboratories in electrical engineering, of several bioengineering laboratories, and the rapid computerization of these and others. All entering freshmen receive experience with digital computers. Each engineering department

has laboratories suitable for research through the doctoral or postdoctoral level and others for undergraduate instruction and experimentation. Some are noted in the Graduate School section of this catalog. Details may be obtained from the departments concerned.

Engineering Minorities Program

Members of ethnic minorities who are fully qualified engineers are urgently needed. The Engineering Minorities Office provides tutoring, advising, and friendly counseling to minority students who request them. Funding of the office comes from gifts from private industry, and its innovative program has been widely studied by other universities. Enrollment of minority students is growing.

International Education

Since engineers frequently work in foreign nations, it is desirable that some engineering students familiarize themselves with foreign cultures by study abroad. Especially active programs in engineering are maintained by the University and the Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico, and the University of East Anglia and the University of Lancaster in England. Students may complete one or more semesters of engineering education abroad (see International Education).

Women Students

The college has been successful in increasing the enrollment of women students and has funding for a research program studying ways to encourage women to seek careers in engineering and to assist them in their academic programs.

Prizes and Awards

Numerous prizes and awards are conferred upon outstanding students, usually during the honors convocation held during Engineers' Days each spring.

Honors at Graduation

Honors at graduation are conferred in recognition of high scholarship and professional attainments. Honors and special honors are recorded on diplomas and indicated on the commencement program.

Scholarships, Fellowships, and Loan Funds

Money contributed to the University Development Foundation for assistance to engineering students is deposited in appropriate accounts and used according to the restrictions imposed by the donors. Numerous industries match employee contributions or offer scholarships and fellowships. About 150 undergraduate scholarships and grants are conferred. Awards are based on academic progress, financial need or both (see Financial Aid, General Information section).

For details students may contact the Office of the Dean of the college.

Student Organizations

The following honorary engineering societies have active student chapters in the College of Engineering and Applied Science:

Chi Epsilon, civil and architectural fraternity
Eta Kappa Nu, electrical engineering society
Pi Tau Sigma, mechanical engineering fraternity
Sigma Gamma Tau, aerospace fraternity
Tau Beta Pi, engineering society

Student chapters of the following professional societies are well established:

American Institute of Aeronautics and Astronautics
American Institute of Chemical Engineers
American Society of Civil Engineers
American Society of Mechanical Engineers
Institute of Electrical and Electronic Engineers
Society for Industrial and Applied Mathematics
Society of American Military Engineers
Society of Manufacturing Engineers
Society of Women Engineers

The student SIAM chapter was the first in the country.

These societies meet frequently to present papers, speakers, films, and other programs of technical interest. A general student organization, known as the Associated Engineering Students, of which all students in the College of Engineering and Applied Science and its extensions are members, has supervision of matters of interest to the whole group through the Control Board, its legislative body. With the advice of the engineering faculty, the Associated Engineering Students (AES) publishes *The Colorado Engineer*.

The usual student activities and organizations, such as athletics, oratorical and debating societies, student publications, and musical, literary, and religious organizations, are open to students in all colleges and schools of the University.

ADMISSION REQUIREMENTS

Requisite Qualifications

The prospective engineering student needs to be able to work hard, should enjoy mathematics, and should have a keen interest in science and its methods. Sound curiosity about the principles governing the behavior of forces and materials and the ability to visualize structures and machines are necessary prerequisites. The ability to express ideas in both written and spoken form is of primary importance.

Too often, high school students and others regard the mere ability to make things with the hands as an indication of engineering ability. Manual and mechanical skills are valuable but, without the faculties mentioned, are not suitable qualifications for an engineer.

Freshmen

In order to enroll, the student must meet the requirements of the College of Engineering and Applied

Science and the Boulder Campus requirements described in the General Information section of this catalog.

SUBJECTS REQUIRED FOR ADMISSION

	<i>Required Units</i> ¹
English (literature, composition, grammar)	4
Algebra	2
Geometry	1
Additional mathematics	1
Natural sciences (physics and chemistry recommended)	2
Social studies and humanities (foreign languages, additional English, history, and literature are included)	3
Electives	3
	16

(A unit of work in high school is defined as a course covering a school year of not fewer than 36 weeks, with five periods of at least 40 minutes each per week. [Two periods of manual training, domestic science, drawing, or laboratory work are equivalent to one period of classroom work.] This is equivalent to 180 actual periods per unit. Fractional credits of value less than one-half unit will not be accepted. Not less than one unit of work will be accepted in a foreign language, elementary algebra, geometry, physics, chemistry, or biology.)

(Electives may be chosen from any of the high school subjects [except physical education] which are accepted by an accredited school for its diploma and which meet the standards as defined by the North Central Association. However, not more than two units will be considered from drawing, shop, or other vocational work; courses that have descriptive geometry features may be considered for elective units beyond the recommended units.)

Beginning students in engineering start their mathematics courses with analytic geometry and calculus. *Makeup courses carry no credit but are recommended for all students not fully prepared to begin the regular mathematics sequence.*

In order to be prepared for the type of mathematics courses that will be taught, the student must be competent in the basic ideas and skills of ordinary algebra, geometry, and plane trigonometry. These include such topics as quadratic equations, graphic representation, simple systems of equations, logarithms, the trigonometric functions and simple applications, and the standard theorems of geometry including some solid geometry. Usually seven semesters are required to cover this material adequately in high school.

Recommendation of the High School Principal. It is urged that principals and high school teachers and counselors recommending students to the College of Engineering and Applied Science consider only those students who have shown evidence of the character, seriousness of purpose, and scholarly attainments that will lead to a satisfactory career in engineering. It is assumed in all cases that the students will have grades distinctly above average, especially in English, mathematics, and science.

Special Students in Engineering. Persons of sufficient maturity and experience who do not satisfy the requirements prescribed for regular students may, upon approval of the dean and if enrollment limits permit, be admitted by examination (oral or written or both) to determine the preparation and capacity of

the applicant for college work. The admission to particular courses shall be subject to the approval of the department concerned.

Students Who Do Not Meet Subject Requirements. Students with subject deficiencies may receive consideration for admission by the dean of the College of Engineering and Applied Science.

Students who have deficiencies should submit their complete applications to the Office of Admissions and Records early in their last semester of high school.

All students who are admitted from the lowest two-thirds of their graduating class and all students with subject deficiencies will be placed on probation and immediately put under the special supervision of the dean. Students on probation may be required to carry reduced programs or ones especially adapted to their needs. A student who does not demonstrate capacity for satisfactory work in engineering during the first semester may be disenrolled.

Transfer Students

Students transferring from other accredited collegiate institutions are admitted if they meet the requirements outlined in the General Information section of this catalog and the freshman requirements for entering the College of Engineering and Applied Science.

Transfers from within the University to the College of Engineering will be considered on an individual basis if both of the following conditions are fulfilled:

1. Enrollment quotas permit.
2. The student's prior academic record fulfills the admission requirements of the College of Engineering and Applied Science.

All transfers are subject to review by a faculty committee which evaluates the applicant's qualifications for academic success in engineering subjects.

The college seeks to identify applicants having a high probability of successful completion of their academic programs. Admission is based on evaluation of many criteria; among the most important are the general level of academic performance before admission to the college and other evidence of motivation, potential, scholarly ability, and accomplishment. These are indicated by trends in the student's record, by letters of recommendation from teachers and others qualified to evaluate the student, by accomplishments outside academic work, and by other relevant evidence.

The Committee on Admissions will set detailed standards for admission annually and may consider applicants on an individual basis.

TRANSFER CREDIT

After a prospective transfer student has made application and submitted transcripts to the University

¹Applicants not meeting these requirements will be considered on an individual basis. A student who is not prepared should expect to make up deficiencies. Beginning students must be prepared to start analytic geometry-calculus, which requires a knowledge of trigonometry. Students planning to do graduate work at the Ph.D. level are urged to take at least two units of a foreign language. Fractional credits of less value than one-half unit will not be accepted. Not less than one unit of work will be accepted in a foreign language, elementary algebra, geometry, physics, chemistry, or biology.

of Colorado, the Office of Admissions and Records issues a Statement of Advanced Standing (currently Form 382) listing those courses that are acceptable by University standards for transfer. A copy of this statement is received by the dean's office at the time the student is admitted by the Office of Admissions and Records, and is made a part of the dean's office permanent record. The appropriate engineering faculty departmental representative will use this copy of the form to indicate which of those credits listed may be acceptable toward the 136-hour graduation requirement in the College of Engineering and Applied Science, and note the tentative acceptance of these credits by dating and initialing each acceptable course listed on the Statement of Advanced Standing. The student will be notified that the acceptance is tentative and is contingent upon satisfactory completion of a minimum of 30 semester hours at the University of Colorado Boulder Campus before the credits may be officially applied toward the degree requirements. *It is the responsibility of the transfer student, after having completed the 30 semester credit hours at the University of Colorado Boulder Campus, to request final validation of the credits by his department and to have this validation noted on the Statement of Advanced Standing kept in the dean's office.*

If at any time a student wishes to have a course not previously accepted considered again for transfer, the student should consult with the departmental transfer adviser and complete a petition to the dean through the department chairman. It is recommended that departments clearly identify transfer students in their records so that when the time comes to evaluate credits for graduation, the dean's office pages can be referred to for proper acceptance of transfer credits applicable toward degree requirements. All transfer credit must be validated by satisfactory achievement in subsequent courses.

NONTRANSFERABLE CREDITS

Students desiring to transfer credits from engineering technology programs should note that such credits are accepted only upon the submission of evidence that the work involved was fully equivalent to that offered in this college.

Some technology courses are given with titles and textbooks identical to those of some engineering courses. These may still not be equivalent to engineering courses because of emphasis that is non-mathematical or otherwise divergent.

In order to assist engineering technology students with transfer problems, the following guidelines have been established:

1. Courses on basic subjects such as mathematics, physics, literature, or history may be acceptable for direct transfer of credit if they were taught as part of an accredited program for all students and were not specifically designated for technology students.

2. Students who have taken technology courses (courses with technology designations) that may be valid equivalents for engineering courses have these options:

- a. They may petition faculty advisers to waive the course. The requirement for a course can be waived if a student demonstrates that, by previous course work, individual study, or work experience he has acquired the background and training normally provided by the course. No credit is given toward graduation for a waived course, but a strong student may benefit from the waiver by being able to include more advanced work later in his or her curriculum. Other students may profit by taking the course at this college instead and thus establishing a fully sound basis for what follows.

- b. Credit for a course may be given if the course work was done at an accredited institution of higher education. The University of Colorado department involved may recommend that credit be transferred to count toward the requirements for a related course in their curriculum. Credit cannot be given for vocational-technical or remedial courses under rules of the University. (See general section on transfer of college-level credit.)

- c. They may seek credit for the course by examination. See Advanced Placement and College-Level (CLEP) Credit.

WORK EXPERIENCE

It is the policy of the College of Engineering and Applied Science at the University of Colorado Boulder Campus that any credits accrued in the official records of the student that were awarded for work experience (or for co-op experience) will not apply as part of the 136 semester hours required for an engineering degree in the college.

The grade-point average of an engineering student will include all academic courses attempted at the University of Colorado.

Former Students

Former students must meet the requirements outlined in the General Information section of this catalog. Records made at collegiate institutions while the student was a member of the armed forces will not necessarily be a determining factor in a student's readmission to the University of Colorado, but all such records should be submitted. *Students who have withdrawn must obtain permission of the dean to reenroll* in the College of Engineering and Applied Science. They must then submit applications for admission for consideration by the Committee on Admissions of the college.

Students who interrupt their course of study may be required to take any preparatory courses which have been added during their absence or to repeat courses in which their preparation is thought to be weak.

Advanced Placement

Advanced placement and college credit may be granted on the basis of the College Entrance Examination Board's Advanced Placement Tests or by special examinations administered by the department

involved. For students who have taken an advanced placement course in high school and who make scores of 4 or 5 in the CEEB's Advanced Placement Examination, advanced placement as well as college credit will be granted. Students who make scores of 3 may be considered for advanced placement and college credit by the department concerned. All advanced placement and transfer credit must be validated by satisfactory achievement in subsequent courses, in accordance with standard transfer policies of the college.

Advanced placement credit for the freshman mathematics courses in calculus and differential equations will be limited to not more than 4 hours each. Equivalent mathematics courses from other colleges are usually accepted at full value.

College-Level Examination (CLEP) Credit

Prospective students may earn college-level credit through the College-Level Examination Program (CLEP) examinations, provided that they score at the 67th percentile or above. Departments will advise students of the credits accepted for such courses. The number of credits so earned must be within the limits of the number of elective hours of the individual department. A list of subjects in which CLEP examination credit will be accepted may be obtained at the College of Engineering and Applied Science. The currently approved list includes 23 subjects in the fields of computing, business, science, mathematics, the humanities, and social sciences. (See also University regulations and instructions for obtaining additional information.)

DEGREES

Undergraduate Degree Programs

The College of Engineering and Applied Science offers four-year courses leading to the Bachelor of Science in:

Aerospace engineering sciences	Electrical engineering
Applied mathematics	Electrical engineering and computer science
Architectural engineering	Engineering physics
Chemical engineering	Mechanical engineering
Civil engineering	Resource systems engineering (Colorado Springs campus only)

Varied programs and options are offered in each of the above areas.

Joint Degrees

Joint Bachelor's Degrees in Engineering and in Other College Academic Programs at the University of Colorado Boulder Campus. Arrangements to obtain joint bachelor's degrees in engineering and in other college academic programs may be made through consultation with and approval of the appropriate deans and completion of a minimum of 30 additional semester hours beyond the largest minimum required by either college or school.

Bachelor of Science Degrees in Engineering in the College of Engineering and Applied Science at the

University of Colorado Boulder Campus. Two Bachelor of Science degrees in engineering may be earned by obtaining the approval of both departments concerned and completing a minimum of 30 additional semester hours beyond the largest minimum required by either department (currently this would require 166 semester credit hours total). Transfer students desiring two bachelor's degrees must present a minimum of 60 semester credit hours taken at the University of Colorado College of Engineering and Applied Science (Boulder Campus), and must satisfy all other stipulations regarding total hours required and approval of all course work by both departments concerned. Of the 30 additional hours for the second degree, a minimum of 24 shall be in courses in the department concerned or in courses approved in writing in advance by the department as substitutes.

Students desiring to pursue the double-degree program in the College of Engineering and Applied Science (Boulder Campus) must formally designate themselves double degree candidates by filing in the dean's office a petition signed by the chairman of both departments concerned prior to enrolling for the last 30 hours of work to be completed for the double degree.

A decision to earn a joint degree should be carefully weighed, since qualified students can obtain a master's degree for the same number of credits (see *Graduate Study in Engineering*).

Joint Degrees in Business. A student in the College of Engineering and Applied Science may be able to obtain a combined B.S. degree in engineering and B.S. degree in business. (See Combined Business and Engineering Curricula.)

Post-Arts Degree. A graduate of the College of Arts and Sciences may obtain an engineering degree in four semesters if such liberal arts courses as science and mathematics and such engineering courses as graphics and certain specialized subjects have been elected.

Premedicine Option

Each engineering department has an option by which a student may fully meet all requirements for entry into medical schools while also earning a degree in engineering. There is also a premedical option in engineering physics. Engineering departments will approve inclusion of appropriate biological and bioengineering courses in the student's program of technical electives.

The courses listed below are prescribed by medical schools and must be completed with superior grades. General overall requirements representative of those for entry into most medical schools are given. Students can meet these requirements by careful substitutions of electives in the engineering curriculum. In some cases where additional hours may be required, interested students should consult with the departmental chairman and the medical school adviser on the Boulder Campus.

General chemistry ¹	2 sem. (8-10 sem. hrs.)
Organic chemistry	2 sem. (8-10 sem. hrs.)
General biology or zoology ¹	2 sem. (8 sem. hrs.)
Literature (in English)	2 sem. (6 sem. hrs.)
English composition ²	1 sem. (3 sem. hrs.)
Physics	2 sem. and Lab (9 sem. hrs.)
Calculus	1 sem. (4 sem. hrs.)
Genetics (required for pre-dentistry only)	1 sem. (3 sem. hrs.)

Various bioengineering courses are listed in this catalog. Students are expected to show a thorough knowledge of chosen subjects and a true understanding of the problems presented and the solutions that have been advanced. In addition, students must acquire understanding of mankind through the study of social-humanistic subjects. Study of courses that will be taken in medical school is strongly discouraged.

To complete a premedical program in the College of Engineering and Applied Science, it is strongly recommended that the student follow a full four-year college course (with the equivalent of at least 136 semester hours) and earn a B.S. degree. A student with unusual vigor might be able to prepare for medical school in three years. In such cases, a minimum of 15 semester hours should be devoted to engineering, instead of the 30 hours required for the four-year student. This student will not, of course, receive a degree in engineering. The study and practice of medicine require persistent, hard effort, and so should the premedical education.

The Admissions Committee of the School of Medicine welcomes inquiries and visits from prospective students, particularly at the time of their first interest in medicine as their chosen profession.

The requirements for premedical programs are indicated under the departmental headings.

Combined Business and Engineering Curricula

Undergraduates with career interests in administration may be able to complete all of the requirements for both a B.S. degree in engineering and a B.S. degree in business by extending their study programs to five years, including one or two summer terms. It may be possible to start earning the 48 semester credits required in the College of Business and Administration in the second, third, or fourth year, depending upon the curricular plan for the particular field of engineering in which the student is enrolled.

It is also possible for qualified graduates (grade-point average of 3.0 or better) to complete the requirements for a master's degree in business within one year after receiving the baccalaureate degree in engineering. Before deciding upon the business option, a student should carefully consider, in consultation with departmental advisers, the relative advantages of the combined B.S. business-engineering curricula, the degree program of the Graduate School of Business Administration, and the M.S. degree program in the student's own discipline.

Combined business and engineering programs for which students may be able to qualify are available for students in all engineering departments.

Before a combined degree student will be admitted to courses in the College of Business, the student must obtain permission and complete an application form from the College of Business. Failure to do so may preclude the student from taking any business courses.

For students in combined programs, the requirements for the degree in business are as follows:

1. Completion of at least 48 semester credits in business and economics, to include Econ. 201 and 202 (6 semester hours), required courses in business (30 semester hours), and a business area of emphasis (12 semester hours).

2. Completion of at least 30 of these semester hours at the University of Colorado while concurrently enrolled in the College of Business.

3. Completion of nonbusiness requirements in mathematics, communications, and the social and behavioral sciences in a degree program approved in advance by the College of Business. In addition, for some courses and areas of emphasis, there are prerequisite requirements which must be met.

4. At least a 2.0 grade average must be earned in all courses undertaken in the College of Business and the area of emphasis.

Shown below is the combined engineering-business program. For other combinations, students must consult with the associate dean for undergraduate studies in the College of Business.

The requirements for all combined business and engineering programs are as follows (no substitutions are permitted):

Courses	Semester Hours
Econ. 201 and 202. Principles of Economics	6
(Should be completed during the student's sophomore or junior year.)	
Acct. 200. Introductory Accounting	3
B.Ad. 200. Business Information and the Computer	3
Q.M. 201. Business Statistics	3
Mk. 300. Principles of Marketing	3
Fin. 305. Basic Finance	3
Pr.Mg. 300. Operations Analysis	3
Or.Mg. 330. Introduction to Management and Organization	3
B.Law 300. Business Law	3
B.Ad. 410. Business and Government; or B.Ad. 411. Business and Society	3
B.Ad. 450. Cases and Concepts in Business Policy; or B.Ad. 451. Management Game and Cases in Business Policy; or B.Ad. 452. Small Business Strategy, Policy, and Entrepreneurship ..	3
Courses in an area of emphasis in one of the following fields: accounting, computer-based information systems, finance, international business, marketing, office administration, operations management, organizational behavior, or transportation management. All course work in the area of emphasis must be taken at the University of Colorado College of Business Administration	12
	48

The student should note that for some courses, and for some areas of emphasis, there are prerequisite requirements which must be met. Since some of the

¹See appropriate chairman for possible substitution of courses.

²Required only of entering freshmen by the University of Colorado School of Medicine.

courses may be taken as engineering electives, it is possible to obtain the two degrees in as few as 166 semester hours; however, most students will require more.

PLANNING THE ENGINEERING PROGRAM

Freshman Year and Curriculum Choices

Fundamentals taught in the freshman year are of prime importance in the more advanced classes, and every effort is made to register beginning freshmen in the proper courses.

All freshmen are urged to consult their instructors whenever they need help in their assignments and should feel free to consult with the deans and/or members of their staffs about their problems. At midsemester, students not doing satisfactory work are required to consult with the dean or his assigned staff members.

It is strongly recommended that students avoid the likelihood of later scheduling problems by following the prescribed sequence exactly.

Courses Required in the Freshman Year. Course requirements for freshmen are detailed within the curriculum given under each department. They are essentially the same throughout the College of Engineering and Applied Science of the University of Colorado. The freshman is exposed to a broad university background, doing much early course work outside the College of Engineering and Applied Science in science, mathematics, and humanities. There is emphasis upon the humanities during the full four years.

About two-thirds of the sophomore year is the same for all students, and the remainder of the courses begin to point to the various fields of engineering taught; however, real specialization begins in the junior year and carries on through the senior year. A fifth year leading to the master's degree is strongly urged for students of more than usual ability who feel they can profit from additional study.

Advising and Records

Freshman students are advised by members of the engineering advising staff and by representatives from each academic department. These combined sources of help are readily available to assist students with academic, vocational, or personal concerns. *Students are assigned specific departmental advisers for academic planning and should consult with the departmental chairman or designated representative for assignment.*

UNDERGRADUATE DEGREE REQUIREMENTS

1. The B.S. degree requires that not less than 136 semester hours in an acceptable curriculum be completed to the satisfaction of the department concerned.

The last 30 hours must be earned after matriculation and admission as a degree student. Many students will need to present more than the minimum hours because of certain departmental requirements and because they may have enrolled in courses that do not carry full credit toward a degree. For example, not more than 6 hours in ROTC courses may be counted toward graduation. Physical education and performance courses do not carry engineering credit.

2. Overall grade-point averages of 2.00 are required for all courses counted toward degrees and (separately computed) for all required courses.

The grades of *P* or *H* in honors courses and of *P* in pass/fail courses count toward graduation but are excluded from these computations. The *F* grade is included.

3. A basic computer course is required by each department. E.E. 210 or C.S. 210 may usually be substituted for E.E./C.S. 201 to satisfy this requirement. In some curricula it is the preferred choice (see adviser).

4. Each B.S. program requires a minimum of 24 hours in social-humanistic subjects. *Six hours of literature are required.* Six hours of social-humanistic subjects should be taken in the junior year and 6 in the senior year. These subjects should be taken from the following categories, with not fewer than 6 hours from category "b" below.

- a. Literature (including foreign literature either in the original or in translation).
- b. Economics, sociology, political science, history, and anthropology.
- c. Fine arts and music (critical or historical).

In some circumstances 6 hours of English composition are accepted. (See English in this section of the catalog for approved sequences).

Qualified students will be permitted to take appropriate honors courses as substitutes for social-humanistic courses.

Such courses as public speaking, elementary foreign languages, technical writing, accounting, contracts, and management should be considered as technical and may be substituted for technical electives where applicable. *Students should consult their faculty advisers.*

5. For Engr. 301 (Thermodynamics), see Engineering.

6. Students should see also Requirements for Graduation and the general rules and policies of the University listed in this catalog.

7. Genuinely equivalent courses usually may be substituted for required courses. However, students must verify with advisers that courses actually are equivalent. Careful checking is required. *A course given at another institution may have the same name and same textbook as a required engineering course and still be taught with a nonmathematical emphasis or other variation that gives it little value for engineering.* (See Transfer Credit.)

8. All courses are not necessarily offered each semester. According to University rules, undergraduate courses having an enrollment of fewer

than ten students will be cancelled. Students can minimize scheduling problems by following closely the sequences given in the curricula of their departments. If a course is unavailable, a junior or senior showing definite need of it may be allowed to enroll for equivalent studies under the course number 400, Independent Study.

9. Students in applied mathematics and engineering physics should choose courses in the College of Engineering rather than the same courses cross-listed elsewhere, in order to be able to demonstrate a maximum depth in engineering to employers.

10. There are no language requirements for the B.S. degree in engineering, but some departments strongly recommend that students who may later seek graduate degrees include language courses in their programs. Elementary language courses may be acceptable as technical electives, and advanced courses as literature.

11. See also the College of Engineering *Student Survival Guide* for the current year. It may be obtained in the dean's office.

English

Communications skills are essential for every professional person and are particularly so for the engineer. Most engineering departments require one of the following series of courses. It is not mandatory but is preferable that the courses be taken sequentially as shown. These courses are intended to develop the student's writing ability and to allow a close analysis of significant works of world literature in translation and in English originals.

Engineering students may choose certain combinations of courses: Engl. 160, 161, 261, preferably in sequence; or Engl. 160, 161, and two of the following introductory literature courses—Engl. 120 (Introduction to Fiction), Engl. 130 (Introduction to Drama), or Engl. 140 (Introduction to Poetry).

Students who achieve a *B* average in two of the following English courses—120, 130, 140, 160, and 161—may take immediately thereafter any literature courses listed by the Department of English.

Also, engineering students have the option of taking humanities courses in the Integrated Studies Program of the College of Arts and Sciences as a substitute for introductory literature courses.

No social-humanistic credit will be given for courses dealing with English as a foreign language.

Electives

Engl. 120-3. Introduction to Fiction.
Engl. 130-3. Introduction to Drama.
Engl. 140-3. Introduction to Poetry.
Engl. 160-3/161-3. Great Books. (Not open to students who have credit in Humanities 101, 102.)
Engl. 220-3. Modern Short Story.
Engl. 221-3. Science Fiction.
Engl. 222-3. Introduction to Folklore.
Engl. 252-3/253-3. Major British Authors.
Engl. 261-3. Contemporary Literature.
Engl. 265-3/266-3. Masterpieces of American Literature.
Engl. 267-3. Contemporary American Literature.
Engl. 274-3/275-3. The American Writer and the Black Man.
Engl. 290-3/291-3. Studies in Literature.

Engl. 315-3. Report Writing. (For engineering students, the course is considered a technical elective).

Engl. 322-3. Folklore.

Engl. 368-3. Twentieth-Century American Literature.

Engl. 390-3/391-3. Studies in Literature.

Engl. 394-3. The Bible as Literature.

Engl. 397-3/398-3. Shakespeare.

Credit for ROTC

Students who complete Army, Navy, or Air Force Reserve Officers Training Corps (ROTC) programs and receive their commissions may be allowed credit toward their degrees for up to 6 semester hours of ROTC course work, provided their major departments consider the ROTC courses to be of suitable educational value. The actual number of degree credits to be allowed is determined by the department.

Any student, including those not working toward ROTC commissions, *may, with department approval, receive up to 6 semester hours of credit* toward an engineering degree from among ROTC courses appearing on an approved list available in the dean's office. The list is subject to change, and the actual number of credit hours awarded for any of the courses appearing on the list must be approved by the department. For an ROTC student these credits may not be in addition to the 6 semester hours mentioned above.

The faculty of the College of Engineering and Applied Science will not recommend an ROTC student for a bachelor's degree until the student has completed all ROTC requirements and is eligible for commissioning. Thus, ROTC students must attend their required summer camps and cruises and receive their commissions at or before the commencement exercises at which their degrees are conferred.

ROTC students who are working for degrees in both engineering and another area will be required to attend at least one summer session.

Requirements for Graduation

It is the student's responsibility to be certain that all the requirements are fulfilled, to file the intended date of graduation in the departmental office upon the completion of 100 semester hours applicable to the B.S. degree sought, to fill out a diploma card at registration at the beginning of the last semester, and to keep the departmental adviser and the dean's office informed of any change in plans.

In order to become eligible for one of the bachelor's degrees in the College of Engineering and Applied Science, a student, in addition to being in good standing in the University, must meet the following minimum requirements.

Courses. The satisfactory completion of the prescribed and elective work in any curriculum as determined by the appropriate department is required. A department may require a minimum grade of *C* in all major courses.

The 100-Hour Requirement. After completing 100 hours toward a degree, each student must complete a Graduation Requirement Card and a checklist in the dean's office during the third week of the semester.

Incompletes and Correspondence Courses. All *incompletes* must be completed and all correspondence course grades must be officially received no later than four weeks prior to graduation. It is the student's responsibility to contact the instructor concerning the removal of *incomplete* grades. Forms are available in the dean's office.

Conferring of Combined Degrees and Degrees and Commissions. Conferring of such degrees is to be simultaneous. (See ROTC and Joint Degrees.)

Faculty Recommendation. The recommendation of the faculty of the department offering the degree and the recommendation of the faculty of the College of Engineering and Applied Science are required.

Commencement Exercises. Commencement exercises are held in May and August. Students finishing in December may attend commencement the following May or receive diplomas by mail.

ACADEMIC RULES AND POLICIES

Credits

Students may receive credit for only those courses for which they officially registered, passed special examinations or correspondence courses, or transferred credits from other institutions. (See Advanced Placement, CLEP Credit). Students who have had extensive experience in the work covered by any required course and feel they are able to pass an examination over the course may apply for such an examination. Credit will be allowed upon successful completion of the test.

Normal Course Schedule

Students should register for regular work as outlined in the departmental curricula. Variations from the normal loads specified should be carefully planned with and approved by the appropriate faculty adviser. Students who are employed should consult with their advisers before each registration regarding course loads to be attempted and should inform the dean's office of the nature and hours of their employment. Guidelines for course load are available in the dean's office.

Sequence of Courses

Students should complete the courses in the department in which they are registered according to the order shown in this catalog. Any course in which there is a *failure* or an unremoved *incomplete* should take precedence over other courses; however, each student must register so that departmental requirements will be completed with the least possible delay.

A student who does not earn a grade of *C* or better in a course that is prerequisite to another may not register for the succeeding course without the permission of both the department and the instructor of the succeeding course.

Students may enroll for as much as 50 percent of their courses in work that is not a part of the

prescribed curricula. To exceed this limit, the approval of the major department and the dean of engineering must be obtained by petition.

Grading System, Pass/Fail and Drop/Add Procedures

See the General Information section of this catalog for the University of Colorado uniform grading system and for additional pass/fail information and drop/add procedures. Also see the current *Schedule of Courses*.

GRADING SYSTEM

It is particularly important to note that in the College of Engineering and Applied Science courses to be counted toward fulfilling the 136-hour graduation requirement *cannot* be taken *no credit (NC)*. *Once a course has been taken for no credit, the course cannot be repeated for credit.*

PASS/FAIL

The primary purpose for offering courses on a pass/fail grade basis is to encourage students, especially juniors and seniors, to broaden their educational experience by electing challenging courses without serious risk to their academic records. In general pass/fail should be limited to 300- or 400-level courses. Below are specific pass/fail regulations for the College of Engineering and Applied science.

1. A maximum of 16 pass/fail hours may be included in a student's total program. A maximum of 6 hours may be taken in one semester, but it is recommended that not more than one course at a time be taken pass/fail.

2. Courses that a student may elect to take pass/fail shall be designated and *approved in advance* by the student's major department. If courses not so designated are taken, the earned grade will be recorded in place of the *P* or *F* grade. An engineering student who has not designated a major field will not be allowed the pass/fail option without approval through the dean's office.

3. A transfer student may count toward graduation 1 credit hour of pass/fail for each 9 credit hours completed in the college; however, the maximum number of pass/fail hours counting toward graduation shall not exceed 16, including courses taken in the Honors Program under that program's pass/fail grading system.

4. Students on academic probation should not enroll for pass/fail courses.

DROP/ADD

Only under very extenuating circumstances will petitions for dropping courses be considered after the tenth week of the semester.

Withdrawal

A student may withdraw from the University without academic penalty before the end of the second week of the semester. After the 10th week of the semester, a student will not be allowed to withdraw

officially from the University except for circumstances clearly beyond the student's control. If a student suspends work by officially withdrawing from the University, *permission must be secured from the dean to reenroll in the College of Engineering and Applied Science*. Students who interrupt their course of study may be required to take any preparatory courses that have been changed during their absence or to repeat any courses showing weak preparation. Students who withdraw may find it difficult to reenroll because of legislative ceilings on enrollments. They must reapply for admission. Their applications will be reviewed by the Committee on Admissions.

Class Standing

To be classified as a sophomore in the College of Engineering and Applied Science, a student must have passed 30 semester hours; to be classified as a junior, 60 hours; and to be classified as a senior, 90 hours of credit. All transfer students will be classified on this same basis according to their hours of credit accepted at the University of Colorado.

Attendance

Successful work in the College of Engineering and Applied Science is dependent upon regular attendance in all classes. Students who are unavoidably absent should make arrangements with instructors to make up the work missed. Students who, for illness or other good reason, miss a final examination must notify the instructor or the Office of the Dean no later than the end of the day on which the examination is given. Failure to do so will result in an *F* in the course.

Policy on Academic Progress

The following is a statement of the Policy on Academic Progress in the College of Engineering and Applied Science.

An overall average of 2.0 or better, in hours taken at the University of Colorado toward graduation requirements, is necessary to remain in good standing in the College of Engineering and Applied Science. Grades earned at another institution are not used in calculating the grade-point average at the University of Colorado. However, grades earned in another school or college within the University of Colorado will be used in determining the student's scholastic standing and progress toward the bachelor of science degree in the College of Engineering and Applied Science.

Students whose overall averages fall below 2.0 will be placed on probation for the next semester in which they are enrolled in the College of Engineering and Applied Science, and will be so notified. If, after that semester the student's average is still below 2.0, the student will be suspended from the college.

The following is additional information and interpretation of the policy:

1. Students who have been suspended are suspended indefinitely and may not enroll at any University of Colorado campus during any regular academic year, September through May, but may

enroll in summer sessions or Vacation College and/or may take *correspondence courses* for credit through the Division of Continuing Education.

2. Students who have been suspended may apply for readmission if they bring their overall average up to a 2.0 through summer session, Vacation College, and/or correspondence work applying to engineering degree requirements as approved by a member of the Academic Progress Committee.

3. A student, upon satisfactorily completing at another college or university a minimum of 12 semester hours of work appropriate to an engineering curriculum subsequent to suspension, may apply for readmission as a transfer student.

4. Applicants for readmission to the University of Colorado cannot be assured readmission.

5. During a probation semester the student must complete a *normal* load, i.e., 12 hours or more (for a full-time student) of courses counting toward graduation requirements. Physical education courses do not count; if the student has previously completed 6 hours of ROTC courses, ROTC courses do not count; if 24 hours of social-humanistic subjects have been completed, social-humanistic subjects do not count.

6. Students who have been on probation or suspension at any time in the past will automatically be suspended if their overall average again falls below a 2.0.

Details of the probationary and suspension status and of the conditions for return to good academic standing will be stipulated in the letters of probation and suspension. Information regarding these matters may be obtained in the Office of the Dean, Engineering Center AD 1-1.

Repetition of Courses

Students may not register for credit in courses in which they already have received grades of *C* or better. When a student takes a course for credit more than once, *all grades are used in determining the grade-point average*. An *F* grade in the repetition of a required course necessitates a subsequent satisfactory completion of the course. *Students may not register for credit in any course which they have previously enrolled in and completed for NC (no credit)*.

Changing Departments

The forms necessary for transferring from one engineering department to another are available in the dean's office.

Other University Campuses

A student who needs to work at a part-time or full-time job while obtaining a college education, or who lives in the metropolitan areas of Denver or Colorado Springs, may prefer to attend the University of Colorado at Colorado Springs or the University of Colorado at Denver. The campus designation on the student's diploma and transcript correspond to the campus designation of the faculty recommending the student for a degree.

UNIVERSITY OF COLORADO AT DENVER

Two departments of the College of Engineering and Applied Science are located on the campus of the University of Colorado at Denver. Complete B.S. and M.S. degree programs are offered by the Department of Civil and Urban Engineering and the Department of Electrical and Computer Engineering. Complete M.S. degree programs are also offered in applied mathematics, as are many of the courses leading to the B.S. degree in mechanical engineering, engineering physics, and other engineering fields. Many graduate courses in other fields are also offered. The Denver Campus is located at 1100 14th Street in downtown Denver.

UNIVERSITY OF COLORADO AT COLORADO SPRINGS

Two departments of the College of Engineering are located on the campus of the University of Colorado at Colorado Springs (UCCS). Complete B.S. degree programs are offered by the Department of Electrical Engineering and Computer Science in electrical engineering, electrical engineering and computer science, and resource systems engineering. The UCCS Department of Mathematics is also a department of the College of Engineering and offers the B.S. and M.S. degrees in applied mathematics. Freshman-year work is offered for all engineering degrees and the majority of the sophomore-year courses are available for many areas.

Summer Courses

Summer session courses are planned for regular students and for those who must clear deficiencies. Courses are offered also for high school graduates who wish to enter as freshmen and for those who need to remove subject deficiencies. For information about courses, students should write to the chairman of the department in which the courses are taught and for the *Schedule of Summer Courses* for the campus on which they plan to enroll.

Division of Continuing Education and Correspondence

Some courses are also available through the Division of Continuing Education, either through correspondence instruction or special courses.

Televised Courses

Televised courses are used to avoid duplication of effort between the campuses of the University at Boulder, Colorado Springs, and Denver. Those given on the Boulder Campus are listed in this bulletin with other courses. For information about televised instruction in courses for industry or at remote locations, contact should be made with the appropriate department or school, or with the Office of University-Industry Relations, Engineering Center AD1-1, Boulder 80309. In-state and out-of-state tuition for off-campus videotaped courses is comparable to that for other instruction.

For information on scheduling of courses, write to the chairman of the department concerned or consult the *Schedule of Courses* issued at the beginning of each semester.

GRADUATE STUDY IN ENGINEERING

The College of Engineering and Applied Science offers degree programs for the Master of Engineering degree (M.E.), Master of Science degree (M.S.), and Doctor of Philosophy degree (Ph.D.). There are degree programs in each of the following departments or fields:

Aerospace Engineering Sciences	Electrical Engineering Engineering Design and Economic Evaluation
Chemical Engineering	Mechanical Engineering Mechanics
Civil, Environmental, and Architectural Engineering	

The Master of Science in telecommunications is presented jointly by the Department of Electrical Engineering, the Department of Communication, the Department of Political Science, and the Graduate School of Business Administration.

Graduate programs within each engineering department offer a variety of options, providing numerous alternative careers.

Programs with emphasis on special fields include civil engineering degrees focused on architectural engineering, construction engineering, illumination engineering, and water purification engineering. Electrical engineering areas in which there are strong subject concentrations include communications, computer science, microwaves, solid state devices, integrated circuits, electric power, and others. In mechanical engineering a strong option is offered in mechanics and a program in design and economic evaluation. The M.S. degree in engineering design and economic evaluation will be available for a limited time only.

In most departments there is a choice among bioengineering, environmental engineering, energy and energy resources, or computer applications. Systems, process control, and dynamic flow are other strong areas.

Education for Practicing Engineers

The Master of Engineering degree permits graduate students flexibility in defining specialized interdisciplinary fields that meet their professional needs. This degree has standards fully equivalent to those of the Master of Science degree (see Master of Engineering). Each of the engineering departments participates with students in setting up acceptable programs for the degree.

The college puts great emphasis upon making graduate courses readily available, through offerings at other campuses of the University. Televised courses through the Audiovisual Continuing Education (ACE) program make available credit or noncredit courses televised on the three campuses for residents and for off-campus students in the region. For information, the prospective student should contact the dean's office.

Graduate Work In Business

Undergraduates in engineering who intend to pursue graduate study in business may complete some of the business background requirements as electives in their undergraduate programs. Seniors in engineering who have such intentions and appear likely to qualify for admission to graduate study in business may be permitted to register for graduate fundamentals courses designed to provide qualified students with needed background preparation in business. (See concurrent B.S. and M.S. degree programs.)

Concurrent B.S. and M.S. Degree Program In Engineering

Students who plan to continue in the Graduate School after completion of the requirements for the B.S. degree will usually find it advantageous to apply for admission to the concurrent degree program.

This program allows the student who qualifies for graduate study and expects to continue for an advanced degree to plan a graduate program from the beginning of the senior year rather than from the first year of graduate study. The student can then reach sooner the degree of proficiency required to begin research and can make better and fuller use of courses offered in alternate years.

Application is made to the Graduate School through the department early in the second semester of the junior year (after completion of at least 84 semester hours). Admission to the Graduate School may be granted on completion of 118 semester hours. (See Seniors at the University of Colorado in the Graduate School section of this catalog.) Requirements are the same as for two degrees taken separately: 136 credit hours for the B.S. degree and 24 hours plus thesis (Plan I) or 30 credit hours (Plan II) for the M.S. or for the Master of Engineering degree. Social-humanistic requirements must be completed within the first 136 credit hours. A 3.0 grade-point average for all work attempted through the first six semesters (at least 96 credit hours) and written recommendations from at least two departmental faculty members are required.

All students will choose or be assigned faculty advisers to help them develop the program best suited to their present interests. Those in each program will be encouraged to pursue independent study on research problems or in areas of specialization where no formal courses are offered. A liberal substitution policy will be followed for courses normally required in the last year of the undergraduate curriculum. The program selected must be planned so that the student may qualify for the B.S. degree after completing the credit-hour requirements for the degree if the student so elects, or if the student's grade-point average falls below the 3.0 required to remain in the program. In this case, all hours completed with a passing grade while in the program will count toward fulfilling the normal requirements for the B.S. degree. There will be no credit given toward a graduate degree for courses applied to the B.S. degree requirements;

however, students are still eligible to apply for admission to the Graduate School under the rules set forth in the Graduate School section of this catalog. Normally, however, the student will apply for admission to the Graduate School when at least 130 of the 136 credit hours required for the B.S. degree have been completed, and will be awarded the B.S. and M.S. degrees simultaneously upon meeting the requirements set forth for the concurrent degree program.

Master of Engineering, Master of Science, and Doctor of Philosophy Degrees

Students wishing to pursue graduate work in engineering leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees in the *Graduate School* section of this catalog. Some departments also have available explanatory material on their advanced degree programs.

Prerequisites. To enroll for an advanced degree in any department of the College of Engineering and Applied Science, candidates either must have previously earned a bachelor's degree in a curriculum that includes the necessary prerequisites for the branch of engineering in which they wish to specialize or qualify for the concurrent B.S. and M.S. program open to juniors. If the candidate's preliminary education was taken at some other institution, the degree of qualification for advanced work shall be determined by the department concerned and by the dean of the Graduate School.

Graduates of engineering technology programs should note that the equivalent of a B.S. degree in an appropriate engineering field is required for entry into the Graduate School. Because the goals and orientation of engineering programs differ from those of technology programs, technology graduates should expect to make up deficiencies before being admitted to graduate study in engineering. Students may not be admitted to the Graduate School while making up deficiencies, but can enroll as special students.

For admission as a regular degree student, an undergraduate grade-point average of at least 3.0 is normally required.

Language Requirement. No engineering department except Mechanical Engineering has a foreign language requirement, but Ph.D. candidates should note the communication requirement of the Graduate School, under which a foreign language is required.

Graduate work in each department of the College of Engineering and Applied Science falls into two classes:

1. Courses that are offered for candidates who have chosen to major in the particular department or as a base for the Master of Engineering combined degree.

2. Courses that are offered as minors for candidates who have chosen their major in some other department.

Graduate students who plan to become candidates for the M.E., M.S., or Ph.D. degree are required to take a qualifying examination in the appropriate field

of specialization during the first semester in which they are registered as candidates for a graduate degree. Individual departments should be consulted for the timing of this examination. The purpose of this examination is to enable the adviser and student to plan a suitable program of study.

Course Requirements. Graduate students majoring in any department receive no credit in the Graduate School for courses listed as required undergraduate work in the same department. They may, however, receive graduate credit for advanced undergraduate courses in an engineering department other than that in which they receive the bachelor's degree, with the approval of the department granting the degree.

Availability of Courses. All courses are not necessarily offered every year. They are available only if there is sufficient demand. According to University rules, a graduate course, even though offered, will be canceled if the enrollment is less than five students. Some courses are offered in alternate years on the Boulder Campus and the Denver Campus; others usually at Boulder only, and some only at Denver. If a course is not available at either Boulder or Denver, a student showing urgent need for the material may apply for equivalent studies under the course titles of Independent Study or Selected Topics (see course description numbers 400, 500, and 600).

AEROSPACE ENGINEERING SCIENCES

Office in Engineering Center OT 6-16
Professor Franklin Essenburg, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The primary objective of the aerospace engineering sciences curriculum is to provide sound general education in subjects fundamental to the practice of and research in this branch of engineering sciences. The major part of the first three years is devoted to the study of mathematics, physics, mechanics, chemistry, and the humanities. The fourth year is devoted to the professional courses in the fields of physics of fluids (fluid dynamics); propulsion and energy conversion; flight dynamics, control, and guidance; space systems analysis; materials and structural mechanics; space environment; and bioengineering.

Students in the Department of Aerospace Engineering Sciences are encouraged to pursue special research topics of their own choosing during the junior and senior years. Course credit will be allowed for suitable studies under the courses designated as Aero. 461 or 462. This research is under the direction of a member of the departmental faculty. Students should contact the faculty member of their choice at the beginning of the semester.

Planning of graduate study for students having sufficient ability and interest should begin by the start of the junior year. Such a plan should consider the foreign language requirements of appropriate graduate schools and an advanced mathematics program included in technical electives consisting of M.E. 462, Math. 431/432, Math. 481, or Math. 443

(see Graduate Programs). ROTC courses may be substituted for not more than 3 hours of technical electives, subject to the approval of the student's adviser. Certain specified ROTC courses are accepted for social-humanistic credit. The total credit for ROTC courses may not exceed 6 hours. Students who wish to combine the business and aerospace engineering sciences curricula are advised to consider obtaining the B.S. degree in aerospace and the M.S. degree in business rather than a combined B.S. degree. Business courses may not be substituted for technical electives in the aerospace curriculum.

Premedical Option in Aerospace Engineering Sciences

The Department of Aerospace Engineering Sciences offers a premedical option which has been specifically designed for students who wish either to attend medical school or to enter graduate work in bioengineering after receiving their B.S. degree. This option has been so arranged that no choice need be made by the student until the first semester of his senior year. Students wishing to enter the premedical option program will be allowed to substitute the following for some of their normal course work during the senior year:

<i>Fall</i>	<i>Semester Hours</i>
Bioengineering elective (Aero. 581 recommended)	3
MCDB 384. Molecular Genetics	
or EPOB 383. Genetics	3
Chem. 331. Organic Chemistry	4
 <i>Spring</i>	
Chem. 332. Organic Chemistry	4
Aero. 380. Bioengineering I.	3

Computer Option in Aerospace Engineering Sciences

The Department of Aerospace Engineering Sciences offers a computer option designed for students who are particularly interested in the computational aspects of engineering and scientific problems. The student who elects this option should have an interest in and an aptitude for mathematics.

The first three years are the same in this option as in the standard program. In the senior year fall semester, a course in numerical analysis, assembly language, or analog computer should be taken in place of electronics theory and laboratory. The following program is recommended for the senior year spring semester:

SENIOR YEAR

<i>Spring Semester</i>	<i>Semester Hours</i>
Aero. 417. Aerospace Laboratory	2
Aero. 462. Undergraduate Research (Individual Computational Problem)	1
Computation elective	6
Social-humanistic elective	3
Technical electives	6
	18
Minimum hours for degree	136

Curriculum for B.S. in Aerospace Engineering Sciences

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Aero. 130. Introduction to Aero. I	2
A.Math. 135. Calculus for Engineers I	4
Ch.E. 210. Physical and Chemical Properties of Matter (Note 2)	4
Engr. 160. Great Books (Notes 1 and 3)	3
Social-humanistic elective (Note 3)	3
	16

Spring Semester

A.Math. 136. Calculus for Engineers II	4
E.Phys. 111. General Physics	4
Engr. 101. Fundamentals of Design I	2
Engr. 161. Great Books (Notes 1 and 3)	3
Social-humanistic elective (Note 3)	3
	16

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
M.E. 281. Mechanics I	3
C.S. 210. Fundamentals of Computing I	3
Social-humanistic elective (Note 3)	3
	18

Spring Semester

A.Math. 236. Introduction to Linear Algebra and Differential Equations	3
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
M.E. 282. Mechanics II	3
Engr. 301. Thermodynamics	3
Social-humanistic elective (Note 3)	3
	16

JUNIOR YEAR

Fall Semester

Aero. 304. Analytical Dynamics	3
Aero. 311. Fluid Dynamics I	3
E.E. 303. Electrical Circuits I	3
E.E. 343. Electrical Laboratory I	1
Aero. 326. Aerospace Materials	3
M.E. 371. Systems Analysis I	3
	16

Spring Semester

Aero. 312. Fluid Dynamics II	3
Aero. 322. Structures I	3
Aero. 336. Foundations of Propulsion	3
Aero. 380. Bioengineering I or technical elective (Notes 3 and 5)	3
Aero. 441. Guidance and Control (Note 4)	3
Social-humanistic elective (Note 3)	3
	18

SENIOR YEAR

Fall Semester

Aero. 403. Flight Mechanics	3
Aero. 413. Gasdynamics and Propulsion	3
Aero. 447. Computational Fluid Mechanics	3
E.E. 403. Elements of Electronics	2
E.E. 443. Elements of Electronics Laboratory	1
Technical electives (Notes 3 and 5)	6
	18

Spring Semester

Aero. 417. Aerospace Laboratory I	2
Technical electives (Notes 3 and 7)	13
Social-humanistic elective (Note 3)	3
	18

Curriculum Notes

- For other options in English, see the English language listings under degree requirements.
- Chem. 103, General Chemistry, may be substituted. Chem. 202, General Chemistry, may also be substituted. In the latter case, take a social-humanistic elective in the freshman fall semester and Chem. 202 in the sophomore spring semester.
- Technical electives, social-humanistic electives, and English may be taken *pass/fail*, subject to the regulations of the College of Engineering and Applied Science.
- E.E. 413, Control Systems Analysis, may be substituted.
- Up to 3 credit hours of Independent Study may be counted as a technical elective.

GRADUATE DEGREE PROGRAMS

Professional courses in the graduate area cover the fields of physics of fluids (fluid dynamics); propulsion and energy conversion; flight dynamics, control, and guidance, space systems analysis; materials and structural mechanics; space environment; and bioengineering. In addition, the department has cooperative research programs with institutes in Boulder and the surrounding area.

Presently active areas of research include acoustics, aerospace vehicle design, bioengineering, computational fluid dynamics and data processing, control theory, cryogenics, environmental fluid dynamics, flight mechanics and astrodynamics, high temperature gas dynamics, kinetic theory, magnetohydrodynamics, material sciences and solid state physics, physics of fluids, plasma physics, space sciences and astrophysics, turbulence and stochastic processes, and unsteady aerodynamics.

Requirements for Advanced Degrees

All graduate students applying for admission to Aerospace Engineering Sciences after September 1, 1977, will be required to present the results of the analytical, quantitative, and verbal sections of the Graduate Record Examination. Each student is encouraged to present also the results of one specialized section in any area of engineering, mathematics, physics, chemistry, or biology.

The department offers graduate programs leading to the M.S. and Ph.D. degrees in aerospace engineering sciences. Degree plans often are formulated on the basis of the student's interest and needs. Portions of the program are included to assure the student's engineering and professional development.

A core of courses is required of all M.S. students as follows: Aero. 517/M.E. 532, Macroscopic Physics of Fluids; Aero. 547, Computational Fluid Mechanics; and M.E. 521 and 522, Methods of Engineering Analysis I and II (or their equivalents). Students may satisfy these requirements by transfer credit. Both the M.S. candidacy examination and the Ph.D. preliminary examination contain a written part based on the content of this core curriculum of four courses.

This test is given once a semester or once a year, depending on the demand. The form of the remainder of the examinations, covering specific areas, is decided by the student's committee and can be written, oral, or both.

Further information on specific requirements can be obtained by writing to the Graduate Committee, Department of Aerospace Engineering Sciences, University of Colorado, Boulder, Colorado 80309.

APPLIED MATHEMATICS

Office in Engineering Center OT 2-38
Professor Wolfgang Schmidt, Chairman

The Department of Mathematics offers all courses in mathematics for the College of Engineering and Applied Science. The department also offers four options leading to the degree B.S. (A.Math.) in the College of Engineering and Applied Science. In Option I, the student takes a specified amount of course work in a specific engineering department. In Option II, the student takes course work in distributed engineering departments including a solid grounding in mechanics, electronics, and materials. Option III is a joint mathematics-computer science program. Option IV is a program designed for the mathematics major who is interested in statistics, operations research, and applied probability.

Pregraduate Courses. Students considering doing graduate work in mathematics are strongly urged to take Math. 314 and Math. 431-432. Without these courses students may have difficulty gaining admission to some graduate schools and, if admitted to graduate school, may expect a delay of an additional year in earning an advanced degree.

The undergraduate curriculum is designed to give training in mathematics and in engineering and science. The use of numerical methods and electronic computers is included. *It is anticipated that technical electives indicated in the curriculum will be selected from courses offered by the six departments of the College of Engineering and Applied Science* (aerospace engineering, chemical engineering, civil and environmental engineering, electrical engineering, engineering design and economic evaluation, and mechanical engineering).

In general, nontechnical electives should be broadening and have cultural value. Students interested in research are encouraged to take a foreign language as early as possible. German, French, and Russian are strongly recommended. (Only language courses at the 300 and 400 level may be counted toward the social-humanistic requirement.)

BACHELOR'S DEGREE REQUIREMENTS

The B.S. degree in applied mathematics requires the completion of a minimum of 136 credit hours of course work with an average grade of C (2.0) or better. Students majoring in applied mathematics must complete the following minimum requirements:

1. At least 36 hours of mathematics all with a grade of C or better.

2. At least 18 hours of mathematics courses numbered above 300, of which at least 6 hours must be numbered above 400.

3. Three semesters of calculus. (Math. 130, 230, 240 are recommended but A. Math. 135, 136, and 235 may be taken.)

4. Math. 313.

5. A minimum of 18 hours in addition to required engineering courses E.E./C.S. 210, Engr. 101, and Engr. 301 must be in courses taught in the six departments of the College of Engineering and Applied Science.

6. One of the four options below.

Note: A. Math. 120 does not count toward the B.S. (A.Math.) degree.

Of the 15 hours required in the social-humanistic area in addition to the literature courses, at least 6 hours must be courses at the 300 level or higher.

OTHER PROGRAMS

Other degree programs are offered by the Department of Mathematics in the College of Arts and Sciences and in the Graduate School, including the M.S. degree in applied mathematics.

Curriculum for B.S. (Applied Mathematics)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Math. 130. Analytic Geometry and Calculus I	5
E.Phys. 111. General Physics	4
Engl. 160. Great Books (Note 1)	3
E.E. 210. Fundamentals of Computing I	3
	<u>15</u>

Spring Semester

Math. 230. Analytic Geometry and Calculus II	5
Engr. 101. Fundamentals of Design I	2
Engl. 161. Great Books (Note 1)	3
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
	<u>15</u>

SOPHOMORE YEAR

Fall Semester

Math. 240. Analytical Geometry and Calculus III	4
Engl. 261. Contemporary Literature (Note 1)	3
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
Electives (Note 2)	6
	<u>17</u>

Spring Semester

Chem. 103. General Chemistry	5
Electives (Note 2)	12
	<u>17</u>

JUNIOR YEAR

Fall Semester

Math 313. Introduction to Linear Algebra	3
Electives (Note 2)	15
	<u>18</u>

Spring Semester

Engr. 301. Thermodynamics	3
Electives (Note 2)	15
	<u>18</u>

SENIOR YEAR

Fall Semester

Electives (Note 2) 18

Spring Semester

Electives (Note 2) 18

Minimum total hours for degree 136

Requirements under each option are as follows:

OPTION I—ENGINEERING MINOR Semester Hours

Specialty in a specific engineering department 18

Technical electives 15

Required social-humanistic electives 15

OPTION II—DISTRIBUTED ENGINEERING MINOR

Distributed engineering subjects in the College
of Engineering 18

(A minimal program would consist of the following courses: Aero. 304, Aero. 311, C.E. 212, C.E. 213, E.E. 303, M.E. 301, or their equivalents.

Technical electives 15

Required social-humanistic electives 15

OPTION III—COMPUTER SCIENCE

Specific courses required, all with grades of C or better.

C.S. 310 4

E.E. 257 3

E.E. 453 3

E.E. 459 3

E.E. 401 3

Additional hours of upper division C.S. courses or upper division
E.E. courses which are cross-listed with C.S. 6

Technical electives 10

Required social-humanistic electives 15

Note: It is strongly recommended that students on Option III take the following mathematics courses: Math. 413, 443, 465, 466, and 481.

OPTION IV—STATISTICS AND OPERATIONS RESEARCH

Approved courses in statistics, operations research, and applied
probability taught by departments in the College of
Engineering 21

These hours must include EDEE 441, EDEE 442, EDEE 351
(Chem.E. 351), EDEE 352.

Technical electives 12

Required social humanistic electives 15

Additional required courses offered by the Department of
Mathematics are Math. 281, Math. 481, Math. 482.

Students electing this option should consult with an adviser no
later than their fourth semester.

A. Math. Curriculum Notes

1. See the general engineering section for a list of alternate
English courses.

2. Electives include technical, social-humanistic, and electives
in chosen option.

ARCHITECTURAL ENGINEERING

Office in Engineering Center OT 5-30

Professor Ronald N. Helms, Division Head

BACHELOR'S DEGREE REQUIREMENTS

The architectural engineering curriculum is devised
and administered by the joint efforts of the Depart-

ment of Civil, Environmental, and Architectural
Engineering of the College of Engineering and Ap-
plied Science and the College of Environmental
Design.

Options in Architectural Engineering. Architec-
tural engineering prepares students to specialize
within the building industry in engineering design,
construction and contracting, or sales engineering.
Accordingly, the architectural engineering student
may select any one of three options offered: construc-
tion engineering, environmental engineering, or struc-
tural engineering.

Construction Engineering. Specialization in con-
struction leads to contracting and building construc-
tion. This program involves courses in construction
management, planning and scheduling techniques,
cost accounting, estimating and pricing, and in
building materials and construction methods.

Environmental Engineering. Those students in-
terested in environmental engineering may con-
centrate their efforts in the fields of illumination and
building electrical systems design; heating-
ventilating-air conditioning systems design; sanita-
tion and water supply; or acoustics. A range of courses
is available covering these subjects.

Structural Engineering. The third area of
specialization is for those who are interested in the
design of structural systems for buildings. Courses
available include structural analysis, indeterminate
structures, and steel, concrete and timber design.

COMBINED DEGREE

The five-year combined degree supplements
architectural engineering with study in one of the ma-
jor areas of business administration, such as personnel
and business management, marketing, or finance.
Course work begins in the sophomore year. In that
year, the student is introduced to the functions of the
specialty divisions within the building industry. A
basis for understanding architecture and the
relationship and contribution of architectural
engineering to it is provided. In addition, there is
more advanced work in mathematics and physics.
The junior year is devoted largely to the engineering
sciences and a continuation of those courses fun-
damental to understanding architecture and building.
The last year is devoted to engineering analysis,
design, or construction of buildings, the field of
specialization being determined by the student's
choice of his technical electives.

In the senior year, 6 hours of social-humanistic
courses are required as nontechnical electives.

The junior, senior, and fifth years of the combined
curriculum in architectural engineering and business
are devoted to pursuit of the full requirements for the
architectural engineering degree, as well as the course
work necessary to a specific major study area within
the College of Business and Administration.

Curriculum for B.S. (Arch.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Arch.E. 130. Introduction to Architectural Engineering	2
A.Math. 135. Calculus for Engineers I	4
Engr. 101. Fundamentals of Design I	2
E.Phys. 111. General Physics	4
Literature elective	3
	15
 <i>Spring Semester</i>	
A.Math. 136. Calculus for Engineers II	4
EDEE 102. Fundamentals of Design II	2
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
C.S. 210. Introduction to Computing	3
Literature elective	3
	17

SOPHOMORE YEAR

<i>Fall Semester</i>	
C.E. 212. Analytical Mechanics I	3
A.Math. 235. Calculus for Engineers III	4
Basic science elective	4
Social-humanistic elective	3
Specialty requirement (structures and construction majors take C.E. 221; environmental majors take Arch.E. 362)	3
	17
 <i>Spring Semester</i>	
Arch.E. 240. Building Materials and Construction	3
C.E. 312. Mechanics of Materials	3
C.E. 213. Analytical Mechanics II	3
A.Math. 236. Introduction to Linear Algebra and Differential Equations	3
Ch.E. 210. Chemical and Physical Properties of Materials (Note 1)	4
	16

JUNIOR YEAR

<i>Fall Semester</i>	
Arch.E. 330. Basic Structural Analysis and Design (structures majors substitute C.E. 350)	3-4
Arch.E. 354. Illumination I	3
Engineering science electives (Structures take C.E. 316)	2
Arch. 320. Architectural Appreciation and Design	3
Specialty requirement (structures and environmental majors—E.E. 303, 343; construction—Acct. 212)	3-4
Social-humanistic elective	2
	16-18
 <i>Spring Semester</i>	
Arch.E. 363. Introduction to Acoustics and Noise	3
Arch. 321. Architectural Appreciation and Design	3
Engr. 301. Thermodynamics	3
Technical elective	3
Specialty requirement (structures—C.E. 331, M.E. 362; construction—Acct. 214, B.L. 300)	6
	18

SENIOR YEAR

<i>Fall Semester</i>	
Arch.E. 441. Construction Costs, Estimating, Pricing	3
Arch. 470. History/Philosophy	3
Arch.E. 362. Mechanical Systems for Building (environ- mental majors substitute technical elective)	3
Social-humanistic elective (construction majors required to take Econ. 201)	3

Specialty requirement (structures—C.E. 456, 457, technical elective; environmental—technical elective; construction—EDEE 351, engineering science elective)	5-6
	17-18

Spring Semester

Arch.E. 470. Applied Structural Design (construction majors substitute Arch.E. 446)	3
Arch. 471. History/Philosophy	3
Technical elective	6
Social-humanistic elective (construction majors required to take Econ. 202)	3
Specialty requirement (structures—C.E. 458; technical elective; environmental—technical elective; construction—C.E. 497)	3
	18
Minimum hours for degree	136

Courses Available for Specialization

Upon consultation with their advisers, students must select courses applicable to their areas of interest and specialization. The areas of specialization are construction engineering and management, environmental engineering, and structural engineering. In addition to the courses listed below, other courses, not listed, may be proposed by a student and approved by the adviser if they are found to be applicable.

Arch.E. 446-3. Construction Planning and Scheduling
Arch.E. 455-3. Illumination II
Arch.E. 457-3. Building Electrical Systems Design I
Arch.E. 458-3. Building Electrical Systems Design II
Arch.E. 470-3. Applied Structural Design
Acct. 202-3. Introduction to Managerial Accounting
B.Ad. 410-3. Business and Government
B.L. 300-3. Business Law
C.E. 221-3. Plane Surveying
C.E. 332-3. Applied Fluid Mechanics
C.E. 350-3. Structural Analysis
C.E. 380-3. Introduction to Geotechnical Engineering
C.E. 453-3. Computer Techniques in Engineering
C.E. 456-2. Design of Timber Structures
C.E. 457-3. Design of Steel Structures
C.E. 458-3. Reinforced Concrete Design
C.E. 459-3. Applied Structural Design
C.E. 481-2. Intermediate Soils Engineering
C.E. 497-3. Engineering Economy
Econ. 201-3. Principles of Economics I
Econ. 202-3. Principles of Economics II
E.E. 313-3. Electromagnetic Fields I
E.E. 316-3. Energy Conversion I
E.E. 354-2. Power Laboratory I
E.E. 495-3. Energy
E.E. 576-3. Industrial Power System
Fin. 401-3. Business Finance
M.E. 314-2. Measurements I
M.E. 316-2. Measurements II
M.E. 362-3. Heat Transfer
M.E. 371-3. Systems Analysis I
M.E. 372-3. Systems Analysis II
M.E. 421-3. Air Conditioning
M.E. 424-3. Refrigeration
M.E. 442-3. Mechanical Engineering Laboratory
Mk. 300-3. Principles of Marketing
R.Es. 300-3. Principles of Real Estate Practice

Arch.E. Curriculum Note

1. Chem. 103-5 may be substituted for Ch.E. 210-4, in which case the technical level requirement is reduced by 1 credit hour.

GRADUATE STUDY

Graduate credit in architectural engineering is offered in the following courses:

- C.E. 525-3. Construction Management
- C.E. 526-3. Industrialized Building Techniques and Systems
- C.E. 528-3. Construction Engineering I
- C.E. 529-3. Construction Engineering II
- C.E. 570-3. Specification of Visual Stimuli
- C.E. 572-3. Visual System Anatomy—Eye and Orbit

CHEMICAL ENGINEERING

Office in Engineering Center OT 2-6
Professor W. Fred Ramirez, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The chemical engineering student must master the broad fields of organic and inorganic chemistry and be able to apply them on a large scale for a widely varied assortment of products. Among these are the whole range of petroleum products, the plastics, rubbers, detergents, synthetic and natural fibers, and many others. Production of these must be nonpolluting; in addition many of the most pressing current pollution-control problems, such as automobile smog, are fundamentally chemical engineering problems. Chemical engineers are actively engaged in meeting today's crises in oil and energy.

There is a natural affinity between chemical engineering and medicine, and the department emphasizes its special premedical and bioengineering program. Paralleling the technical courses are studies in literature, social sciences, and humanities.

Each student is requested to obtain close and careful counseling from the faculty. Students each year plan programs that will qualify them not only as chemical engineers but also for professional training in medical, law, or business schools or for graduate work in systems engineering or computing science. The department has an analog computer and several real-time process computers. Process control is stressed. *The department believes that since no two students are alike, no two programs should be alike either.* Students may carry out a portion of their studies in another country (see International Education). In particular, there is a junior year program of study in Monterrey, Mexico.

Options in the Chemical Engineering Curriculum

Curricular options have been established in fields of major importance and of particular interest. To follow one of these requires careful planning and course selection by student and adviser.

Bioengineering—Premedical Option. Since all biological systems are essentially intricate chemical machines, chemical engineering is a natural professional basis for either medical school or bioengineering research. The department has a strong undergraduate premedical program and graduate bioengineering research programs at both the M.S. and Ph.D. levels. The following courses comprise the central core of the bioengineering program: Ch.E. 370, Animal Engineering; Ch.E. 571, Molecular Bases of

Behavior; Ch.E. 572, Neural Modeling; and Ch.E. 573/Psych 507. Brain/Mind Modeling. In addition, bioengineering premedical students are required to complete two semesters of general biology.

The graduate research program in bioengineering is strongly oriented to specialization in the neurosciences.

Environmental Engineering Option. Chemical engineers can make major contributions in the fields of pollution control, resource utilization, and environmental control. The environmental option is designed to emphasize biological and environmental sciences, the sociopolitical effects of engineering on the environment, and chemical engineering applications in environmental problems. The department has a strong interest in this field, including an active graduate program.

Computer Science Option. Modern machine computation continues to have a great impact on the practice of chemical engineering. The computer science option allows the student to emphasize computer work, including the theory of computer operation, programming, and mathematical techniques for computer utilization. The department, the college, and the University have extensive, modern computing facilities.

Curriculum for B.S. (Ch.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
A.Math. 135. Calculus for Engineers I	4
Chem. 103. General Chemistry (Note 1)	6
Engl. 160. Great Books (Note 2)	3
Engr. 101. Fundamentals of Design I	2
Ch.E. 130. Introduction to Chemical Engineering	2
	<hr/> 16

Spring Semester

A.Math. 136. Calculus for Engineers II	4
Chem. 106. General Chemistry (Note 1)	5
Ch.E. 201. Introduction to Chemical Engineering	
Calculations	3
Engl. 161. Great Books (Note 2)	3
Technical elective	3
	<hr/> 18

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
Chem. 331. Organic Chemistry	4
Ch.E. 241. Chemical Engineering Materials and Energy	2
E.Phys. 111. General Physics	4
Social-humanistic elective (Note 3)	3
	<hr/> 17

Spring Semester

A.Math. 236. Introduction to Linear Algebra and	
Differential Equations	3
Chem. 332. Organic Chemistry	4
Ch.E. 212. Chemical Engineering Material	
and Energy Balances	3
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
Social-humanistic elective (Note 3)	3
	<hr/> 18

JUNIOR YEAR

Fall Semester

Chem. 451. Physical Chemistry or	
Engr. 301. Thermodynamics	3
Ch.E. 321. Chemical Engineering Principles I	4
E.E. 303. Electric Circuits I	3
E.E. 343. Electrical Laboratory I	1
Social-humanistic elective (Note 3)	3
Technical elective	3
	<hr/>
	17

Spring Semester

Chem. 453. or	
Chem. 452. Physical Chemistry	3
Chem. 454. Physical Chemistry Laboratory	2
Ch.E. 322. Chemical Engineering Principles II	4
Ch.E. 351. Engineering Statistics	3
Ch.E. 432. Chemical Engineering Thermodynamics	3
Social-humanistic elective (Note 3)	3
	<hr/>
	18

SENIOR YEAR

Fall Semester

Ch.E. 403. Chemical Engineering Laboratory or	
Technical elective	4
Ch.E. 433. Chemical Engineering Reaction Kinetics	3
Ch.E. 442. Organic and Polymeric Technology	3
Ch.E. 458. Chemical Engineering Process Dynamics	3
Social-humanistic elective (Note 3)	3
	<hr/>
	16

Spring Semester

Technical elective or	
Ch.E. 403. Chemical Engineering Laboratory	4
Ch.E. 452. Chemical Process Synthesis	4
Ch.E. 457. Instrumentation and Process Control	3
Social-humanistic elective (Note 3)	3
Technical elective	2
	<hr/>
	16

Minimum total hours for degree 136

Ch.E. Curriculum Notes

1. See adviser concerning the requirement of Chem. 103.
2. For other English options, see the English department list of English courses suggested for engineers.
3. Up to 6 hours of social-humanistic electives may be specified by the adviser during the four years.

GRADUATE DEGREE PROGRAMS

Major areas of current research interests in the department are catalysis and kinetics, cryogenics, fluid dynamics, heat transfer, polymer processing, process control, surface phenomena, systems modeling, transport in porous media and thermodynamics. There is a strong emphasis on the application of chemical engineering to environmental, energy and industrial problems.

Master of Science Degree

A candidate for the Master of Science degree in chemical engineering must fulfill the following departmental requirements:

1. Twenty-seven semester hours of graduate work including a satisfactory thesis. Maximum credit of 6

semester hours will be allowed for the completion of the master's thesis. Twelve hours at the 500 level or above (excluding 6 hours of thesis) must be completed. Six to 9 semester hours are to be taken in a minor field approved by the Department of Chemical Engineering.

2. A final examination as required by the Graduate School on the thesis and/or course work must be passed.

It is expected that a qualified student can complete the master's degree in one and one-half calendar years. A graduate student with a bachelor's degree in a field related to chemical engineering can obtain the master's degree in chemical engineering. Programs will be arranged on an individual basis.

Three of the following core courses for the M.S. and Ph.D. degrees must be taken, including Ch.E. 575.

Ch.E. 537. Intermediate Chemical Engineering Thermodynamics
Ch.E. 539. Reaction Kinetics
Ch.E. 574. Advanced Chemical Engineering Calculations
Ch.E. 575. Transport Phenomena (Required)

A degree plan must be prepared at the beginning of the academic program in consultation with an advisory committee. The student is urged to maintain close contact with this advisory committee during the entire course of study.

The M.S. thesis committee must consist of three members, including two faculty members from the Department of Chemical Engineering.

Master of Engineering (M.E.) Degree Requirements

Admission. (The standards of admission to the M.S. program also apply to M.E. degree applicants.) A 3.0 overall undergraduate grade-point average is required for regular admission; a 2.75 overall undergraduate grade-point average is usually required for provisional acceptance.

M.E. Degree Adviser. All M.E. candidates should see the chemical engineering Master of Science degree adviser for counseling.

Requirements for Graduation. Nine hours of chemical engineering at the 500 level or above are required for those M.E. degree students enrolled in the Department of Chemical Engineering. The student will orally defend his written report as specified in the M.E. degree description. A comprehensive examination will be administered by the student's advisory committee on his report and course work. Television course credit will be given as approved by the committee.

Doctor of Philosophy Degree

Admission requirements for the Ph.D. include:

1. The applicant must have achieved an academic performance equivalent to a Master of Science degree from an accredited college or university, with a grade-point average substantially above the minimum normally required for the degree.

2. The applicant must show the ability to perform independent research.

3. The applicant must indicate a field of specialization and be acceptable as a thesis advisee to a member of the chemical engineering graduate faculty.

4. The applicant must pass the Ph.D. preliminary examination administered by the Department of Chemical Engineering.

Admission to the doctoral program will be based on consideration of the above four criteria and decided by majority vote of the chemical engineering faculty.

A candidate for the Doctor of Philosophy degree must meet the requirements as described under Requirements for Advanced Degrees in the Graduate School section. A minimum of 30 semester hours of courses numbered 500 or above is required for the degree. Twelve hours should be taken outside the Department of Chemical Engineering.

The Ph.D. dissertation committee must consist of five members, including at least three from the Department of Chemical Engineering and at least one from outside the department. A regular faculty member of the department must be chosen to act as chairman of the committee.

CIVIL, ENVIRONMENTAL, AND ARCHITECTURAL ENGINEERING

Office in Engineering Center OT 4-34
Professor George G. Goble, Chairman

BACHELOR'S DEGREE REQUIREMENTS

This curriculum requires the student to obtain a good background in the humanities, a broad knowledge of the basic engineering sciences of chemistry, mathematics (including differential equations), physics, mechanics (including fluid mechanics and soil mechanics), electrical engineering, and thermodynamics. Social-humanistic hours may be devoted to literature, the social sciences, or to selected courses in engineering which emphasize the impact of engineering on people and their problems.

Advanced technical courses are elected in the senior year. Random selection is not allowed, the objective being to permit a graduate to enter the engineering profession with a firm groundwork in fundamental engineering science and adequate knowledge in specialized fields. Students should consult their advisers.

A five-year program has been arranged for those students who wish to pursue the combined curriculum for the civil engineering and business degrees. ROTC students taking the combined curriculum will require at least one summer of course work in addition to the five years.

A student interested in a premedical option should consult with an adviser and the department chairman at the earliest possible time in order to make proper plans for an acceptable program (see Premedical Option).

Curriculum for B.S. (C.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
C.E. 130. Intro. to Civil Engr.	2
A.Math. 135. Calculus for Engineers I	4
E.Phys. 111. General Physics	4
E.E. 201. Introduction to Computing	3
Social-humanistic elective (Note 1)	<u>3</u>
	16

Spring Semester

C.E. 221. Plane Surveying	3
A.Math. 136. Calculus for Engineers II	4
Engr. 101. Fundamentals of Design I	2
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
Social-humanistic elective (Note 1)	<u>3</u>
	17

SOPHOMORE YEAR

Fall Semester

C.E. 212. Analytical Mechanics I	3
C.E. 241. Introduction to Environmental Engineering	3
A.Math. 235. Calculus for Engineers III	4
Chem. 103/202. General Chemistry (or Ch.E. 210)	4-5
Social-humanistic elective	<u>3</u>
	17-18

Spring Semester

C.E. 312. Mechanics of Materials	3
E.E. 303-3. Electrical Circuits I	3
C.E. 360. Transportation Engineering	3
A.Math. 236. Introduction to Linear Algebra and Differential Equations	3
Basic science elective	3-4
Social-humanistic elective	<u>3</u>
	18-19

JUNIOR YEAR

Fall Semester

C.E. 213. Analytical Mechanics II	3
C.E. 331. Theoretical Fluid Mechanics	3
C.E. 380. Soils and Foundation Engineering	3
C.E. 316-2. Materials Testing Laboratory	2
Engineering science elective	3
Social-humanistic elective	<u>3</u>
	17

Spring Semester

C.E. 332. Applied Fluid Mechanics	3
C.E. 350. Structural Analysis	3
Engr. 301. Thermodynamics	3
Technical electives	6
Social-humanistic elective	<u>3</u>
	18

SENIOR YEAR

Fall Semester

C.E. 457. Design of Steel Structures	3
Technical electives	3
Geol. 497. Geology for Engineers	4
Engineering science elective	3
Social-humanistic elective	<u>3</u>
	16

Spring Semester

C.E. 458. Reinforced Concrete Design	3
C.E. 499. Senior Seminar	1
Technical electives	6
Engineering science elective	3
Social-humanistic elective (Note 1)	3
	<hr/>
	16
Minimum hours for degree	136

C.E. Curriculum Note

1. Each student must take not less than 6 hours of literature.

GRADUATE DEGREE PROGRAMS

A pamphlet on the requirements for graduate study in civil, environmental, and architectural engineering is available from the departmental office.

No qualifying examination is required by the department for the Master of Science degree; however, in competition for University and other fellowships, the Graduate Record Examination, consisting of the aptitude tests and the advanced test in engineering, is used in the evaluation of candidates. Therefore, students are advised to take this examination prior to their arrival on campus.

ELECTRICAL ENGINEERING

*Office in Engineering Center OT 2-32
Professor Frank S. Barnes, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

The electrical engineering department offers two options. One focuses primarily upon either electronics or energy and power. The other offers specialization in electrical engineering and computer science. Within these standard options seniors may elect several courses from various areas of concentration. These include:

- Circuit logic, computer software and computer design and application
- Electromagnetic field propagation associated with radio and related areas
- Signal processing, communications, and communications systems
- Electrical devices, from vehicles to lasers
- Solid-state devices, solid-state materials, integrated circuit fabrication techniques
- Bioelectronics—devices for diagnosis, therapy, prosthetics, research
- Modeling of systems related to electrical engineering

Within these areas of specialization the fields are so numerous it is impossible for the four years of training to cover them in detail. Intense specialization may be left to possible additional training that graduates may receive when they assume positions with industrial firms, or which they acquire by specialization in a research field through graduate work beyond the bachelor's degree. The curriculum in electrical engineering is designed to make it possible for the graduating senior with high scholarship to finish a master's degree in electrical engineering in about one additional full year of work at any of the nation's major universities.

Study of the principles of physics, chemistry, and mathematics form the core of the first two years.

Early, intensive training in the theory and laboratory application of electrical circuits is necessary. In the third year the student learns more fundamentals in electronic circuits, electromagnetic and transmission theory, electrical machines and transformers, heat, and mechanics. In the summer between the junior and senior years, many students find an opportunity to put their knowledge to work with jobs in industry or research projects being conducted at the University. In the senior year students elect courses from a wide variety of subject matter to fit their particular interests. Throughout the entire four years, students reinforce their understanding of theory in well-equipped laboratories.

Students are also encouraged to develop interests outside of their electrical engineering specialty. Each student enrolls in at least one nontechnical subject each semester, frequently in the College of Arts and Sciences, thus obtaining a well-rounded background and a sense of awareness and responsibility for a professional role in society. Students are urged to attend meetings of their student professional society, where practicing engineers from many engineering specialties speak.

The curriculum is arranged so that qualified transfer students may join the program without appreciable loss of time or credit. For example a transfer student who has completed the mathematics and physics of the freshman and sophomore years and who has a total of about 68 credit hours acceptable to the department could obtain the degree in four semesters.

Standard Curriculum for B.S. (E.E.)

In the standard curriculum the student has considerable freedom in electives during the senior year. These electives can provide a good foundation in several of the seven electrical engineering areas. Some of these electives may be used for courses in other branches of engineering or in other colleges. Students primarily interested in taking courses in the digital or computer area may do so in this curriculum or in the Computer Option Curriculum discussed below. If they do not care to take all the courses required in the latter curriculum or if they are not strong in mathematics, they may prefer to use the standard curriculum to specialize in computers.

Students interested in premedical programs should inquire at the departmental office as early as possible.

Computer Option Curriculum for B.S. (E.E. and C.S.)

The computer option in electrical engineering covers both hardware and software aspects of computer system design. This program is administered in cooperation with the Department of Computer Science. It is directed to students whose major interests are in the computer itself and in a broad range of applications. The program leads to a B.S. (E.E. and C.S.) and can be extended for one year to obtain either an M.S. in computer science or an M.S. in electrical engineering.

A student interested in this program should be sure to choose E.E. 210 for his Introduction to Computing course in the freshman year. The details of the program are listed in the E.E. and C.S. curriculum. This curriculum includes graduate mathematics courses that provide a basis for graduate work in computer-related fields and permits inclusion of courses in logic circuits, scientific application of computers, logic structure of computers, and assembly language programming. The student obtains operating experience with the departmental computers. Students who leave the program to return to the B.S. (E.E.) curriculum must be aware of B.S. (E.E.) requirements not present in the B.S. (E.E. and C.S.) curriculum. In particular, such a transition is eased if E. Phys. 213 and 215 are taken as electives as early as possible. For other computer-related programs, see the Computer Science listings.

Combined Business Option

Students who take the *combined engineering-business program* should not start this program until their fourth year, with the exception of electing Econ. 201 and 202 for two of their social-humanistic electives.

Curriculum for B.S. (E.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
A.Math. 135. Calculus for Engineers I	4
E.Phys. 111. General Physics	4
Engr. 101. Fundamentals of Design I	2
E.E. 130. Problems and Methods of Modern Electrical Engineering (Note 1)	2
Social-humanistic elective (Note 2)	3
	15

<i>Spring Semester</i>	<i>Semester Hours</i>
A.Math. 136. Calculus for Engineers II	4
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
E.E. 201 or E.E. 210. Introduction to Computing (Note 3) ...	3
Social-humanistic elective (Note 2)	6
	18

SOPHOMORE YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
A.Math. 235. Calculus for Engineers III	4
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
E.E. 213. Circuit Analysis I	4
E.E. 253. Circuits Laboratory I (Note 3)	1
Social-humanistic elective (Note 2)	3
	16

<i>Spring Semester</i>	<i>Semester Hours</i>
Mathematics (Note 4)	3
Chem. 202. General Chemistry or Ch.E. 210. Chemical and Physical Properties of Matter	4
E.E. 214. Circuit Analysis II	4
E.E. 254. Circuits Laboratory II	1
E.E. 257. Logic Circuits	3
Social-humanistic elective (Note 2)	3
	18

JUNIOR YEAR

Fall Semester

E.E. 313. Electromagnetic Fields I	3
E.E. 321. Electronics I	3
E.E. 361. Electronics Laboratory I	2
C.E. 313. Applied Mechanics (Note 5)	3
E.E. 381. Introduction to Probability Theory	3
Social-humanistic elective (Note 2)	3
	17

Spring Semester

E.E. 314. Electromagnetic Fields II	3
E.E. 322. Electronics II	3
E.E. 316. Energy Conversion I	3
E.E. 354. Power Laboratory I	2
E.E. 362. Electronics Laboratory II	2
Social-humanistic elective (Note 2)	3
	16

SENIOR YEAR

Fall Semester

E.E. 302. Statistical Thermodynamics	3
E.E. 331. Linear Systems Theory	3
Electives (Note 6)	9
Social-humanistic elective (Note 2)	3
	18

Spring Semester

Electives (Note 6)	18
Minimum hours for degree	136

Curriculum for B.S. (E.E. and C.S.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
A.Math. 135. Calculus for Engineers I	4
E.Phys. 111. General Physics	4
E.E. 130. Problems and Methods of Modern Electrical Engineering (Note 1)	2
E.E. or C.S. 210. Introduction to Computing (Note 3)	3
Social-humanistic elective (Note 2)	3
	16

Spring Semester

A.Math. 136. Calculus for Engineers II	4
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
Engr. 101. Fundamentals of Design I	2
Social-humanistic electives (Note 2)	6
	17

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
E.E. 213. Circuit Analysis I	4
E.E. 253. Circuits Laboratory I (Note 3)	1
E.E. 257. Logic Circuits	3
E.E. 351. Introduction to Computer Engineering	3
Social-humanistic elective (Note 2)	3
	18

Spring Semester

Math. 313. Introduction to Linear Algebra	3
E.E. 214. Circuit Analysis II	4
E.E. 254. Circuits Laboratory II	1

Chem. 202. General Chemistry or Ch.E. 210. Physical and Chemical Properties of Matter	4
Social-humanistic elective (Note 2)	6
	18

JUNIOR YEAR

Fall Semester

E.E. 313. Electromagnetic Fields I	3
E.E. 321. Electronics I	3
E.E. 361. Electronics Laboratory I	2
E.E. 381. or Math. 481. Introduction to Probability Theory	3
E.E. 459. Computer Organization	3
Math 465. Numerical Analysis	3
	17

Spring Semester

E.E. 302. Statistical Thermodynamics	3
E.E. 314. Electromagnetic Fields II	3
E.E. 322. Electronics II	3
E.E. 331. Linear Systems Theory	3
E.E. 401. Introduction to Programming Language and Processors	3
E.E. 458. Logic Laboratory	1
	16

SENIOR YEAR

Fall Semester

Math. 413. Advanced Finite Mathematics I	3
E.E. 453. Assembly Language Programming	3
Social-humanistic elective (Note 2)	3
Electives (Note 6)	7
	16

Spring Semester

E.E. 460. Computer Laboratory	2
E.E. 551. Hardware-Software Interface (Note 7)	3
Social-humanistic elective (Note 2)	3
Electives (Note 6)	9
	17

E.E. Curricula Notes

In completing a schedule to meet the electrical engineering department curriculum requirements listed, the student should keep in mind the following:

1. The requirement of E.E. 130 is waived if the student already has completed A.Math. 135 or equivalent work in calculus.
2. Social-humanistic electives (24 hours required) must be chosen to include not less than 6 hours of literature plus at least 6 hours in social sciences. The electrical engineering department does not require a sequence of two courses in one area.
3. E.E. 201 or 210 and E.E. 253 (Introduction to Computing and Circuits Laboratory I) may be a repetition of material covered in high school or through practical experience by some students. If this seems to be the case, the student should request a waiver of the course in question from his adviser prior to or during the first week of the semester in which he is registered for the course.
4. The mathematics requirement in the spring semester of the sophomore year of the standard B.S. (E.E.) option may be satisfied either by A.Math 236 or any mathematics course with a number higher than 240 except Math. 481.
5. The mechanics requirement of the B.S. (E.E.) sequence may be satisfied by the 3-hour course C.E. 313 or the 6-hour sequences of either C.E. 212 and 213, or E.Phys. 321 and 322.
6. The elective hours prescribed for the senior year are designed to allow students to develop some breadth in electrical engineering as well as to develop some depth in areas in which they are most likely to concentrate after graduation. Usually these courses will be taken in electrical engineering, mathematics, and physics at the 300, 400, or 500 levels. In all cases the approval of the student's undergraduate adviser is required.

In selecting these electives, students should note that electrical engineering courses at the 400 and 500 levels are separated into the following seven areas: Communications (C), Digital (D), Electronics (E), Fields (F), Materials (M), Power (P), and Systems (S). Seniors may elect courses from any of these areas but, in order to insure a minimum breadth of studies, every student's program must include at least 9 semester hours of electrical engineering theory courses in three areas. Also, every student must elect a minimum of three electrical engineering laboratory courses from three different areas. Independent study (E.E. 400 and E.E. 500) may be used only once to satisfy part of the distribution requirements. Courses at the 400 and 500 level without a letter designation may not be used to satisfy the distribution requirement.

7. E.E. 551 is not required but is highly recommended for students with a grade average of 3.0 or better.

The student who has good grades and is interested in graduate work should certainly take additional mathematics. Some preliminary consulting with a department graduate adviser is desirable.

Some students, after satisfying their minimum electrical engineering requirements, may wish to use some of their remaining elective hours in areas other than electrical engineering, mathematics, or physics. With the approval of their adviser, they can take additional courses in other departments of the University. One restriction on these electives is that there may be no performance courses such as those in music or physical education.

GRADUATE DEGREE PROGRAMS

The electrical engineering graduate programs leading to the M.S. and Ph.D. degrees cover the areas of biomedical engineering, materials and quantum electronics, information systems, energy conversion and systems, control theory, circuits and electronics, fields and propagation, and computers. The department works in close cooperation with the National Bureau of Standards and other organizations in the Boulder area, and its research capability is strengthened by the addition of adjunct faculty members from these institutions.

Requirements for Advanced Degrees

The student should obtain a copy of the specific electrical engineering requirements by writing to the Director of Graduate Admissions, Electrical Engineering Department, Boulder, Colorado 80309. A student formally accepted into the graduate program will be assigned a program adviser.

Master's students are expected to include two semesters of graduate seminar (without credit) in their programs and to present a thesis under Plan I unless specifically exempted by the department.

The Ph.D. preliminary examination will include the following areas:

Circuits (active, passive, models).	Energy conversion
Communication theory	Mathematics
Computers	Physical and semiconductor electronics
Control systems	
Electrical and magnetic fields	

Each student must complete two sections of the examination, mathematics and the area in which he plans to specialize, and must present an acceptable

master's thesis or the equivalent as an indication of ability to perform independent research.

The department is involved in an interdisciplinary study leading to an M.S. degree in telecommunications, details of which are shown under Telecommunications in this catalog.

Each semester several courses are taught under the Special Topics Classification (course numbers 491-499, 591-599, or 691-699). Courses taught during the last several years include:

Industrial Power Systems	Conduction in Metals at
Signal Processing for	Low Temperatures
Remote Probing	Pulse Response of
Computer Memory and	Transmission Lines
Storage	Error Correcting Codes
Nonlinear Optics	Problems in Pattern
Crystal Physics	Recognition
Foundations of Plasma	Decision Theory
Physics	Semiconductor Diode
Interaction of Light and	Lasers
Sound	Computerized Design of
Power System Transients	Networks
Integrated Circuits	
Laboratory	

ENGINEERING DESIGN AND ECONOMIC EVALUATION

Office in Engineering Center OT 4-7,
Mechanical Engineering Department

Starting in the fall of 1978, no new students will be enrolled in the engineering design and economic evaluation (EDEE) program. However, the core of the program will be continued in the Mechanical Engineering Department, and students will draw upon the strengths of the mechanical engineering faculty as well as those of the EDEE faculty. (Refer to the mechanical engineering section for details of the EDEE program.)

New students wishing to pursue a curriculum emphasizing design and economic evaluation should enroll in mechanical engineering. A special committee to coordinate the curriculum will be available to advise students having this interest.

EDEE BACHELOR'S DEGREE REQUIREMENTS

The EDEE program is kept broad and flexible to allow for the diverse interests of students as well as to ease transfer from other disciplines in the physical sciences or engineering. Lengthy chains of prerequisites have been avoided as well as the traditional insistence on certain rigid patterns of courses. Wherever possible, students are admitted to advanced courses on the basis of their intellectual maturity rather than on set prerequisites. Individuals are encouraged to discuss their objectives with the department's advising staff and to develop plans which best meet their aspirations.

The student must attain a solid background in the natural sciences and mathematics, the engineering sciences, modern economic theory and practice, and current thought in the social sciences and humanities. The development of sound judgment in the proper application of this background to contemporary problems is also essential.

Curriculum for B.S. (EDEE)

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
Ch.E. 210. Physical and Chemical Properties of Matter (Note 3)	4
C.E. 212. Analytical Mechanics I	3
Social-humanistic elective (Note 4)	3
EDEE 221. Product Definition	3
	<u>17</u>

Spring Semester

A.Math. 236. Introduction to Linear Algebra and Differential Equations	3
C.E. 213. Analytical Mechanics II	3
EDEE 222. Introduction to Computer-Aided Design	3
EDEE 331. Engineering Materials	3
Social-humanistic elective (Note 4)	6
	<u>18</u>

JUNIOR YEAR

Fall Semester

EDEE 351. Engineering Statistics I	3
EDEE 232. Experimental Mechanics for Design	3
Engr. 301. Thermodynamics	3
E.E. 303. Electrical Circuits I	3
E.E. 343. Electrical Laboratory I	1
Social-humanistic elective (Notes 1 and 4)	3
	<u>16</u>

Spring Semester

EDEE 332. Experimental Stress Analysis and Design	3
EDEE 497. Engineering Economy	3
M.E. 362. Heat Transfer	3
E.E. 403. Elements of Electronics	2
E.E. 443. Elements of Electronics Laboratory	1
Social-humanistic elective (Notes 1 and 4)	3
EDEE 441. Introduction to Operations Research	3
	<u>18</u>

SENIOR YEAR

Fall Semester

M.E. 414. Mechanical Engineering Design I (Note 5)	3
EDEE 442. Operations Research II	3
EDEE 451. Engineering Management	3
EDEE 461. Senior Project	2
Social-humanistic elective (Notes 1 and 4)	3
Technical elective	3
	<u>17</u>

Spring Semester

M.E. 416. Mechanical Engineering Design II	3
EDEE 462. Senior Project	2
Social-humanistic elective (Notes 1 and 4)	3
Technical electives (Note 2)	9 or 10
	<u>17 or 18</u>

Minimum hours for degree 136

EDEE Curriculum Notes

1. In fulfilling the social-humanistic requirement of 24 semester hours students must complete a minimum of two literature courses. (See also note 6.)

2. Technical electives must include a minimum of three EDEE elective courses.

3. The chemistry requirement may be satisfied by any approved chemistry course of 3 or more hours.

4. EDEE-business students should include Econ. 201 and 202 among their social-humanistic courses. (See also note 2.)

5. The sequence of courses leading to EDEE 332 prepares students for M.E. 414.

6. A minimum of 136 hours is required for the degree. Up to 6 hours of ROTC credit may be acceptable.

GRADUATE DEGREE PROGRAMS

The department offers graduate programs leading to the M.S. and Ph.D. degrees in mechanical engineering to students whose goal is teaching, research, or advanced development in the broad disciplines of mechanical science (solid and fluid) or thermal science. Although degree plans are formulated on the basis of the student's interest, specific courses are required to give the student a broad maturity in the general aspects of modern mechanical engineering. Information on these specific requirements may be obtained by writing to the Graduate Adviser, Department of Mechanical Engineering, University of Colorado, Boulder, Colorado 80309.

Graduate courses for which fewer than five students are enrolled will be cancelled.

Students working toward the Ph.D. in mechanical engineering must meet the foreign language communication requirement described in the Graduate School section of this catalog.

Graduate Study In Mechanics

Graduate programs leading to the M.S. and Ph.D. degrees in mechanics are available through the Department of Mechanical Engineering. For students working in mechanics, a strong cognate program in mathematics is imperative. Specific degree plans emphasize courses of both a fundamental character and a research level treatment.

Students working toward the Ph.D. in mechanics must meet the foreign language communication requirement described in the Graduate School section of this catalog.

Graduate Study in Engineering Design and Economic Evaluation¹

The engineering design and economic evaluation graduate program leading to the M.S. degree is especially adapted for all engineers holding B.S. degrees who wish to increase their competence in the areas of engineering design; bioengineering; economic factors in design, research, or manufacturing; planning and control of engineering operations; and the interaction of engineering, business, and management, i.e. the expanded area of industrial engineering.

Requirements for Advanced Degrees

There are three branches: the engineering design branch, the operations research and industrial engineering branch, and the bioengineering branch.

An approximate course distribution for all branches would be 6 to 12 hours in the student's special branch (including thesis); 3 to 6 hours of courses of common interest to the other two branches; up to 3 hours in design-oriented or other courses in the student's undergraduate specialty; and 6 to 9 hours in a minor field outside the E.D.E.E. department. In addition to

the course work and the thesis, an oral examination on the thesis is required.

ENGINEERING PHYSICS

Office in Duane Building E-032

Professor Chris Zafiratos, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The engineering physics curriculum gives students a thorough foundation in the physical principles underlying most of engineering. The large number of engineering electives which may be incorporated in the curriculum make it possible for the student to prepare himself for professional work or graduate school in a wide variety of fields. Because the program is particularly flexible, the student should be aware that proper preparation for his professional field will require careful selection of his engineering electives. The student is urged to prepare, in consultation with a departmental adviser, a coherent plan of courses to meet his professional objectives.

During the freshman and sophomore years, the student must attain a thorough training in mathematics and a grounding in fundamental methods and principles of the physical sciences.

During the junior and senior years the work in physics is amplified to provide a comprehensive knowledge of the various branches of physics such as nuclear physics, atomic physics, electronics, thermodynamics, mechanics, electricity and magnetism. Individual initiative and resourcefulness are stressed. For purposes of federal Civil Service requirements this degree is an engineering degree from an accredited College of Engineering. Students who plan to become registered professional engineers should check the requirements for registration in their state before choosing their engineering electives.

It is recommended that students preparing for graduate school also prepare for its foreign language requirement as part of their undergraduate curriculum.

In order to earn a bachelor's degree in engineering physics from the Department of Physics and Astrophysics a student must, in addition to any other requirements, successfully complete 30 semester hours of courses on the Boulder Campus, including 12 semester hours in upper division physics courses.

Applied Physics Option

It is also possible to earn the degree Bachelor of Science (Engineering Physics) with an applied physics option. This option differs from the regular engineering physics degree primarily in that fewer advanced theoretical physics courses are required and in their place a selection of applied science courses is required. This option should not be selected by students intending to pursue graduate study in physics, but it is appropriate for students intending to pursue

¹Students presently enrolled in the EDEE program will receive the M.S. in EDEE upon completing program requirements. Students wishing to transfer into the EDEE program should be prepared to complete program requirements by May 1981.

graduate work or employment in related fields such as geophysics, environmental science, oceanography, nuclear engineering, medicine, and law. Students intending to pursue this option should consult an adviser by the beginning of their junior year regarding the electives which they wish to propose. The 24 hours of electives in pure or applied natural science must be approved by the engineering physics advising committee. The committee will consider the proposed courses relative to the student's stated educational and/or professional objectives. *At least 30 semester hours of credit must be earned after the student's proposed program is approved.*

Curriculum for B.S. (E.Phys.) (Note 1)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
A.Math. 135. Calculus for Engineers I	4
Engr. 101. Fundamentals of Design I	2
Social-humanistic elective (Note 2)	3
E.Phys. 111. General Physics	4
	13

Spring Semester

A.Math. 136. Calculus for Engineers II	4
Social-humanistic elective (Note 2)	3
E. Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
C.S. 210. Fundamental of Computing I (or C.S. 110-3)	3
Elective (Note 3)	1
	16

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
Social-humanistic elective (Note 2)	3
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
Electives (Note 3)	6
	17

Spring Semester

A.Math 236. Introduction to Linear Algebra and Differential Equations	3
Chem. 202. General Chemistry (Note 4)	4
Social-humanistic elective (Note 2)	3
E.Phys. 214. Introductory Modern Physics	3
Electives (Note 3)	5
	18

JUNIOR YEAR

Fall Semester

Upper division mathematics elective	3
E.Phys. 317. Junior Laboratory	2
E.Phys. 321. Classical Mechanics	3
E.Phys. 331. Principles of Electricity and Magnetism	3
Social-humanistic elective (Note 2)	3
Elective (Note 3)	3
	17

Spring Semester

E.Phys. 318. Junior Laboratory	2
E.Phys. 322. Classical Mechanics and Quantum Mechanics	3
E.Phys. 332. Principles of Electricity and Magnetism	3
E.Phys. 341. Thermodynamics and Statistical Mechanics	3

Chem. 453. Physical Chemistry (Note 5)	3
Chem. 454. Physical Chemistry Laboratory (Note 5)	2
Social-humanistic elective (Note 2)	3
	19

SENIOR YEAR

Fall Semester

E.E. 403. Elements of Electronics	2
E.E. 443. Elements of Electronics Laboratory	1
E.Phys. 491. Atomic and Nuclear Physics	3
E.Phys. 495. Senior Laboratory	2
Electives (Note 3)	7
Social-humanistic elective (Note 2)	3
	18

Spring Semester

E.Phys. 492. Atomic and Nuclear Physics	3
E.Phys. 496. Senior Laboratory (Note 6)	2
Electives (Note 3)	10
Social-humanistic electives (Note 2)	3
	18

Curriculum for B.S. (E.Phys.)—Applied Physics Option

The first five semesters are identical to those of the regular engineering physics curriculum.

JUNIOR YEAR

Spring Semester

	<i>Semester Hours</i>
E.Phys. 322. Classical Mechanics and Quantum Mechanics	3
E.Phys. 332. Principles of Electricity and Magnetism	3
Upper Division Thermodynamics elective	3
Social-humanistic elective (Note 2)	3
Electives (Note 7)	7
	19

SENIOR YEAR

Fall Semester

E.E. 403. Elements of Electronics	2
E.E. 443. Elements of Electronics Laboratory	1
Social-humanistic elective (Note 2)	3
Electives (Note 7)	12
	18

Spring Semester

Social-humanistic elective (Note 2)	3
Electives (Note 7)	15
	18

Minimum total hours for degree 136

E.Phys. Curricula Notes

1. The minimum total number of hours for the degree is 136. Approved ROTC courses may be substituted for a maximum of 6 hours of electives.

2. A total of 24 hours of social-humanistic electives is required. These must include 6 hours of literature and 6 hours selected from economics, sociology, political science, history, and anthropology. The other 12 hours must be selected from the above subjects and/or fine arts and music (critical or historical courses only), philosophy, and psychology.

3. Required and elective engineering courses (excluding mathematics and physics) must total 22 semester hours.

4. Or two semesters of general chemistry.

5. One semester of any upper division chemistry course with associated laboratory may be substituted for physical chemistry.

6. Or Phys. 455, or 3-hour physics elective.

7. The elective courses are divided into three exclusive groups. (1) physics electives—there must be 5 hours from among E.Phys. 318, 341, 361, 365, 366, 367, 446, 451, 455, 461, 462, 491, 492, 495,

496, 500, 501, 503, 504, and 580; (2) applied natural science electives (24 semester hours, minimum)—these must include 4 hours of upper division laboratory courses and sufficient engineering courses so that the total of engineering courses (excluding mathematics and physics) is at least 22 semester hours; (3) other courses.

MECHANICAL ENGINEERING

Office in Engineering Center OT 4-7
Professor William Jahsman, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The mechanical engineering curriculum begins with a strong emphasis on mathematics, physics, and chemistry. It continues with a concentration in engineering sciences such as solid and fluid mechanics; thermodynamics, heat and mass transport; materials; and systems analysis and control. It concludes with laboratory and design courses which demonstrate the ways in which scientific knowledge is applied in the design and development of useful devices and processes.

The mechanical engineering program may be roughly subdivided into two-year groupings. In the first two years, the program emphasizes the fundamentals of those engineering sciences that are essential for an understanding of most branches of professional engineering. Because broad and varied demands are imposed on the mechanical engineer, the department provides two plans—A and B—for the curriculum leading to the degree Bachelor of Science in mechanical engineering. The plans are designed to accommodate the professional objectives of the individual student.

Plan A specifies a typical mechanical engineering curriculum and is intended for students who wish to obtain a broad, general education in mechanical engineering without an emphasis on any of the specific professional aspects.

Plan B is designed for students who know what they intend to do upon graduation. It allows the student to pursue any course plan that meets a valid professional objective and has been approved by the advisory committee. Under Plan B, the specific requirements of the program are determined after a detailed conference with an appropriate departmental adviser. In the course of this conference, the professional objectives of the individual student are studied in detail, and a specific plan (with a minimum of 136 credit hours) is designed to meet these objectives. With liberal use of courses throughout the University, the following may be considered typical among the professional concentrations which can be achieved:

Thermodynamics	Design
Heat transfer	Power
Fluid mechanics	Dynamics and controls
Solid mechanics	Materials science
Electromechanical systems	Premedicine

Curriculum for B.S.(M.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Engl. 160. Great Books (Note 1)	3
A.Math. 135. Calculus for Engineers I	4

C.S. 210. Fundamentals of Computing	3
M.E. 130. Introduction to Mechanical Engineering	2
Social-humanistic electives	6
	<u>18</u>

Spring Semester

Engl. 161. Great Books (Note 1)	3
E.Phys. 111. General Physics	4
A.Math. 136. Calculus for Engineers II	4
Engr. 101. Fundamentals of Design I	2
Social-humanistic elective	3
	<u>16</u>

SOPHOMORE YEAR

Fall Semester

M.E. 281. Mechanics I	3
Engl. 261. Contemporary Literature (Note 1)	3
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
A.Math. 235. Calculus for Engineers III	4
Social-humanistic elective	3
	<u>18</u>

Spring Semester

M.E. 282. Mechanics II	3
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
A.Math. 236. Introduction to Linear Algebra and Differential Equations	3
M.E. 212. Engineering Thermodynamics I	3
Social-humanistic elective	3
	<u>16</u>

JUNIOR YEAR

Fall Semester

M.E. 313. Engineering Thermodynamics II	3
M.E. 314. Measurements I	2
M.E. 362. Heat Transfer	3
M.E. 371. Systems Analysis I	3
M.E. 383. Mechanics III	3
Chem. 202. General Chemistry	4
	<u>18</u>

Spring Semester

M.E. 301. Introduction to Materials Science I	3
M.E. 316. Measurements II	2
M.E. 372. Systems Analysis II	3
M.E. 384. Mechanics IV	3
M.E. 385. Mechanics V	3
Free elective	3
	<u>17</u>

SENIOR YEAR

Fall Semester

M.E. 442. Mechanical Engineering Laboratory	3
M.E. 401. Introduction to Materials Science II	3
Technical electives	7
M.E. 414. Mechanical Engineering Design I	3
	<u>16</u>

Spring Semester

Technical electives	14
Social-humanistic elective	3
	<u>17</u>
Minimum total hours for degree	136

M.E. Curriculum Note

1. For other *English options*, see the English department listings for engineering students.

GRADUATE DEGREE PROGRAMS

The department offers graduate programs leading to the M.S. and Ph.D. degrees in mechanical engineering to students whose goal is teaching, research, or advanced development in the broad disciplines of mechanical science (solid and fluid) or thermal science. Although degree plans are formulated on the basis of the student's interest, specific courses are required to give the student a broad maturity in the general aspects of modern mechanical engineering. Information on these specific requirements may be obtained by writing to the Graduate Adviser, Department of Mechanical Engineering, University of Colorado, Boulder, Colorado 80309.

Graduate courses for which fewer than five students are enrolled will be cancelled.

Students working toward the Ph.D. in mechanical engineering must meet the foreign language communication requirement described in the Graduate School section of this catalog.

Graduate Study in Mechanics

Graduate programs leading to the M.S. and Ph.D. degrees in mechanics are available through the Department of Mechanical Engineering. For students working in mechanics, a strong cognate program in mathematics is imperative. Specific degree plans emphasize courses of both a fundamental character and a research level treatment.

Students working toward the Ph.D. in mechanics must meet the foreign language communication requirement described in the Graduate School section of this catalog.

College of Environmental Design

Dwayne C. Nuzum, Dean

INFORMATION ABOUT THE COLLEGE

Scope and Purpose

The environmental design professions have long been recognized as major contributors to and reflectors of a culture. The College of Environmental Design at the University of Colorado exists to serve society through these professions and to provide education for professional responsibility.

To fulfill this obligation, the college provides the student an educational experience that is founded in the humanities and sciences and that evolves through this background to creative work in technical and aesthetic disciplines. It brings to the practicing professional an opportunity for continuing education and a means of keeping abreast of cultural and technological change. It encourages a better informed public through provision of academic experience for students other than those majoring in the environmental design professions and through presentations to the general public outside the academic environment. In these various efforts the College of Environmental Design seeks to fulfill its responsibility for continuing improvement of man's physical and psychological environment.

Designers and planners of the physical environment have in recent years moved into expanded roles and responsibilities; changes in breadth of concern and scope of service have brought closer together the architect, the landscape architect, the urban and regional planner, the technologist in environmental systems, and often the interior designer. All are being asked to make larger decisions from wider alternatives with deeper effects. Lines of demarcation among these professions are being minimized and interdependence among them increased.

These requirements necessitate a broader base of educational experience including not only a background for design technique but also an increased association with and understanding of the physical and social sciences. The social and economic determinants to contemporary life, the complexities of urban and regional interdependence and the allied problems of transportation and population, the effect of business and governmental activity, rapid technological advance—all require of the environmental designer a broad educational base if he is to meet present needs and anticipate and guide the future.

Preparation for professional service through careers in these fields is partially fulfilled through the academic process. Accordingly, the University of Colorado has expanded its offerings to provide an undergraduate degree in environmental design and a series of professional graduate degrees allowing specialization in particular areas of concern within environmental design.

Full professional status in most environmental design fields requires a minimum of five to six years of academic experience and three years of practical experience followed by state registration or licensing through a professional examination. Completion of the four-year curriculum allows those who do not wish to pursue further academic work to follow careers in social, technical, or product research; marketing; government and corporate service; and other contributing activities which do not require professional registration.

Organization

The College of Environmental Design is presently organized into five programs. At the undergraduate level there is a four-year environmental design program leading to a Bachelor of Environmental Design degree. At the graduate level there are programs in architecture, urban design, landscape architecture, and urban and regional planning. The environmental design program is presently offered on the Boulder Campus and architecture, urban design, landscape architecture, and urban and regional planning programs are on the Denver Campus.

Facilities

Facilities for academic programs at Boulder are provided in the College of Environmental Design Building. On its lower floors are administrative and faculty offices, lecture rooms, and exhibit halls. The art and architecture library also is located in this building.

A workshop, a darkroom, and drawing studios supplement design rooms, which are available throughout the building. An attempt is made to provide space within the design studios for each upper division student for academic use during the entire semester. These facilities are available to the student throughout the day and evening.

New facilities are being developed to house the graduate programs at Denver in the Bromley Library Building.

Students in the college join with those of other disciplines in the use of specialized facilities.

Equipment such as special drawing instruments, the heliodon for use in studying the continuing effect of sun rays on a building, and photocopying equipment are available to the student.

Recognition of Scholarship

As a professional school, the College of Environmental Design provides an atmosphere for study and creative investigation in which the attainment of quality is held in the highest esteem. In recognition of high scholarship and professional attainment, the college grants honors at graduation in two categories: honors and special honors. At an annual awards program, scholarships, prizes, and awards are conferred on outstanding students.

Scholarships, Loans, Awards, and Prizes

SCHOLARSHIPS

Several scholarships are designed specifically for students in the College of Environmental Design and are awarded upon recommendation of the faculty of the school. In 1961 the Educational Fund of the Colorado Chapter, American Institute of Architects, was incorporated by appropriate action of its executive committee. The purpose of this fund is to advance education in architecture by the granting of scholarships, prizes, and financial aid to deserving students in architecture and to architects interested in research programs directly related and of value to the architectural profession.

The original Educational Fund was founded in January 1934 by William E. Fisher, F.A.I.A.; George H. Williamson, F.A.I.A.; Fred E. Mountjoy, A.I.A.; William H. Bowman, A.I.A.; and Robert K. Fuller, F.A.I.A. Kenneth R. Fuller, son of the founder, now serves as secretary of the fund and, acting with the president and vice president of the Colorado Society, American Institute of Architects, forms the board of directors of the fund. This board has granted scholarships annually to students and alumni of the College of Environmental Design.

Scholarships and prizes have been awarded also by other organizations in the building industry. Such awards have been made by Blumcraft of Pittsburgh, the Monarch Tile Company, the Portland Cement Association, the American Concrete Institute, the Producers' Council, and Dow Chemical Company.

The Dana Soper Memorial Scholarship. This \$2,000 grant, started in 1973, is awarded to a second-year student in environmental design based upon the following criteria: proved academic performance, personality and character, contribution to the college, and professional potential.

SPECIAL LOAN FUNDS

In addition to those funds available through the Office of Financial Aid, students majoring in architecture also have available three special loan funds: the Carolyn Miller Scott Memorial Loan Fund, established in 1962, the Batchelder Foundation, and the J. Roger Craig Memorial Loan Fund, established in 1971.

Exhibits, Lectures, and Trips

The regular academic program of the College of Environmental Design is supplemented by visiting lecturers who make particular contributions to the education of the student. Exhibits, both local and traveling, are displayed within the teaching facility of the college and are available to its students, the general student body, and the public.

Field trips are organized as a part of regular class activity or as an extracurricular program.

The College of Environmental Design cooperates with other divisions of the University in the presentation of the annual Creative Arts Program held each summer on the Boulder Campus.

UNDERGRADUATE DEGREE PROGRAM

The baccalaureate program in environmental design is intended to help the student in the attainment of the following qualities:

1. Effective understanding of forces that shape the environment.
2. Logical and analytical thought processes in problem evaluation, concept development, and solution.
3. Concern for creativity and aesthetics in this process.
4. Ability to communicate ideas by oral, written, and visual means and to work collaboratively with others of similar purpose.
5. Awareness of professional responsibility, personal organization, and self-discipline.
6. Incentive and ability to continue the educational process after attainment of the baccalaureate degree.

Requirements for Admission

Candidates for regular admission to the College of Environmental Design are expected to meet the general requirements for admission to the University.

All credentials presented for admission to the University of Colorado become the property of the University of Colorado and must remain on file permanently.

FRESHMAN STUDENTS

Freshman applicants are required to present 16 units of acceptable high school work including the following:

English (literature, composition, grammar)	3
Mathematics (college preparatory)	2
Physics	1
Biological science	1

Foreign language, social science and history	5
Additional English	
Electives	4

A unit of work in high school is a course covering a school year of not less than 36 weeks, with five periods of at least 40 minutes each per week. (Two periods of manual training, domestic science, drawing, or laboratory work are equivalent to one period of classroom work.) The 15 required units are equivalent to 30 "points." High school is interpreted as the 9th, 10th, 11th, and 12th grades. Fractional units of value less than one-half unit will not be accepted. Not less than one unit of work will be accepted in a foreign language, elementary algebra, plane geometry, physics, chemistry, or biological science.

Acceptable English units are courses in literature, composition (including all composition given as part of a basic English course), grammar, speech, and journalism. All modern and classical languages are acceptable as foreign language units.

Applications should be submitted early since the College of Environmental Design has a quota.

TRANSFER STUDENTS

Qualified students transferring from other institutions as well as those seeking admission from another division of the University of Colorado will be accepted into the College of Environmental Design. Former students who have attended another college or university for one semester (12 hours or more) will be considered transfer students. Since the College of Environmental Design has a transfer quota, all qualified students are not guaranteed admission. Transfer students must have attained a 2.5 cumulative grade-point average in all previous college work and should make application to the Office of Admissions and Records. Applicants must meet the general requirements for admission to the University of Colorado. Students who possess a bachelor's degree in another discipline are encouraged to apply for one of the graduate programs in the college instead of pursuing an additional bachelor's degree.

The sequentially structured curriculum allows acceptance of transfer students only at the lower levels and only for the regular fall semester.

A 2.0 (2.0=C) cumulative grade-point average for all college work completed is required of all students. All course work except the last term, if in progress, must be completed and on the official transcript sent for admissions consideration.

Courses prerequisite for application include one year of either high school or college-level physics; mathematics through analytic geometry and calculus; 3 semester (5 quarter) hours of credit for second-year transfers and 6 semester (10 quarter) hours for third-year transfers in college-level natural science/technology courses (physics, biology, chemistry, geography, geology, physical anthropology, structure, etc.); 3 semester (5 quarter) hours for second-year transfers and 6 semester (10 quarter) hours for third-year transfers in college-level societal science/history

courses (behavioral sciences, economics, sociology, psychology, history, etc.); 3 semester (5 quarter) hours for second-year transfers and 6 semester (10 quarter) hours for third-year transfers in college-level language/media courses (English composition, speech, journalism, computer sciences, drawing, drafting, photography, etc.).

Normally students should effect the transfer prior to the third year of college-level work; all transfer students will be required to take six semesters of design/problem-solving courses. Curriculum planning is difficult for students with more than 60 credit hours.

Although preference will be given to Colorado residents, all applicants will be considered on an individual basis in relation to the requirements they have completed and the overall quality of their work. Letters of intent and recommendation must accompany the application. It is the responsibility of the student to be sure transcripts and other application materials are complete at the Admissions and Records Office located in Regent Administrative Center. Only complete application files will be considered for admission.

A maximum of 60 semester hours taken at a junior college may be applied toward the baccalaureate degree.

NONDEGREE STUDENTS

A student may, under exceptional circumstances, be admitted to the College of Environmental Design as a nondegree student. This admission is on the basis that the student is not a degree candidate and that a more limited program of study appears to be indicated. Admission is only with the permission of the dean and is for one semester only. It may, under appropriate circumstances, be renewable.

Course Requirements

The course requirements for the Bachelor of Environmental Design are as follows:

<i>Required Professional Courses</i>	<i>Semester Hours</i>
a. Problem Solving Design (6 semesters, 6 hrs. each)	36
First year — Env. D. 100-6 (fall); Env. D. 101-6 (spring). An additional minimum of four semesters of Env. D. problem solving is required. Each student must complete at least one problem solving course at the 200 level, 300 level, and 400 level.	
b. Input Courses. Input courses are open to all Env. D. students with year level students receiving priority	27
Env. D. Language/Media, 3 semesters, 3 hrs. each	
Env. D. Natural Science/Technology, 3 semesters, 3 hrs. each	
Env. D. Societal Science, 3 semesters, 3 hrs. each	

<i>Elective or General Study Courses</i>	65
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These are necessary to graduate but not strictly representative of the environmental design professions. They include such work as mathematics (through calculus) and physics (one semester of physics required if one year of high school physics has not been completed).

Students may select the elective courses from any department on campus. These courses include a broad spectrum of offerings from other colleges as well as the College of Environmental Design but should support the declared minor or double major.

A minor is usually selected during the second year with faculty consultation.

Total hours required for graduation 128

Students should note that during the first semester they have four required courses. Before graduation, calculus must also be completed. Since the required courses total 15 credit hours, it may be desirable to delay taking the mathematics and elective courses for two or three semesters. A maximum of 18 credit hours is recommended for the first semester.

Permission to take more than 19 hours or fewer than 12 hours may be granted only by written petition to the dean, showing approval of the student's adviser.

The electives are provided in the curriculum to allow the student to pursue personal interest areas but also to provide support for the environmental design program. Substitute courses for environmental design content courses taken elsewhere in the University must be approved by the content coordinator involved and the division director. For example, the following architecture courses could qualify as environmental design content courses:

<i>Course</i>	<i>Content Area</i>
Arch. 452/453-2. Structures	Science/Technology
Arch. 410/411-3. Graphics	Language/Media
Arch. 450/451-3. Environmental Systems	Natural Science/ Technology

Grade-Point Average

Students must have a cumulative grade-point average of 2.0 for all courses attempted at the University of Colorado after admission to the College of Environmental Design.

Residence Requirement

In all instances, a student must be in residence for at least one full academic year's work (normally 32 semester hours, and usually in the fourth year) in the College of Environmental Design to be eligible for the degree Bachelor of Environmental Design.

ACADEMIC POLICIES — UNDERGRADUATE COURSE OF STUDY

The undergraduate course of study in the College of Environmental Design is four academic years in length and leads to the degree Bachelor of Environmental Design. Some students devote more than this specified time to completion of the program.

Students may enroll for as much as 50 percent of their current course schedule in work not a part of the prescribed curriculum of the College of Environmental Design provided they have at least a 2.0 grade-point average in all undergraduate work attempted. Exceptions to this policy may be made with the consent of the dean or the director.

Special Educational Opportunities

Advanced placement and college credit may be granted on the basis of the College Entrance Examination Board's Advanced Placement Tests. For

students who have taken an advanced placement course in high school and who make scores of 4 or 5 in the CEEB's Advanced Placement Examination, advanced placement as well as college credit will be granted. College credit granted will be treated as transfer credit without a grade, but will count toward graduation and the meeting of other specific requirements for which it may be appropriate.

Grade-Point Average Requirements and Scholastic Suspension

As a general rule, students who fail to meet the minimum grade-point requirements in the fall semester of any year will be permitted to continue their studies during the spring semester. Scholastic records of students will be reviewed as soon as possible after the close of the spring semester, and students will be informed in writing if they are to be suspended.

The normal period of suspension is two regular semesters (one academic year, excluding the summer term). However, students suspended a second time will be reinstated only under unusual circumstances. Students who believe that their situations warrant a departure from these normal stipulations may petition the Committee on Academic Progress for reinstatement. The committee will look with favor on such petitions only if the student's total grade point average exceeds the required 2.0, if marked improvement in academic work is indicated by the student's record, or if there are unusual circumstances that have contributed to the student's academic difficulties. Deadlines for petitions will be specified in the letter of suspension.

Academic work undertaken at another institution while the student is under suspension from the University of Colorado will not be credited toward a degree in the College of Environmental Design without special permission by the dean or his representative. Students should also be aware of the fact that if they enroll for as many as 12 semester hours at another institution, regardless of their status in the University of Colorado, they must apply as transfer students if and when they wish to return to the University.

Attendance Regulations

Students are expected to attend classes regularly and to comply with the attendance regulations specified by their instructors. At the beginning of each semester the instructor shall inform the students of policies governing attendance in his classes.

Students who miss a final examination for illness or other good reasons must notify the instructor or the director of environmental design no later than the end of the day on which the examination is given.

Transfer Credits

Credits in subjects transferred from other institutions to the University of Colorado will be limited to the number of credit hours given for similar work in the regular offerings at the University of Colorado.

Exceptions to this regulation may be made by the dean upon written petition.

A grade of C or better is required in any course for which credit is granted in transfer from another institution to the University.

University Campuses

Certain professional and nonprofessional courses are available on the university's Denver Campus. These credits are applicable toward residence requirements only when earned after admission to the college.

Students in residence on the Boulder Campus in the College of Environmental Design may take work on the Denver Campus with the approval of the dean of the college.

Environmental Design and the ROTC Program

Students matriculating in the College of Environmental Design are eligible to participate in the ROTC programs on the Boulder Campus.

Students interested in such programs should contact the professor in charge of the ROTC program of their choice (army, navy, air force), and also the dean of the College of Environmental Design for information on residence and curriculum requirements for graduation. Credit for ROTC courses may be given upon faculty recommendation to a maximum of 8 hours. Such credit is given only if the student completes all requirements of the four-year ROTC program.

Convocations

All students registered in the College of Environmental Design may be required to attend convocations and special lectures scheduled throughout the year. Usually these programs occur during the day, but occasionally it is necessary to schedule an evening program. The purpose of the convocations and special lectures is to augment regular classroom programs and to give students the opportunity to meet and hear outstanding scholars.

Retention of Student Work

The College of Environmental Design reserves the right to retain any student project submitted in fulfillment of class requirements for whatever period of time it deems necessary. This retained work is used to provide accrediting agencies with tangible evidence of performance, to serve as additional visual aid material in presentation to other students, and to make possible meaningful exhibits for study by design students, non-design students, staff within the University, and the general public.

Course work is organized in a prescribed sequential manner. For environmental design students, satisfactory completion of this program prepares them for graduate study in one of the several facets of environmental design or for direct entry into many professionally related activities.

Sequence of Work

Each student should complete the work according to the Order of Studies. Any required course in which there is a failure or unremoved *incomplete* should, upon the first recurrence of such course, take precedence over other courses; all students must be registered so that their requirements will be completed with the least possible delay.

A student who does not earn a grade of C or better in a professional course that is a prerequisite to another may not register for the succeeding course. Exception to this policy may be made in unusual circumstances by the dean or persons designated by him.

GRADUATE PROGRAMS

Present and proposed graduate programs within the College of Environmental Design allow for advanced experience in areas introduced in the undergraduate curriculum, with greater emphasis on particular facets of environmental problems and the constraints that shape present-day professional practice. The programs also provide greater comprehension of continuing changes in the social, economic, political, scientific, and technological setting of our society. Graduate students must constantly develop their ability to respond to these changes and to formulate new concepts for a better environment.

Graduate students in all of the graduate programs will be accepted at the Denver Campus of the University of Colorado. Facilities in the Bromley Library Building are presently being prepared for graduate studies, classrooms, library, faculty offices, and support spaces. The programs in architecture, urban design, urban and regional planning, and landscape architecture will occupy this space.

Financial Aid

Graduate scholarships, fellowships, loans, and teaching assistantships are available to qualified students who demonstrate need. Information about scholarships, loans, and fellowships can be obtained by writing:

Office of Financial Aid
University of Colorado at Denver
1100 14th Street
Denver, Colorado 80202

Master of Architecture

There are three programs leading to the degree Master of Architecture. The one-year program is open to students with a Bachelor of Architecture degree; the two-year program is available to the student with a Bachelor of Environmental Design or Architectural Studies; and the three-year program is open to students who have a Bachelor of Science or Bachelor of Arts degree in any field.

The objective of the architectural program and its curriculum is to promote intellectual growth and those professional skills necessary to enhance the architect's role in contemporary society. The architect

must be able to respond to the problems of today, both theoretically and practically, and must be able to develop new approaches to practice and research for the problems of the future.

The Master of Architecture program is the first professional degree program in architecture offered by the College of Environmental Design. Its aim is to educate students whose careers will be in the design of the built environment. The curriculum is based upon a core program in design, technology, architectural history, and professional practice. Design is concerned with the understanding of form and shape consistent with human needs and the technology available along with the development of graphic communication skills. Technology provides basic knowledge of the physical systems of structure, mechanical equipment, illumination, acoustics and the interrelationships of these systems. Architectural history reviews the forms of the past and their philosophic significance as well as current architectural ideas and directions. Professional practice is concerned with the skills and knowledge needed to make design a reality.

The curriculum is implemented by recognizing the uniqueness of the Colorado region and the fact that architecture has its roots in the geology, topography, vegetation, climate and culture of the area. The program has a close alliance with the profession and an effort is made to involve the student with actual architectural projects and problems through professionals, the Community Design Center, and public or non-profit organizations. The design curriculum is based upon a sequential progression of courses which begin with a small social unit (i.e., family, small group) and progress to a large-scale design problem (i.e., a college campus, a new ski village, urban redevelopment). The technological sequence starts with the basic concerns (i.e., basic structures, materials, water supply, wastes) and develops to a course that involves the synthesis integration of the structural and environmental systems in a building. The professional practice courses lead to an internship program where the student is placed in a practicing professional's office and exposed to the range of activities in that office.

ONE-YEAR PROGRAM

The one-year program is available only to students with a Bachelor of Architecture degree. The Master of Architecture degree is awarded upon satisfactory completion of 32 semester hours and special projects previously agreed upon for the particular candidate's program. The candidate and the adviser mutually develop the course of study through selection of offerings in the College of Environmental Design and other divisions of the University. The program is primarily research oriented and students are allowed to pursue independently an area of their choice related to architecture.

<i>Course Requirements</i>	<i>Semester Hours</i>
Arch. 710-711. Research/Design	14
Arch. 680. Research Methods in Architecture	3

Cognate courses	12
Elective	3
	32

Arch. 710 and 711 are course designations for the area of concentration as selected by the student. Options are:

1. *Facility Design.* Research and design work in design programming, the design process, and the products of architectural design (i.e., housing, educational facilities, and recreational facilities).

2. *Man and Environment.* The interactions between people and the man-made and natural environment. Man's physiological, sociological, and psychological relationships to the design environment will be studied.

3. *Architectural Technology.* Building technology and its interrelationship to architectural design. Structural and environmental control and constructional systems and materials may be studied.

4. *Design Methods.* Systematic methods for decision making in architectural design, such as simulation, gaming, decision theory, computer-aided design, and information systems.

5. *History and Preservation.* Architectural history and its social relevance as it pertains to renewal, restoration, and the preservation of significant examples of architecture.

6. *Urban Design.* The curriculum focuses upon the complex problems that are generated by change and growth within the urban area. Emphasis is on participatory community and public-funded design.

Order of Studies (One-Year Program)

<i>Fall Semester</i>	<i>Semester Hours</i>
Arch. 680. Research Methods in Architecture	3
Arch. 710. Research/Design	7
Cognate courses	6
	16
<i>Spring Semester</i>	<i>Semester Hours</i>
Arch. 711. Research/Design	7
Cognate courses	6
Elective	6
	16
Total semester hours required	32

The option and research/design project must be approved by the graduate faculty committee before the student enters the program. The student is asked to submit a statement describing the proposed project with the application. This project may be individual or collaborative, theoretical or real.

Cognate courses are selected with the guidance of the faculty adviser from course offerings in the College of Environmental Design and other departments on the Denver Campus.

TWO-YEAR PROGRAM

For the student with a Bachelor of Environmental Design or architectural studies degree who desires a professional degree in architecture, a two-year 64-semester-hour program leading to a Master of Architecture degree is offered.

Students in the third or fourth year of the University of Colorado environmental design program who intend to apply to the Master of Architecture program should take the first two courses in the structural sequence (Arch. 552 and 553). Required courses are Environmental Systems (Arch. 450), Materials and Methods of Construction (Arch. 551), Architectural History (Arch. 470 and 471), and Architectural Graphics (Arch. 510 and 511). Students who have not completed these courses previous to entry will be asked to complete them while in the program. The graphics course may be waived if the student's portfolio indicates excellent graphics ability. Students from other four-year programs must have taken two semesters of architectural history, two semesters of basic structures (statics, strength of materials) and must show, with the portfolio, a graphics ability equivalent to the two-semester course in architectural graphics. Required courses in the two-year program that have been taken by the student in a previous program may be waived if the grade received is *B* or above. The Master of Architecture is awarded upon satisfactory completion of 64 semester hours and all required courses.

<i>Course Requirements</i>	<i>Semester Hours</i>
Architectural design	24
Environmental systems	10
Structures	6
Professional practice, construction drawings, and internship	10
Allied professions (planning and landscape architecture)	6
Research methods in architecture	3
Electives	5
	<u>64</u>

Order of Studies (Two-Year Program)

FIRST YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Arch. 520. Planning	3
Arch. 600. Design	5
Arch. 650. Mechanical Systems	3
Arch. 652. Timber Structures	2
Arch. 653. Steel Structures	2
Arch. 655. Architecture Acoustics	1
	<u>16</u>

Spring Semester

Arch. 601. Design	5
Arch. 630. Landscape Architecture	3
Arch. 651. Illumination and Electrical Systems	3
Arch. 654. Concrete Structures	2
Arch. 660. Professional Practice	2
Arch. 661. Construction Documents	2
	<u>17</u>

SECOND YEAR

Fall Semester

Arch. 700. Architecture Design	7
Arch. 662. Internship (Optional course)	3
Arch. 690. Research Methods	3
Elective	2
	<u>15</u>

Spring Semester

Arch. 701. Architecture Thesis	7
Arch. 663. Internship (Optional course)	3
Arch. 750. Structural and Systems Synthesis	3
Elective	3
	<u>16</u>

THREE-YEAR PROGRAM

The three-year program is open to students with a Bachelor of Arts or Bachelor of Science degree, one year of high school or college physics, one semester of college algebra and trigonometry, and one semester of analytical geometry and calculus. The mathematics and physics requirement can be fulfilled while the student is in the program. The Master of Architecture is awarded upon satisfactory completion of 96 semester hours and all required courses.

<i>Course Requirements</i>	<i>Semester Hours</i>
Architectural design	34
Environmental systems	16
Structures	10
History/philosophy	6
Graphic communications	6
Professional practice, construction documents, and internship	10
Allied professions (planning and landscape architecture)	6
Research methods in architecture	3
Electives	5
	<u>96</u>

Order of Studies (Three-Year Program)

FIRST YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Arch. 410. Architecture Graphics I	3
Arch. 450. Environmental Systems	3
Arch. 470. Architecture History/Philosophy I	3
Arch. 500. Architecture Design	5
Arch. 552. Structures I	2
	<u>16</u>

Spring Semester

Arch. 411. Architecture Graphics II	3
Arch. 471. Architecture History/Philosophy II	3
Arch. 501. Architecture Design	5
Arch. 551. Materials and Methods of Construction	3
Arch. 553. Structures II	2
	<u>16</u>

SECOND YEAR

Fall Semester

Arch. 520. Planning	3
Arch. 600. Design	5
Arch. 650. Mechanical Systems	3
Arch. 652. Timber Structures	2
Arch. 653. Steel Structures	2
Arch. 655. Acoustics	1
	<u>16</u>

Spring Semester

Arch. 601. Design	5
Arch. 630. Landscape Architecture	3
Arch. 651. Illumination and Electrical Systems	3
Arch. 654. Concrete Structures	2
Arch. 660. Professional Practice	2
Arch. 661. Construction Documents	2
	<u>17</u>

THIRD YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Arch. 700. Design	7
Arch. 680. Research Methods in Architecture	3
Arch. 662. Internship (Optional course)	3
Elective	2
	<hr/> 15

<i>Spring Semester</i>	
Arch. 701. Research/Design	7
Arch. 750. Environmental Systems Synthesis	3
Arch. 663. Internship (Optional course)	3
Elective	3
	<hr/> 16

ADMISSION REQUIREMENTS AND PROCEDURES

Application

In order for a student to be considered for admission into the graduate program, application forms, college transcripts, three recommendations, statement of purpose, and a portfolio of academic and professional work must be submitted by March 15 preceding the fall semester the student plans to enter. The portfolio format is to be 14 inches by 17 inches or smaller. Application forms and information may be obtained by writing to:

Director of Master of Architecture
College of Environmental Design
University of Colorado at Denver
1100 14th Street, Denver, Colorado 80202

Applicants must hold a Bachelor of Arts, Bachelor of Fine Arts, or Bachelor of Science degree from an accredited four-year college or university to be accepted into the three-year Master of Architecture program. A four-year degree in architecture or environmental design from an accredited college or university is required for acceptance into the two-year Master of Architecture program. A five-year Bachelor of Architecture degree from an accredited architecture program is required for acceptance into the one-year master's program. A student in the fourth year of the architectural engineering program may enter the first year of the three-year program if qualified. Qualification will be based upon the course work taken previously and upon academic performance. However, a student in this program still must apply and be accepted into the Master of Architecture program and have completed all requirements for the Bachelor of Science degree in architectural engineering before entry into the second year of the program.

Admission

A faculty admissions committee will review the application materials and select the students to be admitted to the programs. Applicants will be notified that they have been accepted, are on a waiting list, or have not been accepted. Applicants are to be notified of their status prior to May 1.

The recommended minimum grade-point average is 2.75 on a four-point scale. If the student's grade-point

average is below 2.75, the Graduate Record Examination is recommended as part of the application materials. The student, however, will be evaluated for admission on the basis of all the application materials and not the grade-point average alone.

Transfer Students

Qualified students transferring from other institutions will be accepted into the architecture program when there are vacancies in the program. Transfer students must have been in a similar program and have attained a 3.0 (on a four-point system) cumulative grade-point average in that program. To be considered for transfer, the student must submit an application form, three recommendations, two copies of transcripts from each college or university attended, and a brief portfolio of creative work. Transfer students must complete all of the courses required for a degree at the University of Colorado and fulfill the total hour and grade-point requirements for graduation.

Former Students

Students in good standing who are returning to the program after being out for more than a year must notify the director of architecture of their intention to return by March 15 for fall semester and by November 1 for spring semester.

Special Students

A student may, under special circumstances, be admitted to the architecture program or to courses within the program as a nondegree student. Admission is on the basis that the student is not a candidate for a degree and that a limited program of study is advisable. Admission is for one semester at a time and requires the permission of the director of architecture as well as the permission of the instructor(s).

ACADEMIC POLICIES—GRADUATE

Students should consult the General Information section of this catalog for information concerning the University's standard policy on grading, dropping and adding courses, and withdrawal. Specific information regarding pass/fail credit in the College of Environmental Design is given below.

Pass/Fail Enrollment

The instructor is responsible for determining the requirements for whatever grade is assigned. Students in the three-year program may take a total of 12 hours with a pass/fail grade. Students in the two-year program may take 8 hours pass/fail and students in the one-year program may take 4 hours pass/fail. No required courses may be taken pass/fail. Students must register for a course pass/fail within the first two weeks of class. The record of pass/fail registration is maintained by the Admissions and Records Office. Only 6 hours of course work may be pass/fail in any given semester.

Grade-Point Average Requirements and Scholastic Suspension

Graduate architectural students must maintain a 3.0 average for a degree. Students who fail to meet the minimum requirements during the first semester will be permitted to continue their studies during the second semester. Students who fail to meet the minimum requirement after two semesters will be suspended.

After a period of one year, appeal for readmission may be made by petition to the Scholastic Deficiency Committee. Petition for readmission in September must be made by March 15 of the same year. Also, grades of *C* in two consecutive architectural design courses will require the student to repeat both courses.

Attendance Regulations

Students are expected to attend classes regularly and to comply with the attendance regulations specified by their instructors. At the beginning of each semester the instructor shall inform the students of policies governing attendance in his classes.

Students who miss a final examination for illness or other good reasons must notify the instructor or the director of architecture no later than the end of the day on which the examination is given.

Independent Study Courses

Arch. 590 and 591 are special problem courses in which studies are initiated by students or faculty and sponsored by a faculty member to investigate a special topic or problem related to architecture. A student must propose the problem in writing and place a copy of this proposal in his record and with his instructor. Forms on which to make the proposal are in the Office of the Dean. These forms will require a signature of the instructor, director of architecture, and the Office of the Dean. A student may take no more than 6 hours of independent study courses per semester. Students in the one-year program may take 6 hours of independent study; in the two-year program, 9 hours; in the three-year program, 12 hours.

Independent study credit of 3 hours may be given to students who participate in the WICHE internship programs.

Internship Program

Students are given 3 hours of academic credit for spending 8 hours per week in a design professional's office during the regular semester. The student is placed in an office by the college and receives academic credit instead of pay. This course must be taken during both semesters of the student's final year in the two or three-year program and is not recommended for students with previous office experience. The course is to be taken on a pass/fail basis.

Sequence of Courses

Students are required to complete the design and technological courses in the sequence shown in the order of studies. If a student does not earn a grade of *C*

or better in a course that is a prerequisite to another, he may not register for the succeeding course.

Transfer Credits

Credits in subjects transferred from other institutions to the University of Colorado will be limited to the number of credit hours given for similar work in the regular offerings at the University of Colorado. A grade of *B* or better is required in any course for which credit is granted in transfer from another institution to this University.

Retention of Student Work

The architecture program reserves the right to retain any student project submitted in fulfillment of class requirements for whatever period of time it deems necessary. This retained work is used to provide accrediting agencies with tangible evidence of performance, as visual aids in class instruction, and as material for exhibits.

Master of Architecture In Urban Design

This curriculum focuses upon the complex problems that are generated by change and growth in a vigorous urban and regional laboratory. Emphasis is given to (a) participatory community and (b) public-funded design, (c) research, and (d) technology. Special efforts are made to utilize the vast resources of information that are available from federal, state, and local agencies and institutions which are concentrated in the immediate community. Specific courses and projects attempt to incorporate these allied academic, civic, and citizen resources.

The sequential format, content, and progression of the urban design program is purposely parallel to the graduate architectural program with the major exception of the final two semesters. Direct daily contact with students and instructors in the planning and architectural divisions is very important and beneficial.

A specific effort is made in professional practice, internship, and directed elective courses to expose urban design students to broader group-oriented factors in the problem-solving process. Placement of students in combination architecture, urban design, and planning firms is a major consideration in the internship requirements.

In all three sequences, the final year is a synthesis of the special civic scale factors influencing urban design within the four options previously listed. In this phase, the student is carefully advised throughout the course of his independent research and design studies. Opportunities to work in association with the Center for New Towns and Community Design and the Bureau of Community Services (adjuncts of the College of Environmental Design) are available. Many other real problems and/or case studies from the community which require anticipatory and feasibility design and development are also available. Whenever possible, team projects in cooperation with allied disciplines and institutions are encouraged.

ONE-YEAR PROGRAM

A one-year program leading to the degree Master of Architecture in Urban Design is available to students holding a Bachelor of Architecture degree. The degree is awarded upon satisfactory completion of 32 semester hours.

The program is designed for students who wish to pursue advanced study in architecture with options in the following areas: anticipatory design, technology and research methods, community action design, urban and regional design and development, and health and recreational facilities design.

<i>Course Requirements</i>	<i>Semester Hours</i>
Urban design studio	10
Urban design seminar	4
Research factors/methods	3
Planning	6
Electives (professional)	6
Independent study	3
	<hr/>
	32

The design studio is the focal point for the area of specialization that is selected by the student, and each project is developed on an independent study basis with meetings, seminars, and evaluations scheduled by the faculty adviser and student. Cognate courses are selected with the guidance of the faculty adviser from related courses offered by the College of Environmental Design or other college within the University.

ADMISSION

In order for a student to be considered for admission into the graduate program, he must submit application forms, college transcripts, three recommendations, statement of purpose and a portfolio of academic and professional work by April 15 preceding the fall semester that he wishes to enter. Application form and information may be obtained by writing to:

Director of Master of Architecture in
Urban Design Program
College of Environmental Design
University of Colorado at Denver
1100 14th Street
Denver, Colorado 80202

Master of Urban and Regional Planning-Community Development

The MURP-CD program prepares planners to research, design, and evaluate the ends and means of social and environmental action. Careers in planning usually center in such growing fields as environmental design, community development, social services, natural resources, ecology, planning consultation, environmental assessment, urban renewal, and regional planning. Because Denver is the Rocky Mountain region's central location for managing these fields of action, University of Colorado at Denver planning students are able to combine easily the general principles of academic learning with practical experience in nearby operating agencies and organizations.

CURRICULUM

The curriculum requires 48 semester hours as a minimum for graduation. Thirty of these semester hours are required "core" courses aimed at training the student in basic planning principles, content, research methods, and plan/policymaking skills. Of these 30 required credits, 6 are spent in "experiential learning" and internships with public agencies and other organizations.

Another 15 credit hours of the curriculum are elective. They are chosen in consultation with the student's faculty adviser to form a consistent pattern of planning expertise along the lines of the individual's major interests. The courses may be chosen from the MURP-CD's own "core electives," from other programs in the College of Environmental Design or from other graduate colleges at UCD. Typical areas of specialization have been ecology, transportation, planning administration, community development, urban design, and health planning.

The final curriculum requirement is the satisfactory completion, in the student's last semester, of an in-depth planning study or project. The aim is to illustrate the individual's ability to integrate and apply the knowledge and experience gained in the program. It may take the form of a traditional master's degree thesis, an extended policy research paper, or a major planning laboratory project.

ADMISSION

In order for a student to be considered for admission into the program, application forms must be submitted by April 15 for the fall semester. Entry into the program at other times is not normally permitted. Applications for admission are reviewed by a faculty-student committee. Criteria for admission consist of academic performance, experience, interest, and motivation for study.

Candidates for admission should note that there are three prerequisite courses which must have been taken prior to entry, or made up as nondegree credit courses during the time at UCD. These are local and state government, basic statistics, and a course in mapping and graphics.

Application forms and information may be obtained by writing to:

Director of Urban and Regional Planning-
Community Development Program
University of Colorado at Denver
1100 14th Street
Denver, Colorado 80202

Master of Landscape Architecture

The College of Environmental Design recognizes both traditional landscape design work and many of the new, large-scale trends in landscape architecture by offering three programs leading to the Master of Landscape Architecture.

The three-year program is open to students with B.A. degrees from fields other than landscape

architecture, urban design, environmental design, or architecture.

The two-year program is open to students with B.A. degrees from accredited undergraduate landscape architecture programs or B.A. degrees from many environmental design and architecture programs. It consists of the second and third years of the total program.

The one-year program is open only to those students with five-year B.L.A. degrees or four-year B.L.A. degrees and considerable additional experience. This program is intended to allow such students to specialize in one of the following areas: advanced site planning or project design, landscape architectural education, historic preservation or landscape architectural research. This course of study will be developed by the student and his advisor from courses within the College of Environmental Design and other divisions of the University. A total of 32 credit hours will be required, divided approximately as follows:

	<i>Semester Hours</i>
Two thesis courses (7 hours each)	14
Four cognates (3 hours each)	12
(see the architecture one-year program for some available cognates)	
Two electives (3 hours each)	<u>6</u>
	32

These programs will be based on two important course sequences and varying amounts of independent study. The design sequence will begin with the principles of art and progress through small-scale projects (parks and residences), to large-scale design (new towns and regional scale projects). The technology sequence will include grading, drainage, surveying, road alignment, irrigation systems, deck and small building construction, and paving materials.

These programs have been developed according to American Society of Landscape Architects guidelines,

and have been arranged to give the student a comprehensive view of contemporary landscape architecture. Those interested in taking the national registration examination should be able to do so in a relatively short time.

It should also be noted that the curriculum (especially the courses in plant materials, engineering, and planting design) will be oriented to the many unique characteristics of the dry and fragile Rocky Mountain Region. However, the overall purpose will be to enable students to develop advanced skills and capabilities for a comprehensive practice of contemporary landscape architecture.

ADMISSION

Admission policies for this program are similar to those for the University as a whole and particularly the Master of Architecture programs.

Motivation and potential for professional growth as indicated by trends in the student's record, by letters of recommendation from teachers and by accomplishments outside academic work will be given primary consideration.

For those interested in the two-year or three-year program, material illustrating creative potential in some visual art is considered especially significant. Also, previous knowledge of plants, architecture, or civil engineering would be very helpful though definitely not essential.

In order to be considered for admission, the student must submit application forms, college transcripts, three recommendations, a statement of purpose and a portfolio of academic and professional work by April 15. Additional information can be obtained by writing to:

Coordinator of Landscape Architecture
University of Colorado at Denver
1100 14th Street
Denver, Colorado 80202

Graduate School

Milton E. Lipetz, Dean

INFORMATION ABOUT THE SCHOOL

M. Laurance Morse, Acting Associate Dean
(Medical Center)

Rose-Marie G. Oster, Associate Dean

Robert N. Rogers, Associate Dean (Denver)

Ernest Patterson, Assistant Dean

Robert P. Larkin, Associate Dean (Colorado Springs)

History

Graduate work at the University of Colorado began on a small scale in 1892. Following some years of development, the present Graduate School was organized in 1909 with a separate faculty. The Graduate School is administered by a dean in conjunction with the Executive Committee appointed by the president of the University.

Degrees Offered

The Graduate School of the University of Colorado offers instruction leading to the following advanced degrees:

Doctor of Philosophy (Ph.D.)
Doctor of Business Administration (D.B.A.)
Doctor of Education (Ed.D.)
Doctor of Musical Arts (D.Mus.A.)
Specialist in Education (Ed.S.)
Master of Arts (M.A.)
Master of Science (M.S.)
Master of Basic Science (M.B.S.)
Master of Business Education (M.Bus.Ed.)
Master of Education (M.Ed.)
Master of Engineering (M.E.)
Master of Fine Arts (M.F.A.)
Master of Humanities (Denver)
Master of Music (M.Mus.)
Master of Music Education (M.Mus.Ed.)
Master of Social Science (Denver)

The Ph.D. can be earned in the following fields:

Aerospace engineering sciences	Biology
Anatomy ¹	Biometrics ¹
Anthropology	Biophysics and genetics ¹
Applied mathematics	Chemical engineering
Applied physics	Chemical physics
Astro-Geophysics	Chemistry
Astrophysics	Civil engineering
Biochemistry ^{1,2}	Classics
	Communication

Communication disorders and speech science	Mechanical engineering
Comparative literature	Mechanics
Computer science	Microbiology ¹
Economics	Music education
Education	Musicology
Electrical engineering	Pathology ¹
English	Pharmacology ¹
French	Pharmacy
Geography	Philosophy
Geology	Physics
Geophysics	Physiology ¹
German	Political science
History	Psychology
Linguistics	Sociology
Mathematical physics	Spanish
Mathematics	Theatre

The M.A. can be earned in the following fields:

Anthropology	Geography
Art history	Geology
Biology	German
Chemistry	History
Classics	Italian language and literature
Communication	Journalism
Communication disorders and speech science	Linguistics, general
Comparative literature	Mathematics
Dance	Philosophy
Economics	Political science
Education	Psychology
English Language	Russian
English literature	Sociology
French	Spanish
General psychology ⁴	Special education
	Theatre

The M.S. can be earned in the following fields:

Aerospace engineering sciences	Business: organizational behavior
Anatomy ¹	Chemical engineering
Anesthesiology ¹	Chemistry
Applied mathematics	Child health associate ¹
Astro-Geophysics	Civil engineering
Applied physics	Computer science
Biochemistry ^{1,2}	Electrical engineering
Biometrics ¹	Engineering design and economic evaluation
Biophysics and genetics ¹	Environmental sciences ²
Business: accounting	Geology
Business: finance	Health administration ¹
Business: management science	Mechanical engineering
Business: marketing	

¹Departments offering degrees in these fields are located on the campus of the School of Medicine in Denver.

²Also offered on the Boulder Campus in the Department of Chemistry.

³Offered only on the Denver Campus.

⁴Offered only on Colorado Springs Campus.

Mechanics	Physical medicine and rehabilitation ¹
Medicine ¹	Physical therapy ¹
Microbiology ¹	Physics
Nursing ¹	Physiology ¹
Obstetrics and gynecology ¹	Preventive medicine ¹
Pathology	Psychiatry ¹
Pediatrics ¹	Radiology ¹
Pharmacology ¹	Surgery ¹
Pharmacy	Telecommunications
Physical education	

Research Support at the University of Colorado

The University of Colorado takes an active part in research in a wide variety of fields.

Combined research and related instructional programs sponsored within the University represent annual expenditures amounting to over \$44 million. Of this total, the expenditures on the Boulder, Denver, and Colorado Springs campuses are now approximately \$25 million per year. The sponsored research and instructional program of the Medical Center in Denver totals more than \$19 million annually. The principal sources of these funds for research and training contracts and grants are various agencies of the federal government. There is also assistance in the support of the research activity from appropriations of the State of Colorado, research foundations, and private donors.

Special Facilities for Graduate Study and Research on the Boulder Campus

The Institute of Arctic and Alpine Research (INSTAAR) is responsible for an interdisciplinary program of research and teaching on arctic and alpine environments. Its headquarters are located on the Boulder East Campus in Research Laboratory No. 1. Facilities include a group of laboratories, staff research offices, a reading room, office of the quarterly scientific journal *Arctic and Alpine Research*, and World Data Center - A For Glaciology. The institute also maintains the Mountain Research Station located at 9,500 feet elevation 25 miles west of Boulder. Major facilities include a 5,500-square-foot winterized laboratory, a central dining room, and accommodations for staff and visitors. Roads and trails provide access to research areas in altitudes over 13,000 feet. Four small buildings are located in strategic research areas on Niwot Ridge directly above the main station. Environmental parameters have been measured continuously since 1951 in four altitudinally separated ecological regions. Experienced mountain research technicians and special vehicles and equipment permit year-round field operations. Courses for credit in disciplines related to mountain environments are offered at the station during the summer session. A small research-living building is maintained at Broughton Island, N.W.T., in the eastern Canadian Arctic. Current grant and contract research activities include studies in arctic and alpine climatology, climatic change, plant and animal ecology, palynology, geomorphology, permafrost, snow and ice, glaciology, dendrochronology,

remote sensing, and environmental impacts related to land use management. The institute also operates World Data Center - A for Glaciology and publishes *Glaciological Data* in association with NOAA, National Geophysical and Solar-Terrestrial Data Center. The major centralizing theme of INSTAAR research is climatic change and ecosystem response to such change.

The Institute for Behavioral Genetics is an interdisciplinary research organization concerned with the inheritance of behavioral characteristics. Facilities are available for research on a variety of organisms, including man, mice, and fruit flies. Research perspectives of the present staff include population and quantitative genetics, and the study of physiological, pharmacological, and biochemical mechanisms involved in genetic control of behavioral characteristics. Specific behavioral traits under study include learning, memory, motivation, social behavior, habitat selection, mating behavior, perceptual efficiency, and intelligence.

A graduate training program offers specialized interdisciplinary training to students who are degree candidates in various departments.

The Institute of Behavioral Science is an interdisciplinary research organization serving faculty and graduate students in the behavioral sciences. Its principal functions are to conduct and sponsor research programs involving two or more of the behavioral sciences and related fields; to provide research facilities, equipment, and administrative services for participating faculty; to facilitate graduate research training; and to disseminate information about its activities and findings to scientific groups and institutions.

The institute conducts five research programs which constitute its principal administrative units: Center for the Study of Judgment and Decision in Policy Formation, Program of Research on General Social and Economic Dynamics, Program of Research on Personal and Social Problem Behavior, Research Program on Technology, Environment and Man, Program of Research on Population Processes, and Program of Research on Food Systems.

The University Computing Center provides batch, interactive, and associated computing services to meet the instructional and research computing needs of the University. The center has dual Control Data Corporation model 6400 computers and related communication and input/output peripheral equipment. Documentation on the use of Computing Center facilities may be obtained from Computer Stores, 492-8131.

Each semester the Computing Center offers free noncredit short courses on various aspects of computing and programming. They include introductory courses in BASIC, COBOL, FORTRAN, SPSS, and computer graphics. Information regarding the short

¹Departments offering degrees in these fields are located on the campus of the School of Medicine in Denver.

courses may be obtained from User Information Services, 492-8131. Complete short course listings are published at the beginning of each semester in the center's newsletter, the *Digit*. Announcements also appear in the *Colorado Daily* and the *Silver and Gold Record*.

The Cooperative Institute for Research in Environmental Sciences (CIRES) is a joint project of the University of Colorado and the National Oceanic and Atmospheric Administration (NOAA). This institute is devoted to research and advanced training in solid-earth geophysics, geophysical fluid dynamics (especially with application to the oceans and atmosphere), atmospheric chemistry, electromagnetic wave propagation, and solar-terrestrial relationships. The institute serves as a center for multidisciplinary collaboration of research workers from Boulder and institutions throughout the world. A visiting fellowship program enables scientists working in these fields to spend time with CIRES.

Current CIRES research programs in which graduate students participate as research assistants include paleomagnetism and rock magnetism, earthquake prediction and earthquake physics, plate tectonics, seismic wave propagation, nuclear test discrimination, rock deformation and fracture, electromagnetic induction in the earth's crust, boundary value problems in electromagnetic theory, gravity-wave propagation in the lower troposphere, numerical hydro-dynamics, dynamics of the atmospheric boundary layer, rates of chemical reactions of importance in the atmosphere, heterogeneous nucleation in the atmosphere, strains and tilts associated with earth tides and secular deformation, geophysical inverse studies, and normal modes of vibrations of the earth.

The Engineering Research Center coordinates the research activities of the College of Engineering and Applied Science and ensures that these achieve educational as well as scientific value. Currently there are more than 100 research projects in progress, most of them under funding from governmental agencies or industry. Many other projects replace conventional demonstration laboratory work for graduate students. Typical projects which have been ongoing for some time include studies of lightning, carried out with the aid of a million-volt high impulse generator; extensive work with semiconductors; bioengineering studies in various areas including white blood cell communications systems and sensory devices; and areas of energy-related research including coal gasification, power transmission, conservation, and both radiant and photovoltaic solar power. There is an elaborate new integrated circuits laboratory. Faculty and graduate students of the college have made important contributions to the fields of computer technology and programming, smog control, bioengineering, cryogenics, high speed rotating electrical machinery, solid state devices, electromagnetic propagation, analog and digital signal processing, microprocessors, tertiary oil recovery, water resources, materials science, fluid dynamics, and various aspects of the aerospace engineering sciences.

The High Altitude Observatory is an internationally recognized center for the study of solar, interplanetary, and magnetospheric physics with emphasis on the interrelationships between these areas. Established in 1940, HAO now has its central laboratory and administrative offices on the Boulder Campus near the Sommers-Bausch Observatory.

HAO is a part of the National Center for Atmospheric Research which is sponsored by the National Science Foundation. HAO's extensive research facilities are available to and are used by graduate students pursuing advanced studies in the Departments of Astro-Geophysics, and Physics and Astrophysics.

The Sommers-Bausch Observatory on the Boulder Campus is equipped with a 24-inch Cassegrain-Coude telescope with ancillary equipment for photographic, spectrographic, and photometric stellar observations. The facilities at Sommers-Bausch are used by the Department of Astro-Geophysics and the Department of Physics and Astrophysics for undergraduate and graduate teaching and research. Open houses, for both students and the public, are generally held on Friday nights by reservation.

The Fiske Planetarium on the Boulder Campus is one of the finest planetarium facilities in the world. Equipped with a Zeiss VI star projector and a 65-foot diameter dome and 213 seats, the planetarium regularly presents astronomically oriented shows designed to entertain as well as inform. In addition, multimedia shows, dance, and musical concerts are presented in the planetarium. It is also used as a teaching tool in astronomy classes and by many other departments of the University. Students are employed on a part-time basis to help in the running of the planetarium.

The Institute for the Study of Intellectual Behavior (ISIB) was established to promote interdisciplinary instruction and research activities in the fields of psychology, education, linguistics, and other behavioral sciences. Its major current research programs are concerned with cognitive factors in human learning and memory, including such topics as conceptual behavior, individual differences in learning, psycholinguistics, perceptual and motor processes, and developmental and educational psychology. The central offices are located in Muenzinger Psychology Building.

The Laboratory for Atmospheric and Space Physics (LASP) conducts experimental and theoretical research in atmospheric and space physics, particularly for students and faculty from the Departments of Astro-Geophysics and Physics and Astrophysics. LASP has experiments on several current research satellites: the Orbiting Solar Observatory, a high resolution spectrometer to study ultraviolet solar emission lines; the Voyager mission to Jupiter and Saturn, a photopolarimeter to study the atmospheres of these planets; and the Pioneer Venus mission, a programmable ultraviolet spectrometer to examine the atmosphere and cloud tops of Venus. LASP is developing the instruments for

the Solar Mesosphere Explorer satellite which is planned to be launched in 1981 to study the earth's ozone layer. An ultraviolet spectrometer experiment is being prepared for the Galileo mission to Jupiter in 1982. LASP has developed a unique data handling system for use with these space experiments as well as with earlier experiments on the Mariner 9 Mars orbiter. An active program continues in rocket-borne and laboratory experiments to coordinate with the space research program.

The Joint Institute for Laboratory Astrophysics (JILA) was established in 1962 by an agreement between the University and the National Bureau of Standards. Located on the Boulder Campus, the institute provides facilities for advanced research and graduate training in a number of areas of atomic physics, and astrophysics. These areas include both theoretical and experimental studies of atomic interactions, spectroscopy and line broadening, chemical physics, lasers and other optical resonance phenomena, precision measurements, stellar atmospheres and radiative transfer, stellar interiors, solar physics, binary X-ray sources, and the interstellar medium and galactic astronomy. A brochure giving more detailed information is available on request from the institute.

The Nuclear Physics Laboratory is a branch of the Department of Physics and Astrophysics, and its staff members conduct experimental and theoretical research in nuclear physics. Application of techniques of nuclear science to environmental and medical problems is also investigated. The laboratory is equipped with a modern cyclotron capable of accelerating hydrogen ions to 30 MeV and helium ions to 44 MeV, several computers, and instrumentation for precision spectroscopy of charged particles, neutrons, and gamma rays. A magnetic spectrometer system permits very high resolution analysis of charged particle reaction products. Staff members of the laboratory also participate in experiments at the Los Alamos Meson Physics Facility. Research assistantships are available to support graduate students who are doing their thesis research in nuclear physics.

The Business Research Division, the research arm of the College of Business and Administration, was originally chartered as the Bureau of Business Research in 1915.

The research effort of the division falls into three general categories: state service, contract research, and faculty research. State service, the principal activity, focuses on assisting the Colorado business community by providing information and special studies on the state's economy and special business problems. Contract research is conducted for federal, state, and local agencies, as well as for private business firms and associations. Research includes regional and local economic base studies and studies on manufacturing, tourism, and other state industries.

The Business Research Division serves as a Census Summary Tape Processing Center in cooperation with the Colorado Division of Planning. The Business Research Division also maintains the Colorado

Business/Economic Data Bank which contains state information on Colorado economic activities.

Publications of the division include the *Colorado Business Review*, the *Directory of Colorado Manufacturers*, the *Journal of Travel Research*, *Colorado County and City Retail Sales*, *Colorado Ski and Winter Recreation Statistics*, and numerous special interest publications.

The Center for Labor Education and Research (CLEAR) conducts labor education programs and research in various aspects of labor relations. Credit courses in labor relations are offered by the center. Graduate students in related areas are encouraged to participate in CLEAR programs. The services of members of the various faculties of the University and outside resources are also utilized.

The Bureau of Governmental Research and Service publishes reports and monographs on governmental and public policy issues. It also sponsors various conferences and workshops for public officials and for people concerned with governmental problems. The research library, in Ketchum 125 contains materials available to researchers interested in governmental and public policy questions.

The Bureau of Economic Research formulates and conducts research projects in economics and related fields in order to further knowledge about the nature and behavior of economic variables, to develop and refine research methodology, and to provide decision makers in both the public and private sectors with data and techniques to improve the quality of their decision making. The bureau conducts research under contract and grant arrangements with governmental and private agencies. Economics graduate students participate as research assistants to gain professional research experience as a supplement to their formal education.

Bureau of Educational Field Services. Assistance to the schools of Colorado and facilitation of faculty research work are provided through the Bureau of Educational Field Services. Evaluation services, school surveys, assistance in curriculum revision, in-service education programs, educational planning, and a variety of consultant services are available through the bureau, which focuses the resources of the University on educational problems in the state.

The Economics Institute offers intensive transitional course work and orientation to foreign students entering graduate programs in economics and related fields (including business and agricultural economics) at universities throughout the United States and engages in related research and service activities. Its offerings include English, mathematics, statistics, accounting, economic theory, and special topic short courses and seminars in computer fundamentals, management, agricultural systems and economic development, business, and other special fields. The program is organized in five-week terms and participants may be admitted to up to nine consecutive terms, depending on beginning proficiency in English. University of Colorado credit is available for several institute course offerings. The institute is

sponsored by the American Economic Association, in cooperation with the American Assembly of Collegiate Schools of Business, the American Agricultural Economic Association, the Institute of International Education, and the University of Colorado.

The International Economics Studies Center engages in cooperative instructional and research programs with foreign universities with a view to expanding the opportunities of students and faculty members interested in international developmental problems.

Laboratories and Special Equipment

Laboratories, special classrooms, and specialized equipment are essential to graduate training and research. Some of the facilities at the University of Colorado are described in the following paragraphs.

Aerospace engineering sciences laboratories have the following facilities for instruction and research: four low-turbulence wind tunnels and several hot-wire anemometer sets for turbulence and unsteady aerodynamic research; conventional and double-diaphragm shock tubes for combustion and combustion-instability studies; laboratory for the study of ultrasound in gases; laboratory for the study of the hydrodynamics of superfluid helium and geophysical fluid dynamical modeling; bioengineering laboratories for studies in behavior, cardiac physiology, neurophysiology, and neurochemistry; electromagnetic shock tubes for high Mach numbers and high-temperature studies; stroboscopic laser optical techniques for unsteady aerodynamics and aeroacoustics research; and apparatus for studying plasma turbulence.

The astro-geophysics department conducts advanced studies in solar and planetary physics. Special emphases are placed on studies of the sun, atmospheres of the earth, other planets and stars, radio astronomy, aeronomy, space physics, hydrodynamics, plasma physics (including controlled thermonuclear fusion), radiative transfer, and atmospheric circulations.

The department operates the Sommers-Bausch Observatory and a radio observatory west of Boulder and makes extensive use of the Fiske Planetarium on the campus. Also used are observational facilities of the Sacramento Peak Observatory at Sunspot, New Mexico; the Kitt Peak National Observatory, Tucson, Arizona; and the National Radio Astronomy Observatory, Green Bank, West Virginia. A considerable part of the teaching and research is in collaboration with the National Center for Atmospheric Research (including the High Altitude Observatory), the Laboratory for Atmospheric and Space Physics, National Bureau of Standards, Joint Institute for Laboratory Astrophysics, National Oceanic and Atmospheric Administration (e.g., Space Environment Laboratory, Aeronomy Laboratory), Cooperative Institute for Research in Environmental Sciences, In-

stitute for Telecommunication Sciences, and other Boulder institutions.

Chemical engineering laboratories provide facilities for research in catalysis, controls, cryogenics, heat transfer, fluid mechanics, water pollution control, kinetics, tertiary oil recovery, coal gasification, plastics, sensory physiology, and biomedical applications. Cryostats and gas chromatographs are available for low temperature thermal conductivity and phase equilibria studies, as are extrusion and injection molding machines, an intensive mixer, and a rheometer for polymer studies. Also available are excellent analog and on-line analog-digital computers and control instrumentation for process studies; an ecological wind tunnel for research on the effect of chemicals on the growth and water consumption of plants and trees; and special facilities, including hot-water anemometers and frequency analysis meters, for research on flow and turbulence phenomena and heat- and mass-transfer in rotating systems. There are a nitrogen adsorptimeter and a mercury porosimeter for study of the structure of porous solids, and a Wicke-Kallenbach apparatus for diffusion measurements. Mass spectrometers and a molecular-beam diffusion unit facilitate studies of catalysis, pollution control, and coal gasification, which are further aided by various pieces of special apparatus. Water pollution control equipment includes biological reactors and pressure vessels. A unique Rayleigh interferometer, developed at the University of Colorado, is used for measuring transport rates of solutes through liquids and solids.

Civil, environmental, and architectural engineering laboratories facilitate research in structures, vibrations, materials testing (including metals, timber, concrete, soils, rock, and highway materials), hydraulics, sanitary engineering and water quality, surveying and photogrammetry, and illumination. There is polarized light apparatus for study and research in the photoelastic field, and controlled-atmosphere rooms for materials and soils testing are available. The principal feature of the structures laboratory is a massive test bed permitting a wide variety of investigations of structural forms under dynamic as well as static loading. The sanitary engineering laboratories include two laboratories in water quality at the Boulder Campus and an extensive pilot plant for experimentation in waste-water reuse. Masonry research equipment installed recently already has led to advancements in the industry.

Electrical engineering department special equipment and facilities include an anechoic chamber for studying propagation effects at microwave frequencies; laser and maser laboratories; high-voltage laboratory for impulse tests to 1,000,000 volts; high-vacuum and vacuum deposition equipment for thin-films research; an integrated circuits laboratory; ion implantation equipment; crystal-growing facilities; a modern systems laboratory; undergraduate laboratories in circuits, electronics, and energy conversion; a holography laboratory; Librascope system digital computer; an Athena computer facility; a

Nova minicomputer with seven terminals; a roof-mounted antenna range; a special microscope for laser manipulation of microorganisms *in vivo*; and a growing array of other bioengineering research apparatus.

Mechanical engineering laboratories provide for experimental studies of thermal and mechanical systems. Typical investigations include topics in heat transfer, mechanical behavior of materials, combustion and fracture mechanics. Specialized equipment needed for these investigations includes Instron testing machines, a diffused light polariscope, a torsion pendulum for internal friction measurements, high-frequency generators for ultrasonic testing, a digital storage/dual beam oscilloscope, a gas chromatograph for combustion product analysis, a Kolsky apparatus for material measurements at high strain rates, metallographs, shaker tables, and a holographic interferometer.

Electrical and mechanical equipment is available for work in servomechanisms; molding presses and fabrication equipment for plastics technology; equipment for experimental stress analysis, modular analog computer units; high-speed photographic equipment; a precision microscope for grain examination and film reading; time-sharing computer terminals; a servo analyzer; an 8-track instrumentation tape recorder and special equipment for bioengineering studies of skeletal systems, nerves, and prosthetic devices.

The modern language laboratory facility consists of four language laboratories with a total of 114 record-playback positions, a 30-station audiovisual classroom, recording studio, tape library with high-speed duplicator, and two equipment repair rooms. The Colorado Springs campus has a 20-position laboratory. The Denver Center shares facilities at the Auraria campus.

The Computer Laboratory for Instruction in Psychological Research (CLIPR) is a laboratory within the Department of Psychology specializing in research, development, and training in computer use in the social, behavioral, and educational sciences. The laboratory operates a large scale Xerox Sigma 3 computer. The computer is used to provide automation of research laboratories, to control research instruments, to collect research data, to give training in computer use at both the graduate and undergraduate levels, and to offer a facility for research and development in computer assisted research and instruction.

The Speech and Hearing Center has a two-fold purpose. It provides facilities for the training of undergraduate and graduate students, and speech and hearing therapy services for the Boulder community. Any student of the University or member of the Boulder community is eligible for the services offered. Services include evaluations of speech and language skills, training for the improvement of communication skills, hearing tests, lipreading instruction, and auditory training for the hearing-impaired. The center is at 930 Broadway.

The offices and classrooms for the Department of Communication Disorders and Speech Science are located at 934 Broadway.

Facilities for Graduate Study on the Colorado Springs Campus

The University of Colorado at Colorado Springs is located in northeast Colorado Springs. The campus offers programs in the College of Business and Administration and the Graduate School of Business Administration, the School of Education, the College of Engineering and Applied Science, the College of Letters, Arts and Sciences, and the Graduate School of Public Affairs, as well as the Graduate School.

The new library offers seating for over 500 users in a variety of configurations ranging from lounge areas to group study rooms. Also included is an exhibit area and a 24-hour study lounge.

The holdings of the library total more than 100,000 volumes with a subscription list of over 900 titles. Photoreproduction and audiovisual services are available. There is direct batch processing-access by remote job entry to twin CDC 6400 digital computers located in Boulder. In addition, an HP 2100 minicomputer is available for instructional and research purposes.

The following programs at the master's level are available for completion through the Graduate School:

Applied mathematics (M.S.)	Electrical engineering (M.S.)
Basic science (M.B.S.)	Master of Engineering (M.E.)
Education (M.A. or M.Ed.)	Sociology (M.A.) in corrections
Political science (M.A.)	
Psychology (M.A.)	

A Master of Public Administration (M.P.A.) degree is offered through the Graduate School of Public Affairs, and the Master of Business Administration (M.B.A.) degree is offered through the Graduate School of Business Administration.

Further details may be obtained by contacting the individual department on the Colorado Springs Campus.

Facilities for Graduate Study and Research on the Denver Campus

The University of Colorado at Denver is located at 1100 14th Street (14th and Arapahoe) in downtown Denver. The campus offers programs in the following schools and colleges:

College of Business and Administration and Graduate School of Business Administration
 School of Education
 College of Engineering and Applied Science
 College of Environmental Design
 College of Liberal Arts and Sciences
 College of Music
 Graduate School
 Graduate School of Public Affairs

UCD is a partner in the Auraria Higher Education Center with the primary role of providing graduate, professional, and upper division education. The combined Auraria libraries have in excess of 300,000

volumes and a periodical subscription list of more than 2,000. In addition, UCD students can draw on the holdings of the libraries of the other campuses. Good photoproduction and audiovisual services are also available.

The Denver Campus is making research contributions in many areas with special emphasis placed upon programs with an urban direction. The Institute for Advanced Urban Studies, the Center for Urban Transportation Studies, the Center for Public and Urban Affairs, and the Center for New Towns and Community Design are examples of organizations that provide a multidisciplinary approach to the problems of the city.

The following graduate programs are available for completion through the Graduate School on the Denver Campus:

The Master of Arts (M.A.) in:

Anthropology	Geography
Biology	History
Communication and theatre	Mathematics
Communication disorders	Psychology
and speech science	Political science
Economics	Sociology (urban)
English	

The Master of Education (M.Ed.) and the Master of Arts in Education (M.A.) in:

Counseling and guidance	Library media
Counseling and guidance	Reading
in the agency setting	Secondary education
Early childhood education	Social foundations of
Educational psychology	education
Elementary education	

Specialist in Education (Ed.S.)

The Master of Science (M.S.) in:

Applied mathematics	Civil engineering
Business	Electrical engineering
Chemistry	Environmental science

The Master of Basic Science (M.B.S.)

The Master of Humanities (M.H.)

The Master of Social Science (M.S.S.)

Significant course work may be taken in the following programs at the graduate level:

Computer science	Music
Finance	Philosophy
Fine arts	Physical education
Geology	Physics
Mechanical engineering	Spanish

Further details may be obtained by contacting the Associate Dean of the Graduate School, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202, or by consulting the bulletin for the University of Colorado at Denver.

Students should contact the College of Business, the College of Environmental Design, and the Graduate School of Public Affairs for graduate work within their respective programs.

Facilities for Graduate Study and Research at the Medical Center in Denver

The University's Medical Center is located at 4200 East Ninth Avenue, Denver, on its own 32-acre campus. It includes the School of Medicine, the School of Nursing, the School of Dentistry, the Graduate School Division of the Medical Center, and the clinical teaching facilities of Colorado General Hospital, Colorado Psychiatric Hospital, John F. Kennedy Child Development Center, Children's Psychiatric Day Care Center, Diagnostic Service for Rheumatic and Congenital Heart Diseases, Newborn and Premature Center, and Children's Diagnostic Center for the evaluation of emotionally disturbed children.

Also on the Medical Center Campus are the Florence R. Sabin Building for Research in Cellular Biology, the Denison Memorial Library, the Humphreys Postgraduate Center, and the Bonfils Tumor Clinic. Additional facilities on the Medical Campus include the Webb-Waring Lung Institute, Belle Bonfils Memorial Blood Bank, and Eleanor Roosevelt Institute for Cancer Research.

The Denison Memorial Library has a collection of 125,000 bound volumes and a subscription list of 2,100 medical and scientific journals, American and foreign. There are photoreproduction facilities and 120 private study carrels.

The Medical Center is making research contributions in such fields as ultrastructure of cells, molecular genetics, mechanisms of enzyme action, protein synthesis, physical chemistry of macromolecules, neurophysiology, viral structure and function, cell growth and differentiation, and immunochemical mechanisms, as well as in such areas of clinical investigation as transplantation of vital human organs, mental illness and retardation, allergies, viral and bacterial infections, heart disease, muscular dystrophy, cancer, emphysema, arthritis and rheumatism, and radiation effects.

The School of Medicine is composed of two subdivisions: basic science and clinical. Graduate study may be undertaken in either of these subdivisions.

BASIC SCIENCE

Graduate work in the basic sciences may be taken in the following departments at the School of Medicine:

Anatomy	Microbiology
Biochemistry	Pathology
Biometrics	Pharmacology
Biophysics and genetics	Physiology

CLINICAL

The clinical departments of the School of Medicine offer graduate training in the following departments:

Anesthesiology
Division of Health Administration (Department of Preventive Medicine)
Pediatrics (Child Health Associate Program)
Physical Medicine and Rehabilitation (Physical Therapy)
Radiology (Medical Physics and Radiation Biology)

International Education

The staff of the Office of International Education expedites the exchange of students and faculty, entertains foreign visitors, promotes special relationships with foreign universities, and advises students concerning international fellowships such as Fulbright, IREX, and Marshall. The University of Colorado also has graduate exchange programs with the Universities of Erlangen, Göttingen, and Regensburg in Germany, the University of Bordeaux in France, and the University of Lancaster in England. A special program in film studies in Paris is also available to University of Colorado graduate students. The University of Colorado operates a summer program in art history in Florence, as well as other short-term programs which offer graduate credit to the eligible student. Graduate students may apply for directorships and assistant directorships of some of the University's study abroad programs, which are designed for undergraduates. Information and application forms are available from the Office of International Education, 914 Broadway.

Continuing Education

For courses offered and other information, write to the Center for Lifelong Learning, University of Colorado, 970 Aurora, Boulder 80302. Other Continuing Education offices are located at the Denver and Colorado Springs campuses.

Graduate Student Advisory Council

The aims of the Graduate Student Advisory Council (GSAC) are to promote quality graduate education and to insure that no graduate student at the University of Colorado is needlessly denied such an education. While its particular concern is with affairs on the Boulder campus, the GSAC is also affiliated with the Inter-Campus Graduate Student Association, which is comprised of representatives from the Graduate Schools of each of the University campuses. The GSAC has been active in its support of the graduate student associations of the various departments represented in the Graduate School.

Graduate Student Committee on Privilege (GSCP)

Grievances which concern graduate students, and which cannot be redressed through appropriate administrative channels, should be directed to the GSCP, either through the Graduate Student Advisory Council (UMC 183D, ext. 5068) or through the dean of the Graduate School (ext. 7401). The GSCP, a newly established committee composed of Graduate students from all University of Colorado campuses, considers grievances involving graduate student rights and privileges and is designed to expedite grievance proceedings and to protect the grievant from any overt or covert discrimination or intimidation which may result from his or her filing a complaint. The committee has been endorsed by the dean of the Graduate School, the Executive Committee of the Graduate School, and the graduate faculty.

TUITION AND FEES

Tuition and fees for the 1979-80 school year have not yet been set. The tuition rates per campus for the 1978-79 school year are given below.

Boulder Campus Tuition

See Tuition and Fees in the General Information section of this bulletin.

Colorado Springs Campus Tuition, Per Semester¹

See the *University of Colorado at Colorado Springs Bulletin* for schedule of fees and academic calendar.

Credit Hours of Enrollment	Resident	Nonresident
0-1	\$ 20	\$ 60
2	40	120
3	60	180
4	80	240
5	100	300
6	120	360
7	140	420
8	160	480
9	180	540
10	200	600
11-18	225	675
Over 18	\$15 per hour additional	\$60 per hour additional

Denver Campus Tuition, Per Semester¹

See the *University of Colorado at Denver Bulletin* for schedule of fees and academic calendar.

Credit Hours of Enrollment	Resident	Nonresident
0.0 — 3.0	\$ 63	\$ 144
3.1 — 4.0	84	192
4.1 — 5.0	105	240
5.1 — 6.0	126	288
6.1 — 7.0	147	336
7.1 — 8.0	168	384
8.1 — 9.0	189	432
9.1 — 18.0	211	480
Each credit hour over 18.0	14	56

Graduate School Division of the Medical Center

Basic Science Graduate Student Tuition Per Quarter¹

See the *University of Colorado School of Medicine Bulletin* for schedule of fees and academic calendar.

Credit Hours of Enrollment	Resident	Nonresident
0.1 — 3.0	\$ 82	\$ 330
3.1 — 4.0	110	1,209
4.1 — 5.0	137	1,209
5.1 — 6.0	165	1,209
6.1 — 7.0	192	1,209
7.1 — 8.0	220	1,209
8.1 — 9.0	247	1,209
9.1 — 10.0	275	1,209

¹The Board of Regents reserves the right to change tuition and fees at any time.

10.1 — 18.0	302	1,209
18.1 — 19.0	322	1,290
19.1 — 20.0	342	1,370
20.1 — 21.0	362	1,451
21.1 — 22.0	383	1,531
22.1 — 23.0	403	1,612
23.1 — 24.0	423	1,692

School of Nursing Tuition, Per Semester¹

See the *University of Colorado School of Nursing Bulletin* for schedule of fees and academic calendar.

Credit Hours of Enrollment	Resident	Nonresident
0.1 — 3.0	\$ 131	\$ 522
3.1 — 4.0	174	1,914
4.1 — 5.0	218	1,914
5.1 — 6.0	261	1,914
6.1 — 7.0	305	1,914
7.1 — 8.0	348	1,914
8.1 — 9.0	392	1,914
9.1 — 10.0	435	1,914
10.1 — 18.0	479	1,914
18.1 — 19.0	511	2,042
19.1 — 20.0	543	2,170
20.1 — 21.0	575	2,298
21.1 — 22.0	607	2,426
22.1 — 23.0	639	2,554
23.1 — 24.0	671	2,682

FINANCIAL AID FOR GRADUATE STUDY

Financial Aid

Graduate students wishing to apply for long-term loans through the National Direct Student Loan Program and for part-time jobs through the College Work-Study Program should submit an Application for Financial Aid to the Office of Financial Aid by April 1.

Scholarships and Fellowships

The University of Colorado administers various forms of financial assistance for graduate students: fellowships, fellowships for the disadvantaged, traineeships, scholarships, research and teaching assistantships, and a number of awards from outside agencies.

The Graduate School offers two types of assistance: Colorado Doctoral Fellowships and Colorado Graduate Grants.

Colorado Doctoral Fellowships are awarded to entering and continuing regular degree doctoral students and provide an award of \$3,500 for the academic year. These are awarded to entering students on the basis of academic promise; to continuing students on criteria of academic success. All awards are determined in a University-wide competition. In order for a fellowship to be renewed, the student holding it must reapply and must again be successful in open competition. Special fellowships, traineeships, and scholarships are also available for study in certain departments.

Applications for fellowships and scholarships are due in the department before the announced

departmental deadline. Awards are announced on March 15 in accord with the Council on Graduate Schools.

The Colorado Graduate Grant Program is a new program open to graduate students who are residents of the state of Colorado. The competition for these funds is based on need. Applications are available from the Office of Financial Aid.

For further details consult the University of Colorado brochure, *Fellowships, Scholarships, and Assistantships for Graduate Students, 1979-80*.

School of Medicine Fellowships

A limited number of fellowships is available at the School of Medicine for graduate work in the basic science departments.

Part-Time Instructors (F-89) and Teaching Assistants

Many departments employ graduate students as part-time instructors (F-89) or teaching assistants. Part-time instructors (F-89) are enrolled graduate students who have a master's degree or the equivalent. They are compensated on the basis of the number of appointment hours per week. Part-time instructors (F-89) employed 50 percent or more are eligible for resident tuition rates. Nonresident students who are instructors employed less than 50 percent time must pay full nonresident tuition. Teaching assistants are enrolled graduate students and have their tuition waived for up to 9 credit hours per semester depending upon the number of appointment hours per week. Nonresident students employed as assistants are eligible for the nonresident tuition differential for their first-year appointment as an assistant only. Exceptions extending beyond the first year must be approved in advance by the respective dean.

Research Assistantships

Research activities provide opportunities for graduate students to secure part-time work as research assistants in many departments. General fund research assistantships are subject to the one-year rule on eligibility for waiver of the nonresident tuition differential. Nonresident students who are appointed as research assistants in nongeneral fund accounts are eligible for resident tuition rates. Assistants must be enrolled students.

ADMISSION REQUIREMENTS

General Requirements

Students may be admitted to the Graduate School in either of the two categories described below.

Admission to the Graduate School is not admission to candidacy for an advanced degree. A student who wishes to become a candidate for a degree must make special application at the time and in the manner prescribed by the requirements for the degree sought.

¹The Board of Regents reserves the right to change tuition and fees at any time.

A student who is granted admission must reflect in a moral and ethical sense a personal background acceptable to the University. The University reserves the right to deny admission to applicants whose total credentials reflect an inability to assume those obligations of performance and behavior deemed essential by the University and relevant to any of its lawful missions, processes, and functions as an educational institution.

Regular Degree Students

Qualified students are recommended for admission to regular degree status by the appropriate department. In addition to departmental approval, an applicant for admission as a regular degree student must:

1. Hold a baccalaureate degree from a college or university of recognized standing, or have done work equivalent to that required for such a degree and equivalent to the degree given at this University.
2. Show promise of ability to pursue advanced study and research, as judged by his previous scholastic record.
3. Have had adequate preparation to enter graduate study in the field chosen.
4. Have at least a 2.75 (2.0=C) undergraduate grade-point average (for engineering, 3.0).
5. Meet additional requirements for admission as established by major departments.

Pass-Fail Grades. In order to permit a meaningful evaluation of an applicant's scholastic record, not more than 10 percent of those credit hours that are relevant to the intended field of graduate study shall have been earned with pass-fail grades, nor more than 20 percent overall. Applicants whose academic record contains a larger percentage of pass-fail credits must submit suitable additional evidence that they possess the required scholastic ability. An applicant who does not submit satisfactory additional evidence can be admitted only as a provisional student.

Provisional Degree Students

Students who do not meet the requirements for admission as regular degree students may be recommended for provisional degree status by the major department. With the concurrence of the graduate dean these students are admitted to a probationary term of either one or two semesters of full-time study or its equivalent for part-time students. At the end of the specified probationary period, provisional degree students must be either admitted to regular degree status or dismissed from the graduate program to which they were provisionally admitted.

Credit earned by persons in provisional degree status may count toward a degree at this University.

Provisional degree students are required to maintain a 3.0 grade-point average or higher, as may be required by the terms of their provisional admission, each semester or summer session on all work taken, whether or not it is to be applied toward the advanced degree sought. Students who fail to maintain such a standard of performance will be subject to suspension from the Graduate School.

Seniors at the University of Colorado

A University of Colorado senior who has satisfied the undergraduate residence requirement and needs not more than 6 semester hours of advanced subjects and 12 credit points to meet the requirements for a bachelor's degree may be admitted to the Graduate School.

A University of Colorado senior enrolled in the College of Engineering and Applied Science who needs not more than 18 semester hours or 36 credit points to meet the requirements for a bachelor's degree may be admitted to the Graduate School, but is not eligible for financial aid, scholarships, or fellowships as a graduate student until the equivalent of the minimum requirements for the bachelor's degree have been satisfied.

Readmission of Former and Suspended Students

Students who were previously admitted to a graduate degree program but who did not complete that degree and who have not been continuously registered at the University must:

1. Clarify their status with the department to determine their eligibility to return and pursue the same degree.
2. After receiving departmental approval, as indicated above, submit a former student application to the Office of Admissions and Records before quotas are filled or deadlines passed for the term in which they expect to return to the University. Application deadlines are available from the Office of Admissions and Records.

In some instances, students who have left the degree program to which they were formerly admitted must submit a new graduate application form and be reconsidered for admission by the department concerned.

Former students who wish to change from undergraduate to graduate status or from one major to another must complete the appropriate forms at the time they apply for readmission.

Students transferring from one campus to another must apply and be accepted to the new campus.

A student admitted to the Graduate School for the master's program must reapply for admission for the doctoral program.

A suspended student is eligible to apply for readmission after one year. Approval or rejection of this application rests jointly with the student's major department and the dean. In case of lack of agreement between the department and the dean or in case of appeal by the student the final decision will be made by the Executive Committee.

Faculty Members

No member of the faculty above the rank of instructor may receive an advanced degree from this University.

Boulder Campus

All requests for admission to the Graduate School should be sent to the chairman of the department in which the applicant wishes to study.

Colorado Springs Campus

Graduate students who expect to study on the Colorado Springs Campus should apply for admission by contacting the graduate representative for the particular program. Specific admission requirements for programs on the Colorado Springs Campus may be found by consulting the bulletin of the University of Colorado at Colorado Springs.

Denver Campus

Graduate students who expect to study on the Denver Campus should apply for admission by contacting the graduate representative for the particular program. Specific admission requirements for programs on the Denver Campus may be found by consulting the bulletin of the University of Colorado at Denver.

Graduate School Division of the Medical Center

Requests and inquiries regarding admission to either the basic sciences or clinical departments of the School of Medicine should be addressed to the department or division in which the applicant wishes to study, University of Colorado Medical Center, 4200 East 9th Ave., Denver, Colorado 80262.

The Graduate School Division of the Medical Center of the University of Colorado is located in Denver and is under the jurisdiction of the associate dean of the Graduate School.

Aside from the specific prerequisites for each department the minimal admission requirements for the entire division are as follows:

1. Biology—one year.
2. Physical chemistry.
3. General physics—one year.
4. Differential and integral calculus.
5. Satisfactory scores on the Graduate Record Examination.

In the event that an applicant is deficient in any of these subjects, but is otherwise scholastically acceptable for admission to candidacy for the Ph.D. or M.S. degree, it is recommended that he eliminate these deficiencies as early as possible in his residency here by taking the appropriate courses on the Boulder Campus, Denver Campus, or through the University Division of Continuing Education.

Graduate Record Examinations

The Graduate Record examination (verbal, quantitative, analytic, and advanced) is requested of applicants for fellowships and scholarships. At the option of any department, the Graduate Record Examination may be required of applicants for assistantships, or of any student before his/her status is

determined. Special students registering in the summer, except in the School of Medicine, may be admitted by the Office of Admissions and Records without this procedure. For Medical Center see individual departments. Satisfactory scores on the Graduate Record Examinations are required on the Medical Center Campus for graduate students in the basic sciences.

Students who are applying for the fall of 1979 should take the GRE no later than the December testing date so that their scores will be available to the graduate awards selection committee.

Information regarding these examinations may be obtained from the Testing Office, 130 Willard Administrative Center, University of Colorado, Boulder 80309; or from the Educational Testing Service, Box 955, Princeton, New Jersey 08540.

APPLICATION PROCEDURES

An applicant for admission from another institution must present complete application materials which include:

1. Part I and Part II of the graduate application.
2. Two official transcripts of *all* academic work completed to date.
3. A \$20 nonrefundable application processing fee (check or money order). No application will be processed unless this fee is paid.
4. Four reports from references.
5. Test scores and other materials as required by specific departments.

All credentials presented for admission become the property of the University of Colorado.

When a prospective degree student applies for admission, the chairman of each department or a committee named for the purpose shall decide whether an applicant shall be recommended for admission. That recommendation is further reviewed and the student is informed of the decision by the Office of Admissions and Records. Persons who do not wish to work toward an advanced degree should see the section entitled Special Students.

A completed application must be in the office of the major department at least 120 days prior to the term for which the admission is sought or earlier as may be required by the major department.

Completed applications for foreign students must be on file in the Office of Admissions and Records prior to April 1 for the fall semester and October 1 for the spring semester.

Applicants should be aware of the limitation on total enrollment in effect at the University of Colorado Boulder Campus. Acceptable applicants may find that their application cannot be processed for a specific term if the limitation on enrollment has been reached.

Graduate Notification and Confirmation

After the Office of Admissions and Records has received the department recommendation and all required credentials, the applicant will be notified

regarding eligibility for admission. If eligible, the applicant will receive a Certificate of Eligibility as well as a confirmation form and must return the confirmation form and required nonrefundable confirmation deposit before the quotas are filled or the deadline passed. If the confirmation is accepted, the student will be sent information regarding registration. Should the quotas be filled, the confirmation deposit will be returned.

REGISTRATION

Every student entering this Graduate School for the first time must have an Eligibility for Admission Form. Former students must have an Eligibility for Admission Form when changing departments or when working toward another graduate degree. This form is mailed from the Office of Admissions and Records after processing of the approved application has been completed.

Late Registration

Late registration will be held only if enrollment quotas have not been filled. Therefore, there is no guarantee there will be a late registration. Graduate students who fail to complete registration and pay fees during the regular registration days will be charged a late registration fee if a late registration is held. Students registering as Candidate for Degree or for thesis must register during the regular registration period and are subject to the late registration fee.

Limitation of Registration

FULL LOAD

A graduate student will be considered to be carrying a full load during a regular semester for purposes of determining residence credit if the student is registered for not fewer than 5 semester hours in work numbered 500 or above, at least 8 semester hours of other graduate work, or any number of thesis hours.

A full load for purposes of determining residence credit during the summer session is 3 semester hours of work in courses numbered 500 or above, 6 semester hours of other graduate work, or any number of thesis hours.

MAXIMUM LOAD

No graduate student may receive graduate credit toward a degree for more than 15 hours in a regular semester.

The maximum number of graduate credits that may be applied toward a degree during a summer session is 6 hours per 5-week term and 10 hours per 10-week summer session.

UNIVERSITY EMPLOYEES

Full-time employees of the University may not undertake more than 6 credit hours per semester. Part-time employees, including assistants, may take such work as is approved by the major department.

Changes in Registration

A student who wishes to drop a course or take it for no credit should follow the drop/add standard procedure found in the current *Schedule of Courses*. Note that after the 10th week of classes a graduate student may not drop, add, or change a course to non-credit without presenting a letter to the dean of the Graduate School, 308 Regent Administrative Center, stating the exceptional circumstances which justify the change. This letter, endorsed by the instructor of the course, must accompany the properly signed and completed drop/add card.

Withdrawal

A graduate student who desires to withdraw from the University must apply to the dean of the Graduate School for permission to withdraw in good standing. A student who discontinues attendance in a course without official withdrawal will be marked as having failed the course.

REQUIREMENTS FOR ADVANCED DEGREES

Quality of Graduate Work

Although the work for advanced degrees is specified partly in terms of credit hours, *an advanced degree will not be conferred merely for the completion of a specified period of residence and the passing of a given number of courses*. A student should not expect to get from formal courses all the training, knowledge, and grasp of ideas necessary to meet the requirements for an advanced degree.

For all advanced degrees the quality of the student's work must attain an average of *B* in all work offered for the degree.

For the Ph.D., a course mark below *B* is unsatisfactory and will not be counted toward fulfilling the minimum requirements for the degree.

A student is expected to maintain at least a *B* average in *all* work attempted in Graduate School.

A student who fails to do satisfactory work will be subject to suspension from the Graduate School by the dean with the approval of the major department. Appeal may be made to the Executive Committee of the Graduate School whose decision shall be final.

GRADING SYSTEM

Students should refer to the uniform grading system described in the General Information section of this catalog and note the following:

1. Work receiving the lowest passing grade, *D*, may not be counted toward a degree, nor may it be accepted for the removal of deficiencies. Marks below *B* are not accepted for the doctoral degree.

2. Should a student enter the armed forces before completing a course and an *IW* is reported, this grade may be carried on the records for the duration of the student's service provided arrangements have been made in advance with the dean of the Graduate School.

3. An *in progress* grade given for thesis or M.Ed. report will be valid until the thesis or report has been completed.

REPEATING A COURSE

A graduate student may repeat a course once for which a grade of *C*, *D*, or *F* was earned upon written recommendation to the dean by the chairman of the student's advisory committee and major department, provided the course has not previously been applied toward a degree. The grade for the repeated course will substitute for the old grade in computation of the grade point average. All grades received will appear on the student's transcript.

USE OF ENGLISH

A student who is noticeably deficient in the use and spelling of the English language may not obtain an advanced degree from the University of Colorado. The satisfaction of this requirement depends not so much upon the ability to pass formal tests, although these may be demanded, as it does upon the habitual use of good English in all oral and written work. Ability to use the language with precision and distinction should be cultivated as an attainment of major importance.

Each department will judge the qualifications of its advanced students in the use of English. Reports, examinations, and speech will be considered in estimating the candidate's proficiency.

Master of Arts and Master of Science

A student regularly admitted to the Graduate School and later accepted as a candidate for the degree Master of Arts or Master of Science will be recommended for the degree only after the following requirements have been met.

In general, only graduates of an approved institution who have a thorough preparation for their proposed field of study and who do graduate work of high quality are able to attain the degree with the minimum amount of work specified below. All studies offered toward the minimum requirement for the degree must be of graduate rank. Courses taken during the fall semester of 1975 and thereafter will have graduate rank only if they are taught by members of the graduate school faculty and are in one of the two following categories: (1) courses within the major department at the 500 level or above; (2) courses outside the major department at any level, provided they are approved for graduate rank for a specific degree plan by the faculty of the degree-granting program and the dean of the Graduate School. Necessary additional work required to make up deficiencies or prerequisites may be partly or entirely undergraduate courses.

The requirements stated below are minimum requirements; additional conditions set by the department will be found in the announcements of separate departments. Any department may make further regulations not inconsistent with the general rules.

MINIMUM REQUIREMENT

The minimum requirement of graduate work for the degree Master of Arts or Master of Science may be fulfilled by following either Plan I or Plan II below.

Plan I: By presenting 24 semester hours of graduate work, including a thesis. At least 12 semester hours of this work must be at the 500 level or above.

Plan II: By presenting 30 semester hours of graduate work, without a thesis. At least 16 semester hours of this work must be at the 500 level or above.

Plan II does not represent a free option for the student. A candidate for the master's degree may be allowed to select Plan II only on the recommendation of the department concerned.

MASTER'S THESIS OR REPORT CREDIT

Every graduate student working toward a master's degree who expects to present a thesis or M.Ed. report in partial fulfillment of the requirements for the degree must register for thesis for a minimum of 4 semester hours or a maximum of 6 semester hours, or for M.Ed. report for 2 semester hours. The student may register for any specific number of hours in any semester of residence, but the *total number of hours for all semesters* must equal the number of credits the student expects to receive for the thesis or report. The final grade will be withheld until the thesis or report is completed. If the thesis or report is not completed at the end of the term in which the student is so registered, an *in progress (IP)* will be reported. (The student may not register again for any portion of thesis credit on which an *IP* grade has been submitted.)

LANGUAGE REQUIREMENTS

Candidates must have such knowledge of ancient and modern languages as each department requires. See special departmental requirements.

CREDIT BY TRANSFER

Work already applied toward a master's degree received at another institution cannot be accepted for transfer toward the master's degree at the University of Colorado; extension work completed at another institution cannot be transferred; and correspondence work, except to make up deficiencies, is not recognized.

All work accepted by transfer must come within the five-year time limit or be validated by *special* examination.

Credit will not be transferred until the student has established, in the Graduate School of this University, a satisfactory record of at least one semester in residence; such transfer will not reduce the residence requirement at this University, but it may reduce the amount of work to be done in formal courses.

Excess undergraduate credits from another institution may not be transferred to the Graduate School. Seniors in this University may, however, transfer a limited amount of advanced resident work (up to 8 semester hours) provided such work:

1. Is completed with distinction in the senior year at this University.

2. Comes within the five-year time limit.

3. Has not been applied toward another degree.

4. Is recommended for transfer by the department concerned and is approved by the dean of the Graduate School.

The maximum amount of work that may be transferred to this University, dependent upon the master's degree sought, is noted below:

Degree	Semester Hours
M.A. or M.S.	8
M.Bus.Ed.	8
M.Ed.	8
M.Mus.	8
M.Mus.Ed.	8
M.F.A. (Studio)	16

Requests for transfer of credit to be applied toward an advanced degree must be made on the form specified for this purpose and submitted to the Graduate School by the beginning of the semester prior to that in which the student will graduate. This form is to be completed by the student, endorsed by his adviser, the departmental chairman or his designated representative, and the dean of his college if applicable, and sent to the Graduate School. An official transcript of credit must accompany the request. (Information required: course title, number, credit hours, when and where taken, grade received, and certification that student was enrolled in graduate school at the time.) To be eligible for courses to be considered for transfer, a student must have an overall *B* average in all courses taken at the University of Colorado in Graduate School.

TRANSFER OF SPECIAL STUDENT CREDIT HOURS

A department *may* recommend to the graduate dean the acceptance of as much as 8 hours of credit toward the requirements for a master's degree for courses taken either as a student at another recognized graduate school, as a special student at this University, or both. In addition, the department *may* recommend to the graduate dean the acceptance of credit for courses taken as a special student at this University during the semester, quarter, or summer session for which the student has applied for admission to the Graduate School.

CONTINUING EDUCATION COURSE WORK

Students may use the resources of the Division of Continuing Education in the pursuit of graduate study only if they obtain proper academic approval from the major department and the graduate dean in advance. These resources include classes and courses by consultation and group study.

RESIDENCE

In general the residence requirements can be met only by residence at this University for at least two semesters or at least three summer sessions. For full residence a student must be registered within the time

designated at the beginning of a semester and must carry the equivalent of not fewer than 5 semester hours of work in courses numbered 500 or above, or at least 8 semester hours of other graduate work. See Limitation of Registration, Full Load for requirements for full residence credit during the summer. A student who is noticeably deficient in his general training, or in the specific preparation indicated by each department as prerequisite to graduate work, cannot expect to obtain a degree in the minimum time specified.

Assistants and other employees of the University may fulfill the residence requirements of one year in two semesters, provided their duties do not require more than half time. Full-time employees may not satisfy the residence requirements of one year in fewer than four semesters.

CANDIDACY

A student who wishes to become a candidate for a master's degree must file application in the dean's office not later than 10 weeks prior to the completion of the comprehensive-final examination. The number of hours to be presented for the degree must be determined before this application may be filed.

This application must be made on forms obtainable at the dean's office and in appropriate departments and must be signed by a representative of both the major and minor, if any, fields of study, certifying that the student's work is satisfactory and that the program outlined in the application meets the requirements set for the student.

THESIS REQUIREMENTS

A thesis, which may be of a research, expository, critical, or creative type, is required of every master's degree candidate under Plan I. Every thesis presented in partial fulfillment of the requirements for an advanced degree must:

1. Deal with a definite topic related to the major field.
2. Be based upon independent study and investigation.
3. Represent the equivalent of from 4 to 6 semester hours of work.
4. Receive the approval of the major department not later than 30 days (in some departments, 90 days) before the commencement at which the degree is to be conferred.
5. Be essentially complete at the time the comprehensive-final examination is given.
6. Comply in mechanical features with specifications of the Graduate School. (See "Graduate School Specifications for Master's Thesis and Doctoral Dissertations" in *A Manual for Thesis Typing at the University of Colorado* by Margaret Smith Koerner.)

Two weeks prior to the date on which the degree is to be conferred, two formally approved, typewritten copies of the thesis, complete with abstracts, must be filed in the Graduate School.

The thesis must be signed by two professors in the student's major field. All approved theses are kept on

file in the library. The thesis binding fee must be paid when the thesis is deposited in the Graduate School.

Credit hours earned for the thesis will not be accepted toward the requirements for a degree unless such credit has previously been registered. A student working toward a master's degree must register for thesis for a specific number of hours. *The registered credit for thesis must total a minimum of 4 or a maximum of 6 semester hours, the total number of hours depending upon how much credit is to be given for the thesis.*

COMPREHENSIVE-FINAL EXAMINATIONS

Each candidate for a master's degree is required to take a comprehensive-final examination *after* the other requirements for the degree have been completed. This examination may be given near the end of the last semester of residence while the candidate is still taking required courses for the degree, provided satisfactory progress is being made in those courses.

The following rules applying to the comprehensive-final examination must be observed:

1. A student must be registered when the examination is taken.
2. Notice of the examination must be filed by the major department in the dean's office at least three days in advance of the examination.
3. The examination is to be given by a committee of three graduate faculty members appointed by the department concerned with approval of the dean of the Graduate School.
4. The examination, which may be oral or written, or both, must cover the thesis, which should be essentially complete at the time, as well as other work done in the University in formal courses and seminars in the major field.
5. The examination must include all work presented for the degree. The examination on transferred work will be given by representatives of the corresponding fields of study in this University.
6. A student who fails the comprehensive-final examination may not attempt the examination again until at least three months have elapsed and until such work as may be prescribed by the examining committee has been completed. The student may retake the examination only once.

SUPPLEMENTAL EXAMINATIONS

Supplemental examinations should be simply an extension of the original examination and given immediately. If the student fails the supplemental examination, three months must elapse before it may be attempted again.

TIME LIMIT

All work, including the comprehensive-final examination, should be completed within five years or six successive summers. Work done earlier will not be accepted for the degree unless validated by a *special* examination. A candidate for the master's degree is expected to complete the work with reasonable continuity.

Students whose residence in this University is interrupted by military service may apply to the dean of the Graduate School for an extension of time.

Doctor of Philosophy

The Doctor of Philosophy degree is the highest academic degree conferred by the University. To state the requirements for the degree in terms of credit hours would be misleading, since the degree is not conferred merely upon the satisfactory completion of a course of study, however faithfully pursued. Students who receive this degree must demonstrate that they are proficient in some broad subject of learning, and that they can critically evaluate work in this field; furthermore, they must have shown the ability to work independently in their chosen field and must have made an original contribution of significance to the advancement of knowledge. The technical requirements stated below are minimal requirements for all candidates for the degree; additional conditions set by the departments will be found in the announcements of separate departments. Any department may make additional regulations not inconsistent with these general rules.

Studies leading to the Doctor of Philosophy degree must be chosen so as to contribute to special competence and a high order of scholarship in a broad field of knowledge. A field of study chosen by the student may be in one department except for essential related subject matter, or the field of study may include two or more closely related departments. The criterion as to what shall constitute an acceptable field of study shall be that the student's work must contribute to an organized program of study and research without regard to the organization of academic departments within the University.

MINIMUM REQUIREMENT

A minimum of 30 semester hours of courses numbered 500 or above is required for the degree, but the number of hours of formal courses will ordinarily be larger than this. At least 20 of the required hours must be in graduate courses taken at this University. Unless otherwise specified by departmental requirements, all 500-600-level courses taken for the master's degree at the University of Colorado may be applied toward the doctor's degree at the University. Students who have been admitted to the Graduate School with deficiencies may expect to receive little or no residence credit until the deficiencies have been removed.

Ph.D. DISSERTATION CREDIT

To complete the requirements for the Ph.D. and other doctoral degrees, except for the D.Mus.A. degree, a student must register for a total of at least 16 but not more than 24 hours of doctoral dissertation credit with 0 to 8 credits in any one semester. Not more than 8 of these credits may be obtained before the student has been approved as a candidate for the doctorate.

Dissertation credit does not apply towards the 30 hours of required credit for the doctorate and will not be included in calculating the student's grade-point average.

QUALITY OF WORK

Students are expected to complete with distinction all work in the formal courses in which they enroll. A course mark below *B* is unsatisfactory and will not be counted toward fulfilling the minimum requirements for the degree. Upon recommendation by the advisory committee and the executive officer of the department and with the approval of the dean, a student may be required to withdraw at any time for failure to maintain satisfactory progress toward the degree.

ADVISORY COMMITTEE

As soon as the field of specialization has been chosen, the candidate will request the staff member with whom the candidate wishes to work to act as chairman of the advisory committee. The chairman, with the advice and approval of the executive officer of the department, may select two or more others to serve on the committee, so that the several fields related to the student's special interest will be represented. A purpose of the advisory committee (beyond guiding the student throughout his graduate study) is to insure against too narrow specialization. The student shall obtain the signature of the chairman of the committee (thereby signifying his willingness to act) on the Application for Admission to Candidacy Form. Any change in the membership of the Advisory Committee is to be similarly reported.

PRELIMINARY EXAMINATION

Each department will satisfy itself (by examination or other means) that students who signify intent to undertake study for the Ph.D. degree are qualified to do so. The means by which each department makes this evaluation shall be specified in departmental requirements. Students who are thus evaluated will be notified immediately of the results. The results of this preliminary evaluation shall be reported to the Office of the Graduate School on the Application for Candidacy Form filed by the student at least two weeks before the comprehensive examination is attempted.

LANGUAGE REQUIREMENT

Students are required to meet the following language requirements:

Communication Requirement

1. All graduate students for whom English is the native language are required to demonstrate at least second-year college proficiency in a foreign language of their choice. This requirement may be satisfied in the following ways:

- a. The student's undergraduate transcript may be presented, showing completion with a grade of *C* or better of at least 3 semester hours of a fourth-semester undergraduate

college course in a foreign language. The transcript must accompany the student's Application for Admission to Candidacy when it is submitted to the Graduate School.

- b. The student may take the Graduate School Foreign Language Test (GSFLT) of the Educational Testing Service before or after admission to the Graduate School. Students should check with the Graduate School for the passing score required for each language.
- c. If the student wishes to demonstrate competence in a language for which the GSFLT is not available, a test designed and administered by the appropriate language department at the University of Colorado may be taken, with the passing criterion to be set comparable with the above GSFLT criterion.
- d. The student may register at the University for any fourth-semester course in a foreign language and pass it with a grade of *C* or better. (Registration in such courses is contingent upon the language department's approval.)

A student who elects b, c, or d above must complete the requirements before the Ph.D. comprehensive examination may be scheduled.

2. Students whose native language is not English will, by passing their courses and completing their graduate work at the University, demonstrate sufficient ability in English to meet the communication requirement.

Special Languages

When special languages are needed as tools to read foreign literature in a particular field, the individual academic departments may require further training in foreign languages for all their Ph.D. graduate students. The choice and number of languages as well as the required levels of skill and the methods of testing these skills are determined by the individual departments.

CREDIT BY TRANSFER

Resident graduate work of high quality earned in another institution of approved standing will not be accepted for transfer to apply on the doctorate until after the student has established in this Graduate School a satisfactory record in residence, but such credit must be transferred before the student makes application for admission to candidacy for the degree. Such transfer will not reduce the minimum residence requirement at this University, but it may reduce the amount of work to be done in formal courses.

The maximum amount of work which may be transferred to this University, dependent upon the doctoral degree sought, is noted below:

Degree	Semester Hours
Ed.D.	16
Ph.D.	10

D.B.A.	10
D.M.A.	10

Unless otherwise indicated by departmental requirements, all 500-600-level courses taken for the master's degree at the University of Colorado may be applied toward the doctor's degree at this University.

Requests for transfer of credit to be applied toward an advanced degree must be made on the form specified for this purpose and must be submitted to the Graduate School before the student makes application for admission to candidacy for the degree.

This form is to be completed by the student, endorsed by the adviser, the departmental chairman or a designated representative, and the dean of the college if applicable, and sent to the Graduate School. An official transcript of credits must accompany the request. (Information required: course title, number, credit hours, when and where taken, grade received, and certification that the student was enrolled in graduate school at the time.) To be eligible for courses to be considered for transfer, a student must have a *B* average in all courses taken in Graduate School at the University of Colorado.

RESIDENCE

The student must be properly registered to earn residence credit. The minimal residence requirement shall be six semesters of scholarly work beyond the attainment of an acceptable bachelor's degree. Mere attendance shall not constitute residence as the word is here used. Residence may be earned for course work completed with distinction, for participation in seminars, or for scholarly research performed here or elsewhere under the auspices of the University of Colorado.

As a guiding policy in determining residence credit for employed students, those who are employed in three-fourths to full-time work which does not contribute directly to their program toward a degree may not earn more than one-half residence credit in any semester. Students who are employed more than one-fourth time and less than three-fourths time in work that does not contribute directly to the degree may earn not more than three-fourths residence credit. Those who have one-fourth time employment or less may earn full residence credit. (All these provisions are subject to the definition of residence credit given in the preceding paragraph). In case the interpretation of residence credit for any student needs to be clarified, a decision will be made by the chairman of the student's advisory committee, the executive officer of the student's major department, and the dean of the Graduate School.

Two semesters of residence credit may be allowed for a master's degree from another institution of approved standing, but at least four semesters of residence credit, two of which must be consecutive in one academic year, must be earned for work (course and/or dissertation) taken at this University.

CONTINUOUS REGISTRATION REQUIRED FOR DOCTORAL CANDIDATES

A student who is certified as Candidate for the Ph.D., D.Mus.A., Ed.D., or D.B.A. degree, or who has received permission to take the comprehensives and passes them prior to meeting the language requirement, must enroll and pay tuition for fall and spring semesters of each year until either attaining the degree or formally resigning as a candidate. This continuing registration is independent of whether the candidate is in residence at the University. (See also section on Residence.)

APPLICATION FOR ADMISSION TO CANDIDACY

A student must make formal application for admission to candidacy for the Ph.D. degree on forms supplied by the Graduate School office at least two weeks before the comprehensive examination is attempted.

A student shall have earned at least four semesters of residence, shall have passed the language requirements and shall have passed the comprehensive examination before admission to candidacy for the degree.

COMPREHENSIVE EXAMINATION

Before admission to candidacy for the Ph.D. degree, the student must pass a comprehensive examination in the field of concentration and related fields. This examination may be oral, written, or both, and will test the student's mastery of a broad field of knowledge, not merely the formal course work completed. The oral part is open to members of the faculty. *The student must be registered at the time the comprehensive examination is attempted.*

The examination shall be conducted by an examining board appointed by the chairman of the department concerned and approved by the dean. The board shall consist of the advisory committee and additional members as necessary to a minimum of five. A successful candidate must receive the affirmative votes of a majority of the members of the examination board. In case of failure, the examination may be attempted once more after a period of time determined by the examining board.

TIME LIMIT

If a student fails to complete all requirements for the degree within four years of the date on which the comprehensive examination was passed, a second examination similar in extent to the first will be required before the candidate may take the final examination. If this second comprehensive examination is failed, it may be attempted once more after not less than eight months of further work.

THESIS REQUIREMENTS

A thesis based upon original investigation and showing mature scholarship and critical judgment as well as familiarity with tools and methods of research must be written upon some subject approved by the student's major department. To be acceptable, this

dissertation should be a worthwhile contribution to knowledge in the student's special field. It must be finished and submitted in typewritten form at least 30 days (in some departments, 90 days) before the day of the final examination and must be formally approved and made available for inspection by the examining committee before the final examination may be taken.

In mechanical features all dissertations must comply with the specifications of the Graduate School. (See "Graduate School Specifications for Master's Theses and Doctoral Dissertations" in *A Manual for Thesis Typing at the University of Colorado*, by Margaret Smith Koerner.)

It is the student's responsibility to notify the Graduate School of the *exact* title of the dissertation at least six weeks prior to the commencement at which the student will graduate. This title will be printed in the commencement program.

One formally approved typewritten copy of the thesis, including abstract, plus one additional copy of the title page and abstract must be filed in the Graduate School office at least *two weeks* before the date on which the degree is to be conferred.

The abstract, not to exceed 600 words, will be published in *Dissertation Abstracts*. The determination of what constitutes an adequate abstract shall rest with the major department.

Students working toward the Ph.D. and other doctoral degrees, except the D.Mus.A. degree, must register for thesis for a specific number of hours in any term of residence in which such work is being done; *the registered credit for thesis must total a minimum of 16 or a maximum of 24 semester hours, the total number of hours depending upon how much credit is to be given for the thesis.*

All theses must be signed by not fewer than two members of the major department staff who are regularly engaged in graduate instruction.

All approved theses are kept on file in the library.

When the thesis is deposited in the Graduate School, the candidate must pay the thesis-binding fee and sign an agreement with Xerox University Microfilms to allow for publication in *Dissertation Abstracts International* and to grant Xerox University Microfilms the right to reproduce and sell (a) copies of the manuscript in microform and/or (b) enlarged copies of the manuscript made from microform. The author retains all rights to publish and/or sell the dissertation by any means at any time except by reproduction from negative microform.

FINAL EXAMINATION

After the thesis has been accepted, a final examination of the thesis and related topics will be conducted. This examination will be wholly or partly oral, the oral part being open to anyone. The examination will be conducted by a committee appointed by the dean, which will consist of at least five persons, one of whom must be from outside the student's department. More than one dissenting vote will disqualify the candidate in the final examination.

Arrangements for the final examination must be made in the dean's office at least two weeks in advance. The examination must be scheduled not later than two weeks before the date on which the degree is to be conferred. A student must be registered at the time of the final examination.

Professional Degrees

The prerequisites and requirements for professional degrees will be found in the appropriate departmental material in this catalog.

MASTER'S AND DOCTORAL DEGREE CANDIDATES

Students planning to graduate should obtain current deadline dates in the office of the Graduate School. It is the graduate student's and the department's responsibility to see that all requirements and deadlines are met (i.e., changing of *IW* grades, notifying the Graduate School of final examinations, etc.).

Departments or program committees may have additional deadlines which must be met by graduate students in that department or program. It is the student's responsibility to ascertain such requirements and to meet them as designated by the department or program chairman. Medical students should contact the Graduate School office at the School of Medicine for specific dates.

Interdepartmental Programs

See departmental listings in the college and school sections of this catalog for descriptions of graduate programs.

The following are descriptions of interdepartmental programs, medical division programs, and the graduate nursing program.

APPLIED PHYSICS

Students who wish to enter the Applied Physics Program must be admitted to either the Department of Electrical Engineering or the Department of Physics and Astrophysics. Applied physics should be designated on the part of the physics or electrical engineering application form which asks for the intended specialty.

COURSE REQUIREMENTS

Each student accepted into the program will be assigned a faculty adviser who will aid in developing a personalized curriculum to meet the student's individual goals. The credit-hour requirement for both the M.S. and Ph.D. degrees is consistent with the requirements of the department in which the student is enrolled: at least 24 semester hours which include credit for thesis work is required normally for the M.S., and at least 39 hours plus thesis for the Ph.D. Under special circumstances, students will not be required to write an M.S. thesis before proceeding to the Ph.D. program.

A list of currently available courses which will be accepted for credit towards the M.S. and Ph.D. degrees in applied physics is available from the chairman of the Applied Physics Program. Courses not listed require the approval of the student's faculty adviser for credit toward advanced degrees. The students will be expected to complete basic courses in the following areas consistent with the requirement of their originating departments: quantum mechanics, electricity and magnetism, and mathematical methods.

ASTROPHYSICS

The purpose of the interdepartmental program in astrophysics is to prepare students for research in such topics as solar system physics, stellar astrophysics, physics of the interstellar medium, and galactic and extra-galactic astronomy.

Students wishing to pursue graduate work leading to the Ph.D. degree in astrophysics must apply for admission to, and be formally associated with, either the Department of Physics and Astrophysics or the Department of Astro-Geophysics, according to their undergraduate backgrounds and interests. In addition, such students must apply for admission to and be accepted by the astrophysics program. Students who are already enrolled in one of the participating departments may also apply.

Entering students will take any preliminary examination and meet any other entry requirements specified by the department concerned. After admission to the program, each student will be assigned an advisory committee of three faculty members who will be responsible for supervising the academic progress of the student. Each student will present to this committee for approval a written statement outlining plans for course work and individual study for each forthcoming semester. Continuation in the astrophysics program will be contingent upon a student's successful progress in courses and study as determined by his advisory committee.

All students will take a comprehensive examination, written and oral, to be set on a broad range of topics in astrophysics together with appropriate areas of physics and mathematics. Students must meet all general requirements, including any language requirements, imposed by the Graduate School. Students must present an acceptable thesis and pass a final oral examination on the thesis.

Financial support for students in the program in the first year or two is usually obtained from teaching assistantships in the student's department. All students are recommended to teach for at least one year and in some cases for two years. Financial support is often available from research assistantships in one of the departments or in local scientific organizations (JILA, LASP, HAO).

Students are expected to become proficient in at least four of the following areas of astrophysics:

Solar physics	Stellar atmospheres
Planetary physics	Stellar interiors

Interplanetary physics	Interstellar medium
Observational astrophysics	galaxies

Students are also expected to become proficient in three of the following areas of physics:

Quantum mechanics	Fluid dynamics
Electromagnetic theory	Plasma physics
Statistical mechanics	

Students in the Department of Physics and Astrophysics must include quantum mechanics and either electromagnetic theory or statistical mechanics in their selected areas of study. Those in the Department of Astro-Geophysics must include either plasma physics or fluid dynamics.

Students will normally take a small number of special courses in other areas of astrophysics or physics appropriate to their specialty. The precise selection of courses will be made by the student given the approval of his advisory committee. The comprehensive examination will test the knowledge of the student in his chosen fields. Courses available at present which are closely related to the astrophysics curriculum include:

<i>Astrophysics</i>	<i>Semester Hours</i>
A.G. 533. The Sun (Aph. 664)	3
A.G. 633. Advanced Solar Physics	3
A.G. 525. Planetary Aeronomy	3
A.G. 530, 630. Magnetosphere and Interplanetary Space	3
A.G. 590. Introduction to Space Science (Aph. 590)	3
A.G. 602. Physics of the Planets	3
A.G. 624. Physics of Planetary Airglows	3
A.G. 640. Radio Astronomy	3
Aph. 660. Stellar Astrophysics	3
Aph. 661. Stellar Atmospheres	3
Aph. 662. Stellar Interiors	3
Aph. 663. Physics of the Interstellar Medium	3
Aph. 665. Observational Astronomy (A.G. 683)	3
Aph. 666. Galaxies and Cosmology	3
Aph. 696. Special Topics in Astrophysics	3
<i>Physics</i>	
A.G. 511. Internal Processes in Gases	3
A.G. 515, 516. Plasma Physics (Phys. 515, 516)	3
A.G. 540, 541. Fluid Dynamics	3
A.G. 555. Radiative Transfer	3
A.G. 615. Magnetohydrodynamics	3
Phys. 603, 604. Advanced Mathematical Physics I and II (or A.G. 554. Mathematical Methods in Astro-Geophysics)	3
Phys. 621. Theoretical Mechanics	3
Phys. 625, 626. Quantum Mechanics	3
Phys. 631, 632. Electromagnetic Theory	3
Phys. 644. Statistical Mechanics	3
Phys. 652. Atomic, Molecular and Nuclear Processes	3
Phys. 656. Atomic and Molecular Spectra	3

Course descriptions are found in appropriate departmental listings in the Course Descriptions section.

Other courses available in the Department of Physics and Astrophysics and Department of Astro-Geophysics may also be applicable to a student's field of specialization. In planning their programs students should note that while some of these courses are offered annually, others are offered only alternate years, and some less frequently and only on demand.

Applications for admission to the program should be addressed to the appropriate department.

BEHAVIORAL GENETICS

The Institute for Behavioral Genetics offers a training program in behavioral genetics *but is not a degree-granting unit* of the University.

A student wishing to specialize in behavioral genetics must be regularly enrolled as a graduate student in an academic department of the University and must satisfy all requirements of that department. In addition, courses in behavioral genetics will be required.

In general, each student entering the program must demonstrate competence in the subject matter of general genetics either by satisfactory performance on a comprehensive examination administered by the institute or by satisfactorily completing EPOB 383. Unless equivalent subject matter has already been taken, first-year graduate students will be required to enroll in Psych. 410 (Beh. Gen.). A research project under the supervision of a faculty member of the institute must also be initiated during the first year.

During the first two years in the program, each trainee shall complete two semesters of Psych. 510 (Concepts in Behavioral Genetics), one course in molecular genetics (Chem. 481 or 581, or MCDB 384), and one course in population or quantitative genetics (Psych. 412/512 or EPOB 579).

During each semester after the first year, each trainee shall enroll in Psych. 610 (Seminar in Behavioral Genetics) and shall be actively engaged in research in behavioral genetics.

Other courses directly relevant to the program (but not required) are Behavioral Genetics Laboratory (Psych. 411), Advanced Topics in Population Genetics (EPOB 582), and Research in Behavioral Genetics (Psych. 601).

A training program in behavioral pharmacogenetics is available for advanced graduate students in biology, pharmacy, psychology, and possibly other departments. Further information about this interdisciplinary program can be obtained from the institute.

CHEMICAL PHYSICS

The purpose of the interdepartmental doctoral program in chemical physics is to prepare students for research in such interdisciplinary fields as atomic and molecular radiative processes, nuclear and electron magnetic resonance spectroscopy, laser chemistry and physics, x-ray crystallography, molecular quantum mechanics, statistical mechanics, quantum chemistry, and kinetics.

Students wishing to pursue graduate work leading to the Ph.D. degree in chemical physics should apply for admission to, and will be formally associated with, either the Department of Chemistry or the Department of Physics and Astrophysics, in accordance with their undergraduate backgrounds.

Entering students will take the qualifying examination in the area of their undergraduate major, but the comprehensive examination will test their knowledge in the relevant aspects of both chemistry and physics.

Certain requirements associated with the regular Ph.D. programs in the participating departments will be replaced by some in the complementary field; each student's program of course work and research will be individually planned according to the student's special needs.

Some of the courses that will be used in planning most programs in chemical physics are listed below. For descriptions of their contents, refer to the listings of the participating departments.

	<i>Semester Hours</i>
Chem. 501 and 506. Advanced Inorganic Chemistry	6
Chem. 531 and 532. Advanced Organic Chemistry	6
Chem. 550. Chemical Dynamics	3
Chem. 551. Advanced Chemical Thermodynamics	3
Chem. 552. Introductory Quantum Chemistry	3
Chem. 553. Statistical Mechanics	3
Chem. 554. X-ray Analysis and Molecular Structure	3
Chem. 556. Physical Chemistry of Macromolecules	3
Chem. 559. Advanced Molecular Spectroscopy	3
Chem. 653. Nuclear and Electron Magnetic Resonance Spectroscopy	3
Chem. 800 or Phys. 800. Doctor's Thesis	16-24
Phys. 621. Theoretical Mechanics	3
Phys. 625 and 626. Introduction to Quantum Mechanics	6
Phys. 631 and 632. Electromagnetic Theory	6
Phys. 644. Statistical Mechanics	3
Phys. 653. Chemical Physics	3
Phys. 656. Atomic and Molecular Spectra	3

The program is administered by an interdepartmental committee. For further information, contact either the chairman, Department of Chemistry, or the secretary, Department of Physics and Astrophysics.

GEOPHYSICS

This is an interdisciplinary and interdepartmental program leading to the Ph.D. degree. It is designed to encourage students with a wide variety of undergraduate backgrounds to pursue graduate studies in solid earth geophysics and is flexible enough to allow a student to specialize in one of the many aspects of geophysics, while providing a general background in geophysics and an in-depth training in the relevant parts of the parent disciplines.

Students wishing to enter the program should apply for admission and will be formally associated with one of the following departments: geological sciences, astro-geophysics, physics and astrophysics, aerospace engineering sciences, civil and environmental engineering, electrical engineering, and mechanical engineering. The choice will depend upon the student's primary area of interest. A committee on geophysics assists in the choice of department and the planning of individual academic programs. The preliminary examination for the Ph.D. is administered by the student's department, while the comprehensive examination and thesis are conducted by an interdepartmental committee.

Exceptional research opportunities are available through the Cooperative Institute for Research in Environmental Sciences (CIRES). Financial support is available either through teaching assistantships in the

student's department or as research assistantships on research programs. These are awarded on a competitive basis to students applying to the program. For further information contact Professor J. C. Harrison, CIRES, or the Department of Geological Sciences.

MASTER OF BASIC SCIENCE PROGRAM

The program is an interdisciplinary one leading to the Master of Basic Science degree. It provides an opportunity for present and prospective mathematics and science professionals and others to extend and/or broaden their training in computer science, mathematics, museology, and the natural sciences at advanced undergraduate and graduate levels. These professionals would include public school teachers, industrial scientists, engineers, business persons, and others.

The student may elect the mathematics, museology, or science option as described below. Wide latitude is possible in the details of a degree plan so that each student may follow a course of study most pertinent to his or her interest. Each degree plan must be approved by the MBS executive committee.

The Master of Basic Science degree is supervised by an administrative committee appointed by the dean of the Graduate School with representation from the following departments: anthropology; astrogeophysics; environmental, population, and organismic biology; chemistry; computer science; geological sciences; mathematics; molecular, cellular, and developmental biology; museum; and physics and astrophysics. The Colorado Springs and Denver campuses are also represented. The deans of the College of Arts and Sciences and the Graduate School are *ex officio* members.

Application should be made to the Master of Basic Science Program, Ketchum 306E, University of Colorado, Boulder, Colorado 80309.

REQUIREMENTS FOR ADMISSION

1. General regulations for admission to the Graduate School apply (see Admission Requirements).

2. A student must present at least 40 semester hours in the natural sciences and mathematics, preferably including one year of calculus. Students may be admitted to the program with a deficiency in calculus, but must remedy the deficiency within two years after admission by completing one year of calculus (or other courses in mathematical subjects on approval by the executive committee) with a grade of C or better.

REQUIREMENTS FOR THE MASTER OF BASIC SCIENCE DEGREE

1. General regulations of the Graduate School governing the award of the master's degree apply (see Master of Arts and Master of Science) except as modified below.

2. Thirty semester hours of basic science courses numbered 300 and above, taught by members of the

graduate faculty, and selected from two or more departments. Of these 30, 12 hours or more must be from courses numbered 500 and above. Courses fulfilling sequence requirements may be selected only from among the departments listed below. See mathematics, museology, and science options below.

Anthropology (museology option only)	Geology
Astro-Geophysics	Mathematics
Chemistry	Molecular, cellular, and developmental biology
Computer science	Museum (museology option only)
Environmental, population, and organismic biology	Physics and astrophysics

All courses applied toward the degree must be taken over a period of five years or six successive summers. Courses may be taken at each or at all three University of Colorado campuses. A maximum of 8 hours of graduate level course credit of B or better grade transferred from other institutions may be applied toward the M.B.S. degree, provided that such credit has been approved by both the M.B.S. executive committee and the appropriate University of Colorado department. Students already in the program must obtain approval prior to enrolling in courses they may wish to transfer.

3. Completion of a paper describing a research project or other specialized study on a topic approved by the Executive Committee. Approval of the topic is given on the basis of a written explanation or précis submitted no later than the end of the semester in which the student completes 21 hours of course credit or the completion of the third year after entering the program, whichever is earlier. The final paper must be approved by the student's committee and is in lieu of the comprehensive examination.

4. Minimum Grade-Point Average. Courses on the 300 and 400 level will be accepted toward the degree only with grades of A or B; 500- and 600-level courses will be accepted toward the degree with grades of A, B, or C. The student must have a B average in all courses taken subsequent to admission to the program, including courses not actually offered for the degree.

MATHEMATICS OPTION

1. A reasonable degree of competence is required in the fields of analysis, algebra, and geometry. A minimum of 15 semester hours of upper division courses (300-level or above) in mathematics must be offered for the degree, including at least 3 hours of analysis, 6 hours of algebra, and 3 hours of geometry.

2. One upper division sequence of at least 6 semester hours in any of the physical and biological sciences named above. With permission, two independent one-semester courses in the same area may be substituted for the one-year sequence.

3. Upper division electives in science, mathematics, or computer science, to complete an approved 30-hour degree plan. Of these 30, 12 hours or more must be from courses numbered 500 and above. The 30 hours may also include 3 semester hours of courses or seminars in secondary school mathematics

teaching, history of mathematics or science, or philosophy of mathematics or science.

MUSEOLOGY OPTION

1. At least 8 but not more than 12 semester hours of courses offered by the museum. Alternatives are the sequence Musm. 401-402-403; or Musm. 401 and a selection of additional courses in museum. Three to 6 semester hours of courses in the College of Business and Administration (of which 3 semester hours must be in small business management) are required. The total museum-business semester hours may not exceed 15.

2. An upper division sequence (300-level or above) of at least 6 semester hours in one of the departments (other than museum) represented in the program.

3. Upper division electives in science, mathematics, or computer science to complete an approved 30-semester-hour degree plan. Of these 30, 12 hours or more must be from courses numbered 500 and above.

SCIENCE OPTION

1. An upper division sequence (300-level or above) of at least 6 semester hours in each of two of the physical and biological sciences named above. With permission, two independent one-semester courses in the same area may be substituted for one of the one-year sequences.

2. Upper division electives in science, mathematics, or computer science, to complete an approved 30-semester-hour degree plan. Of these 30, 12 hours or more must be from courses numbered 500 and above. The 30 hours may also include 3 semester hours of upper division courses or seminars in secondary school science teaching, history of science, or philosophy of science.

MASTER OF ENGINEERING PROGRAM

The Master of Engineering degree program is administered by the Graduate School through the departments of engineering. The requirements for admission and for quality and quantity of academic work are essentially the same as for the Master of Science awarded in the College of Engineering and Applied Science.

The principal difference between the Master of Engineering degree and the Master of Science is that the Master of Engineering is intended to meet the needs of those practicing engineers who are working full time outside the University and who wish to carry on an integrated program of studies in an exceptionally broad interdisciplinary field in engineering and allied subjects related to the individual student's professional work. Examples of broad interdisciplinary fields include engineering and the social sciences, engineering and the biological sciences, engineering and law, and engineering and business administration. A successful program to meet these needs requires greater flexibility in operation than is normally possible or intended under the existing Master of Science degree program.

The program makes use of the Audiovisual College Education program, and other continuing televised offerings of the University.

The degree is not intended as a means to permit a random, unguided selection of courses. Each prospective student is required to present a well-defined objective in order to be admitted to the program. An academic program is developed to meet this objective in consultation with faculty advisers.

REQUIREMENTS

The requirements for the degree are 30 credit hours plus a written report on a creative investigation, which may be related to the student's professional work. The report will be of the same general quality as that required for the thesis for the Master of Science degree and must be defended orally, but does not in itself carry credit, nor require registration as specified by the rules under Master's Thesis or Report. It may be based upon work done for credit under independent study. At least 15 credit hours must be in engineering at the 500 level or above. As many as 15 credit hours may be taken outside of engineering. Credit in courses below the 400 level will not apply toward degree requirements.

Requirements relating to the following items are the same as those for the Master of Science degree as awarded in the College of Engineering and Applied Science: admission to Graduate School, application procedures, registration, quality of graduate work, status, credit by transfer, residence, admission to candidacy, and time limit.

The admission of each student to graduate study, approval of the degree program, admission to candidacy for the degree, and approval of the awarding of a degree are to originate through a specific department of the College of Engineering and Applied Science in the same manner as for the established Master of Science program. An advisory committee, consisting of not fewer than three faculty members, will be appointed for each student by the major department promptly upon the student's beginning work toward the degree. At that time a plan of study shall be completed and a copy placed on record with the office of the associate dean of engineering for graduate and research programs. Changes in the plan must have the concurrence of the committee and must be reported to the dean.

The members of each advisory committee shall be chosen from the various interdisciplinary academic areas represented in the student's program and will be from more than one department. The advisory committee guides the student. It is responsible for approving the individual's degree program and admission to candidacy; it approves the student's written report and the awarding of the degree.

The student should see also the requirements of the departments involved.

MATHEMATICAL PHYSICS

The interdepartmental program leading to the degree Doctor of Philosophy in mathematical physics

is open to well-qualified students who have been admitted to graduate study in the Department of Mathematics or in the Department of Physics and Astrophysics, and who have acceptable undergraduate backgrounds in both fields. The program is administered by the mathematical physics steering committee, whose responsibilities include the screening of applicants and the monitoring of the progress of those admitted.

Application for admission to the program can be made at any time by letter, addressed to the steering committee in care of one of the two departments, or by completing a form available in the departmental offices and returning it to one of them. Admission into the program normally occurs after about two years of graduate study, when the student has passed the examinations on course content given in the department as well as a previous examination on the undergraduate courses in the other field.

The doctoral thesis will describe original, independent research performed by the student in some area of mathematical physics or of the related mathematics. It will be written under the supervision of a member of one of the participating departments, who need not be a member of the steering committee.

The curriculum for successful completion of the program will usually include, in addition to the core courses in the department in which the student is enrolled, at least two core courses in the second field (see tables below) and two semesters of advanced mathematical physics (Math. 653, 654, 655, 656, same as Phys. 603, 604, 605, 606).

Mathematics Core Courses for Students in the Physics Department
(in addition to mathematics required of all physics students)

- Math. 501, 502. Topology
- Math. 513. Algebra
- Math. 523, 524. Differential Geometry
- Math. 531, 532. Real Analysis
- Math. 635, 636. Functional Analysis

Physics Core Courses for Students in the Mathematics Department

- Phys. 621. Mechanics
- Phys. 625, 626, 627. Quantum Mechanics
- Phys. 631, 632. Electromagnetic Theory
- Phys. 644. Statistical Mechanics

Additional information may be obtained from the Department of Mathematics, from the Department of Physics and Astrophysics, and from any member of the steering committee.

TELECOMMUNICATIONS

The telecommunications program is interdisciplinary, involving the Departments of Communication, Electrical Engineering, Finance, Political Science, and Sociology, leading to a Master of Science degree in telecommunications. The object of this 12-month program is to provide graduate professional education for persons interested in the management of telecommunication systems. Such positions require knowledge about the engineering aspects of communication theory, about governmental regulations

relating to telecommunications, and about the sociological and economic aspects of the operation and growth of telecommunications systems.

It is expected that participants in the program will include both midcareer professional persons and beginning graduate students.

Applicants for admission normally have their undergraduate degrees in engineering, business, or liberal arts areas. Inquiries should be directed to Chairman, Graduate Committee on Telecommunications, Engineering Center OT 2-32.

Although this is a 12-month program, because of the large range of material available for study, students are encouraged where possible to register for an 18-month period.

The program consists of the following:

<i>Fall Semester</i>	<i>Semester Hours</i>
E.E. 531. Telecommunications Systems	3
E.E. 534. Introduction to Telecommunications System Theory ¹	3
E.E. 201. Introduction to Computer Science ¹	3
Comm. 606. Management of Communication Systems	3
P.Sc. 580. The Political System and Telecommunications	3
E.E. 597. Speakers Seminar	0
	15
<i>Spring Semester</i>	
E.E. 537. Telecommunications Laboratory ¹	2
E.E. 532. Telecommunications System Theory	
or	
E.E. 567. Reliability and Queuing Theory	3
E.E. 591. Electromagnetic Wave Transmission	
for Telecommunications	3
Fin. 580. Structure and Financing of the Telecommunication	
Industry	3
P.Sc. 581. Legal Structure and Regulation	3
E.E. 597. Speakers Seminar	0
	14

<i>Summer Session</i>	<i>Semester Hours</i>
E.E. 591. Cable TV	2
E.E. 592. Contemporary Issues in	
Telecommunication Policy	2
Soc. 411/511. The Information Society	2
Telecommunications Project or Thesis	6

Six hours of electives will normally be taken at the 500 level. For students without a previous technical background, and as a review for students with a technical background, E.E. 534 (Introduction to Telecommunications System Theory) is normally recommended. Frequently chosen electives are EDEE 595 (Selected Topics/Engineering Management), Comm. 564 (Mass Media and Society) and Comm. 660 (Seminar in Broadcasting). A 3-hour elementary computer course, E.E. 201, is available for students without any computer background.

E.E. 532 is concerned with traffic theory and makes only a limited use of mathematics. A student who has taken the introductory course, E.E. 534, will be adequately prepared for it. Students with a suitable technical background would normally take E.E. 567 instead.

E.E. 597, Speakers Seminar, is scheduled on a weekly basis. It carries no credit, but exposes the student to a range of topics from speakers representing

¹May not be necessary for recent engineering graduates or others with the relevant experience.

many different sides of the telecommunication industry.

The student will register for a total of 6 hours of credit for a particular project or thesis. The courses registered for will be decided upon for each individual by a graduate committee and the student's adviser. Additionally, it is expected that there will be short conferences and seminars offered in the program, including summer courses on cable TV, issues in telecommunication policies, and social effects. The topic and format will vary from year to year.

Graduate School Division of the Medical Center

ANATOMY

DEPARTMENTAL REQUIREMENTS

Students wishing to pursue graduate work in anatomy leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees, and Graduate School Division of the Medical Center Admission Requirements.

Prerequisites. A student wishing to major in anatomy should have completed the following:

1. Equivalent of an undergraduate major in the field of zoology or biology, including general zoology, comparative anatomy, genetics, and embryology.
2. Courses in chemistry (inorganic, organic, and physical), college physics, integral calculus.
3. Reading knowledge of at least one foreign language.

The Graduate Record Examination is required unless the candidate has attained a master's degree, but is desirable in any event.

Anat. 501A-11. Human Anatomy. *Winter.* Designed to help the student achieve a reasonably competent knowledge and understanding of the structure and function of the human body through lectures, discussions, cadaver dissection, and investigation of clinical correlates. Willson, Cunha.

Anat. 501B-9. Human Anatomy. *Winter.* Course provides, in less time than is normally required, a comprehensive study of the structure and function of the human body. Thorough dissection of one major cadaver area and study of other regions through presentations of dissections by other students in the class. The course also provides training in medical application of anatomy and includes audiovisual and computer approaches. Opportunity is also provided for advanced medical students to enhance their knowledge of anatomy through dissection in a specific area of interest. Whitlock, Jones.

Anat. 502-5. Microanatomy of Cells and Tissues. *Fall.* Lectures describe the way in which cells and tissues execute specific physiological functions. Laboratory sessions permit firsthand light microscopic observations of the cellular architecture of mammalian and human tissues. The constant interrelationship extant between structure and function is strongly emphasized. Roper, Moran, Hahn.

Anat. 503-6. Neuroanatomy. *Spring.* Provides a basic understanding of the various sensory, motor, and associative pathways of the human central nervous system, through lectures, examination of sectioned or dissected material, and clinical illustrations. Nolte, Finger, Smith.

Anat. 602-1. Departmental Seminar. *Fall, Winter, Spring.* Weekly scientific reports on various original research projects are presented by faculty, students and guest scientists. Roper.

Anat. 625-4. Introduction to the PDP-12. *Winter.* Three hrs. lect. and two hrs. lab. Assembly language programming of the PDP-12 is emphasized, but some time is spent in the description of currently available software. PDP-12 hardware is described as it is encountered in the programming portion of the course. Time on the PDP-12 is available during the course. Prer., consent of instructor. Boyle.

Anat. 632-3. Human Embryology. *Fall.* Lectures and demonstrations on the principles of human development including fertilization, early development through implantation, development and function of extra-embryonic membranes, organogenesis, and congenital malformations. Wherever possible, causal as well as descriptive aspects of these processes will be discussed. Lasher.

Anat. 650-credit to be arranged. Research in Anatomy. *All quarters.* Programs of investigation in fields of anatomy including neuroanatomy, cell biology, developmental biology, endocrinology, fine structure, and chemistry. Whitlock and staff.

Anat. 700-6 to 9. Master's Thesis. *All quarters.*

Anat. 800-24 to 36. Doctor's Thesis. *All quarters.*

ANESTHESIOLOGY

Graduate instruction in anesthesiology is offered to develop clinical anesthesiologists, teachers, and investigators. An integrated program is presented over a three-year period. At least the third year may be spent in original investigation in a preclinical department, the anesthesiology department, or in appropriate clinical departments such as surgery, obstetrics, or pediatrics. In certain cases, training for a one- or two-year period may be provided for special aspects such as pediatric, cardiac, obstetric, or transplant anesthesia. The experience (didactic and practical) fulfills the requirements of eligibility of the American Board of Anesthesiology.

Eligible candidates should have the M.D. degree and two years of advanced training in anesthesiology. Special consideration will be given to M.D.'s without advanced training, nurse anesthetists, and physician's assistants in anesthesia who desire to enter either academic anesthesia or anesthesiology research. A thesis based on original investigation will be required for a master's degree. This master's degree may be a step toward a doctoral degree in another discipline.

Anes. 667. Research in Anesthesiology. *All quarters.* Prer., at least two years of graduate training in anesthesiology.

Anes. 669-1. Seminar in Anesthesiology. *All quarters.* Three hours per week. Attended by all clinical graduate students in anesthesiology. Stresses application of basic sciences to anesthesiology.

Anes. 700-4 to 6. Master's Thesis. *All quarters.*

BIOCHEMISTRY

Students wishing to pursue graduate work in biochemistry leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

Prerequisites. As prerequisites for graduate work in biochemistry, a student should take the following courses required of undergraduate majors in chemistry.

Inorganic chemistry two semesters
Qualitative analysis one semester
Quantitative analysis one semester

Organic chemistry	two semesters
Physical chemistry	two semesters
Physics	two semesters
Calculus	two semesters

A student should also take two semesters of biology or two semesters of general zoology.

These are minimum requirements, and more work in chemistry and biology is desirable. For descriptions of the research programs in the department, the applicant may refer to the American Chemical Society *Directory of Graduate Research* and Peterson's *Annual Guide to Graduate Study in the Biological Sciences*.

Biochem. 500-6. Principles of Biochemistry. *Fall.* Primarily for medical and dental students. Protein structure and relationships of structure to biological function. Fundamentals of free energy, bioenergetics, and catalysis. Pathways, mechanisms, and regulation of carbohydrate, lipid, and amino acid metabolism. Biological oxidation and energy transductions. Theory of enzyme kinetics. The structure, function, and metabolism of peptide and steroid hormones. The metabolism of purine and pyrimidine nucleotides and the structure, synthesis, and function of nucleic acids. The mechanism and regulation of protein biosynthesis. Active transport, regulation of the extracellular environment, pH, and gas exchange. Nutritional requirements and energetics in the human. Abrams and staff.

Biochem. 600-8. General Biochemistry for Graduate Students. *Fall and winter quarters.* A two-quarter course, 4 credits per quarter. (Elective for medical students.) Stresses the relationships between molecular structure and function in biological systems. Designed for students whose aim is a career in research and teaching in biochemistry and allied disciplines. The major areas of biochemistry are covered and should provide the foundation for more comprehensive treatment of specialized subjects which a student may wish to pursue further in advanced courses or in the laboratory.

Biochem. 604-2. Protein Biosynthesis. *Spring.* An interdepartmental course. Current topics relevant to protein biosynthesis and its control will be discussed. Prer., Biochem. 600 or equivalent, consent of instructor. Brown and Erickson.

Biochem. 606-4. Structure and Function of Proteins. *Spring.* An interdepartmental course. Comprehensive treatment of protein structure and enzyme action. Students may elect to take one or both of these courses in a single quarter. Prer., consent of instructor. Bublitz.

Biochem. 609-3. Membranes and Transport. *Spring.* An interdepartmental course with physiology. Lect. course covering the structure and function of biological membranes. Prer., Biochem. 500 or equivalent, consent of instructor. Harold.

Biochem. 610-2. Chemical and Biological Aspects of the Environment. *Winter.* A survey of the chemical changes in the environment and a discussion of the physical and chemical parameters responsible for the alterations. Topics discussed include: the components of the air environment, the gases, particles and aerosols and their rate of formation, dispersion, and degradation. The effects of the various pollutants on animal and plant systems. The water environment and the effect of certain water pollutants on biological systems. Effects of the various classes of pesticides on mammalian systems. The common sources of contamination of the environment by heavy metals and their effect on the health of man. The common preservatives used in food and other household goods. Examples of the production of temporary and permanent changes in the ecology due to the exposure to the various pollutants will be discussed. Some social and political aspects essential to the control of the various pollutants will be discussed. Prer., biochemistry or consent of instructor. Reiss and staff.

Biochem. 612-5, A and B. Modern Techniques in Cell Biology. *Winter, Spring.* (An interdepartmental course). A series of two to three week experiments in cell biology; will include genetics, enzymology, animal cells, DNA replication and hybridization, virology, immunology and electron microscopy. Cummings and staff.

Biochem. 650-credit to be arranged. Research in Biochemistry. *All quarters.* Research projects by arrangement with staff of the Department of Biochemistry. Prer., Biochem. 600 or equivalent, consent of instructor. Abrams and staff.

Biochem. 660-1. Seminar Topics in Biochemistry. *Winter, Spring.* Students will present papers from biochemical journals. Prer., Biochem. 600 or equivalent. Abrams and staff.

Biochem. 700-6 to 9. Master's Thesis.

Biochem. 800-24 to 36. Doctor's Thesis.

BIOMETRICS

The Department of Biometrics offers training leading to either an M.S. or Ph.D. degree. Applicants should note the general requirements for admission to the Basic Science subdivision of the Graduate School at the School of Medicine and should arrange to take the verbal and quantitative portions of the Graduate Record Examination no later than the December testing of the year preceding admission. Complete applications, including transcripts of all colleges and universities attended, letters of reference, and GRE scores should be received by the department by March 1 for admission during the fall quarter. Students are ordinarily accepted into the master's program in alternate years, applying in the spring and beginning studies in the fall of odd-numbered years.

The master's program consists of three quarters of course work followed by a preliminary oral and written examination given at the beginning of the second year and covering the course work. The second year is devoted mainly to the thesis with a comprehensive final oral examination covering the area of the thesis topic, and given when the thesis is essentially finished.

The Ph.D. program is offered in cooperation with the Statistics Department of Colorado State University, Fort Collins. A student would typically receive a master's degree in statistics at Colorado State University, although students with equivalent training will be considered for admission directly into the Ph.D. program. The first post-master's year consists of course work in both biometrics and a minor area, and fulfillment of the language requirement. Ph.D. students usually remain in residence during the summer quarter involving themselves in research, possibly in connection with the minor area, and preparing for the Ph.D. comprehensive examination, usually taken at the beginning of the fall quarter of the second year. The student then proceeds with dissertation research with a final oral examination on the dissertation topic given when the dissertation is complete.

Biomet. 601A-2. Biostatistics Methods. *Fall.* First of a three quarter sequence designed primarily to equip graduate students with a thorough knowledge of the quantitative methods most frequently applied in research. Deals with the elements of the theory of probability and their application in biomedical problems. Preparation for the study of statistical methods.

Biomet. 601B-2. Biostatistics Methods. *Winter.* Estimation, inference, and statistical evaluation of laboratory and clinical findings. Comparison of two groups by t-test and non-parametric methods. Elements of experimental design and the analysis of variance. Regression analysis.

Biomet. 604-2. Random Variables and Stochastic Processes. *Spring.* The binomial and Poisson processes; birth-death and birth-death immigration processes; branching processes; the general

theory of Markov chains, principles of model construction, and applications. Prer., calculus through differential equations.

Biomet. 605-2. Applied Regression Analysis. *Fall.* Simple and multiple linear regression with emphasis on the applications, computer methods, and interpretation of results; methods of multiple non-linear regression.

Biomet. 610-2. Computers in Clinical Medicine. *Spring.* History, principles, and applications of computers in medical environment. Introduction to computer hardware and software with emphasis on needs of clinical computing. Opportunity for experience and research using minicomputer.

Biomet. 613-2. Epidemiology. *Fall, Spring.* Designed primarily for medical students who wish to pursue this subject beyond the elements presented in Biomet. 500.

Biomet. 614-3. Cancer Epidemiology. *Winter.* A survey of present knowledge of causes of human cancer, emphasizing critical analysis of published reports and ways of obtaining further evidence. Each 3-hour unit consists of two informal lectures, one on a group of causal agents and one on a group of related cancers, and a seminar where student reports are presented and discussed. Designed for medical students (after pathology) and graduate students with background in biometrics or other biomedical sciences.

Biomet. 617-3. Analysis of Variance. *Winter.* Introduction to applied analysis of variance with emphasis on problems and designs occurring most frequently in medical data.

Biomet. 618-3. Structured Programming. *Winter.* A structured approach to programming is taught, using the University of Colorado Computing Center's Minnesota FORTRAN compiler (MNF). Top-down development, stepwise refinement, structured walk-through, modularity, hierarchy charts, and pseudo code are among the topics covered.

Biomet. 619A-3. Applied Time Series Analysis. Introduction to time and frequency domain analysis of stationary time series including computer assignments. Topics include: fast Fourier transform (FFT), covariance function, spectral density, autoregression and ARMA models for prediction and spectrum estimation, data smoothing, and prediction of multivariate time series.

Biomet. 619B-3. Applied Time Series Analysis. Spectrum estimation of univariate and multivariable time series (including coherence and phase) using both mini-computer FFT approaches and windowed covariance function methods involving several passes of the FFT. Frequency response function estimation.

Biomet. 620A-3. Computer-Oriented Statistical Methods. *Fall.* First of a three-quarter sequence designed to acquaint the student with the fundamental techniques of applied statistical analysis. Selection, use, and interpretation of packaged statistical programs such as the BMD series will be emphasized.

Biomet. 620B-3. Computer-Oriented Statistical Methods. *Winter.* Continuation of Biomet. 620A.

Biomet. 620C-3. Computer-Oriented Statistical Methods. *Spring.* An introduction to FORTRAN programming retaining the emphasis in applied statistical analysis.

Biomet. 621A-3. Statistical Theory. *Fall.* Introductory coverage of the theory of both discrete and continuous random variables and the application of this theory to statistical problems.

Biomet. 621B-3. Statistical Theory. *Winter.* Theoretical development of the standard parametric procedures most used in both theoretical developments and applied work, including detailed coverage of both estimation and statistical testing procedures.

Biomet. 621C-3. Statistical Theory. *Spring.* Introduction to the theory of the general linear model emphasizing multiple regression and analysis of variance.

Biomet. 622A-3. Consulting Methods. *Fall.* The practical and computational aspects of research problems. The student will analyze problems of increasing complexity throughout the first two quarters.

Biomet. 622B-3. Consulting Methods. *Winter.* A continuation of Biomet. 622A.

Biomet. 622C-3. Consulting Methods. *Spring.* A continuation of Biomet. 622B. This quarter will concentrate on design aspects of medical research studies.

Biomet. 623-3. Bioassay. *Fall.* Quantitative methods in bioassay. Parallel line and slope ratio assays, direct and quantal assays, design considerations.

Biomet. 624-3. Sampling and Survey Methods. *Spring.* Introduction to sampling and survey methods. Advantages of sampling over census, sources of error, simple random sampling, stratified sampling, cluster sampling, non-random sampling, case studies.

Biomet. 625-3. Nonparametric Statistical Methods. Non-parametric methods are used in statistical applications when the more standard techniques are inapplicable. This course will cover the most useful of these tools pertaining to estimation, testing, and measuring association.

Biomet. 627-3. Mathematical and Statistical Genetics. Introduction to the mathematics and statistics of clinical, experimental, and population genetics. Covers selected areas of the theories of probability, statistics, and mathematical modeling which have proved useful in the analysis of genetic traits.

Biomet. 629-3. Epidemiologic Methods. A participating seminar review of research problems in methodology most used in epidemiological studies of chronic diseases.

Biomet. 632-3. Bayesian Inference. Bayesian methods for common statistical problems; decision analysis.

Biomet. 633-3. Survival Curves and Lifetable Analysis. An introductory course in survival curve analysis with emphasis on medical applications.

Biomet. 650. Research. *All quarters.* Time and place to be arranged. Credit to be arranged.

Biomet. 660A-3. Longitudinal Data Analysis. This is the first of a three-quarter sequence in the application of advanced multivariate techniques. The principal topic in the first quarter is the multivariate general linear model, including the underlying theory and usage of available multivariate computer programs.

Biomet. 660B-3. Longitudinal Data Analysis. Continuation of Biomet. 660A. The theory and application of multivariate techniques appropriate for longitudinal data are discussed with emphasis on the growth curve models developed principally in the 1960s.

Biomet. 662-3. Mathematical Modeling in Medicine. Mathematical models of dynamic phenomena are becoming more common in all branches of biology and medicine. This course will survey the mathematical tools necessary for the construction of such models and illustrate some of the currently used models.

Biomet. 700-6 to 9. Master's Thesis. *All quarters.*

Biomet. 800-24 to 36. Doctor's Thesis. *All quarters.*

BIOPHYSICS AND GENETICS

The graduate program gives advanced training to candidates for the Ph.D. degree in general biophysics and genetics, theoretical biophysics, cell biology, and human genetics, and for the master's degree in human genetics.

There are also special interdepartmental programs in human and molecular genetics as well as in cellular and molecular biology. These programs combine this department's facilities and faculty with those of other basic science and clinical departments to provide unusually diverse training opportunities.

MASTER'S PROGRAM

Students wishing to specialize in human genetics may apply for admission to a program leading to a master's degree in human genetics. Requirements for admission include a baccalaureate degree or its equivalent, a minimum undergraduate grade-point average of 2.75, and satisfactory scores on the Graduate Record Examination. Background necessary for the program includes courses in biology, physical chemistry, general physics, differential and integral calculus, organic chemistry, and genetics. In a few cases students may be admitted provisionally while completing course deficiencies.

In general, the program of course work will include instruction in basic sciences fundamental to human genetics, laboratory techniques applicable to human genetics, clinical genetics and genetic counseling, and mathematical genetics. The student will also do research for a thesis.

DOCTORAL PROGRAM

Requirements for admission include a baccalaureate degree, a minimum grade-point average of 3.0 and reasonably good performance on the Graduate Record Examination. Background necessary for the program includes courses in organic chemistry, physical chemistry, biology, physics, and calculus, and evidence of promise for research accomplishment in biomedicine.

Students are expected to show proficiency in one foreign language. Some courses are scheduled yearly but others are given on a biennial basis unless there is sufficient demand.

Biophys-Gen. 502-3. Medical Biophysics and Genetics. *Winter.* Human genetics and its biological basis. Three hrs. lect., one hr. demonstration and discussion. Freshmen medical students and graduate students. Pettijohn and staff.

Biophys-Gen. 600-3. Basic Biomedical Electronics. *Fall.* Covers basic electronic concepts through amplifiers and their characteristics; semiconductors, operational amplifiers, types of transducers and their characteristics, electronic filters, and power supplies. Sadler (with Rock).

Biophys-Gen. 601-3. Topics in Medical Genetics. *Spring, Fall, Winter.* The four major parts of Biophys-Gen. 502 will be covered in greater depth using a standard text in each of the following areas: human cytogenetics, inborn errors of metabolism, population genetics, and genetic counseling. Prer., Biophys-Gen. 502 and/or consent of instructor. Morse.

Biophys-Gen. 602-3. Blood Group Genetics. *Fall.* The genetics of human blood groups will be covered extensively. Other cell membrane antigens such as HLA and platelet groups will be studied also. Prer., consent of instructor. Morse and Kimberling.

Biophys-Gen. 603-3. Genetics of Human Serum Proteins. *Winter.* The genetics of human serum proteins. Immunoglobulins, protease inhibitors, and haptoglobin are studied in detail. Other proteins and antibody polymorphisms are also covered. Prer., consent of instructor. Morse and Kimberling.

Biophys-Gen. 604-3. Genetics of Diseases of the Red Cell. *Spring.* Normal and pathologic variation of red cell enzymes are covered. Diseases of the red cell, such as G6PD deficiency, are studied in detail. ADA deficiency, Porphyrias, and hemoglobinopathies are also covered. Prer., consent of instructor. Morse and Kimberling.

Biophys-Gen. 605-2. Biophysics of Molecular Motion. *Spring.* A discussion of the sources of fluorescence, nuclear magnetic resonance, and electron spin resonance spectra and how these spectra are affected by motion of the source and relaxation processes. The utilization of these spectral methods in elucidating macromolecular structure will be described with emphasis on application to biological membranes. Prer., physical chemistry and consent of instructor. Goad and Sinensky.

Biophys-Gen. 608-2. Topics in Mammalian Cell Biochemical Genetics. *Winter.* In-depth readings and discussion of specific areas of the genetics and biochemistry of mammalian somatic cells. Topics will be arranged between students and faculty and include but are not limited to regulation of metabolic pathways; regulation of development; genetic and biochemical markers, both naturally occurring and induced; biochemical genetics of human genetic diseases; biochemical aspects of cancer chemotherapy with particular emphasis on purine-pyrimidine, glycine and folate metabolism; and the biochemical genetics of cell-surface antigens. Prer., consent of instructor and/or Biophys-Gen. 620 or equivalent. Jones and Patterson.

Biophys-Gen. 609-1. Seminar: Biophysics and Genetics. *Fall, Winter, Spring.* Seale.

Biophys-Gen. 610-1. Seminar: Somatic Cell Genetic Biochemistry and Cancer. *Fall, Winter, Spring.* Consideration of current research progress in genetics, biochemistry, differentiation properties, and malignancy of mammalian cells. Puck.

Biophys-Gen. 611-2. Topics in Regulation and Development. *Winter.* Metabolic controls in prokaryotes and, at the cellular level, in eukaryotes. The relevance of cellular mechanisms of regulation to eukaryotic development. Rickenberg.

Biophys-Gen. 612-3. Eukaryotic Genetics. *Spring.* Discussion of principles of genetics, chromosome structure and function, somatic cell genetics, human genetics and cytogenetics, biochemical genetics, immunogenetics, development and regulation in eukaryotic systems. Prer., biochemistry. Minimum of four students. Kao and staff.

Biophys-Gen. 613-5. Nucleic Acids and Protein Synthesis. *Winter.* (Taught interdepartmentally.) Structure and properties of nucleic acids and mechanisms of biological information transfer from nucleic acids. Emphasizes conformation, tertiary structure, dynamic aspects of nucleic acid structure, DNA replication, transcription, protein synthesis in prokaryotes and eukaryotes, the regulation of these processes, and chromosome and ribosome structure. Pettijohn and Pace, course directors.

Biophys-Gen. 614-2. Physicochemistry of Macromolecules in Solution. *Spring.* Thermodynamics and kinetics of the antigen-antibody and other biologically important reactions; electrophoresis and ultracentrifugation (in depth); other physical methods of studying macromolecules in solution; protein structure and interactions with each other and small molecules. Cann.

Biophys-Gen. 615-3. Topics in Molecular Neurobiology. *Spring.* A lecture course designed to give students who lack formal training in neuroscience a basic understanding of neurobiology. An introduction to the embryology, pharmacology, and physiology of the nervous system will be presented; however, the major emphasis will be placed on neurobiochemistry. The following topics will be discussed: morphological and biochemical development of the nervous system; macromolecular synthesis; metabolism, localization, and regulation of neurotransmitters; properties of neuronal membranes and receptor mechanisms. Discussions will focus on some of the major problems in neurobiology and the model systems that may solve them. Prer., biochemistry. Seeds.

Biophys-Gen. 616-1. Topics in Immunology. *Fall.* One hr. lect. Current topics in immunology with emphasis on immunogenetics. The immune response; lymphoid cells, surface markers; immunoglobulins; structure, function, and genetic markers; theories of antibody formation; humoral and cell-mediated immunity; genetic control of immune responsiveness; histocompatibility antigens; diseases affecting humoral and cell-mediated immunity. Review of selected topics covered during course. Abel, Campbell, and Kubo.

Biophys-Gen. 620-3. Mammalian Cell Genetics. *Spring.* Discussion of current developments in various aspects of genetic analysis in mammalian cells *in vitro*. Topics include basic techniques of cell culture, nutritional requirements and growth media, genetic markers, mutation studies, cell fusion and heterokaryon analysis, cell hybridization and its applications to studies of gene expression, complementation, gene mapping and malignancy, differentiated functions in cultured cells, cell surface antigens, repair mechanisms, cell cycle and cell synchrony, biochemical genetics of purine mutants, control mechanisms, cellular aging processes, mammalian chromosome structure, mutagenesis, and carcinogenesis. Applications to human genetics will be considered. Prer., genetics, biochemistry. Kao, Jones, Patterson, Puck, and Waldren.

Biophys-Gen. 621-2. Environmental Mutagens and Their Detection. *Winter.* Considerations of mutagenic agents in the environment; their detection, measurement, and an evaluation of the hazard they present; their relationship to teratogens and carcinogens. Morse.

Biophys-Gen. 622-2. Cytogenetics. *Spring, alternate years.* A broad course in cytogenetics with major emphasis on human cytogenetics and recent advances in cytogenetics. Major topics include developments in methodology, chromosome structure, gene localization, as well as clinical aspects. The latter will include

epidemiology, antenatal diagnosis, and the various cytogenic syndromes. A parallel separate laboratory course will be given. Lubs.
Biophys-Gen. 623-1. Cytogenetics Laboratory. *Spring.* Practical exercise in current cytogenetic techniques including various banding and other new techniques on a variety of human tissues. Lubs.

Biophys-Gen. 624-4. Microbial and Molecular Genetics. *Fall.* Taught interdepartmentally. A lecture course with emphasis on modern microbial genetics, primarily of *Escherichia coli* and its phages. Prer., consent of instructors. Sadler, Taylor, Balbinder, J. Betz.

Biophys-Gen. 628-3. Human Population Genetics. *Spring.* Covers the principles of the study of genes in populations. Topics to be included are equilibrium theory and gene frequency determination, segregation analysis, inbreeding, selection, mutation, and linkage. Prer., genetics and statistics. Kimberling and A. Robinson.

Biophys-Gen. 630-3. Laboratory Techniques of Mammalian Cells in Vitro. *Spring.* Basic techniques in mammalian cell culture and its applications to study of mammalian cell biology, biochemistry, and genetics. Lab. exercises include incubator design and operation, media preparation, sterile techniques, initiation of cell structure, single cell plating, clone isolation, cell growth kinetics, mutant induction and isolation, cell fusion techniques, complementation analysis, chromosome analysis, isozyme techniques, and antigenic analysis. Waldren, Patterson, and Puck.

Biophys-Gen. 631-credit to be arranged. Statistical Physics and Mathematical Modeling in Biological Systems. *Fall.* The connection between micro- and macrobehavior of biological systems at the molecular and cellular levels will be examined using statistical mechanics, information theory, and population mechanics. There will be a workshop in application of the computer to these problems. Bell and Goad.

Biophys-Gen. 632-2. Topics in Clinical Genetics. *Spring.* Treats in detail the methods used in the practice of clinical genetics. Considers genetic counseling, population screening for genetic defects, the genetics of diseases of various organ systems, the biological effects of ionizing radiation, and the social implications of medical genetics. Students will be required to prepare a term paper. Prer., Biophys-Gen. 502. Robinson and Lubs.

Biophys-Gen. 650-credit to be arranged. Research in Biophysics and Genetics. *All quarters.*

Biophys-Gen. 700-6 to 9. Master's Thesis. *All quarters.*

Biophys-Gen. 800-24 to 36. Doctor's Thesis. *All quarters.*

CHILD HEALTH ASSOCIATE PROGRAM

Interested students should read carefully the requirements listed below regarding admission to the Master of Science Child Health Associate degree program to determine eligibility.

1. A satisfactory grade on the GRE as established by the Child Health Associate Program.

2. Entrance into the Child Health Associate Program with sufficient hours of college-level credit to be able to complete a bachelor's degree prior to the beginning of the second year of the program.

3. Completion of the first four quarters of the Child Health Associate Program.

CHA Biol. 514-2. ENT Lecture Series and Practicum. *Fall.* Includes lectures on medical aspects of otorhinolaryngology as well as sessions on audiology and speech pathology. The class is split into small groups for demonstration and practice of specialized ENT examinations, procedures, and audiography/tympanometry. Jafek.

CHA Biol. 516-2. Studies in Dermatology. *Fall, Winter, Spring.* Lect., clinic. Provides discussions and practical experience in evaluating and managing patients with skin problems. Division into small groups permits extensive evaluation of patients. Prer., CHA Biol. 337 and consent of instructor.

CHA Biol. 519-3. Pediatric Pharmacology. *Fall.* Discussion of the practical aspects of drug absorption, metabolism, excretion, pharmacologic actions, adverse reactions, and toxicologic effects. Half

the major drug categories will be covered this quarter including anti-pyretics, antitussives, antihistamines, antibiotics, vaccines, bronchodilators, minor and major analgesics, anticonvulsants, and emergency drugs.

CHA Biol. 524-2. Advanced Pediatric Emergency Medicine. *Fall.* Lect. and lab. A discussion of the principles and management of medical and surgical emergency situations and wound healing. Includes experience in intubating and suturing in an animal laboratory. Prer., consent of instructor.

CHA Biol. 529-3. Pediatric Pharmacology. *Winter.* Discussion of the practical aspects of drug absorption, metabolism, excretion, pharmacologic actions, adverse reactions, and toxicologic effects. The major drug categories covered this quarter include local anesthetics, sedatives, tranquilizers, muscle relaxants, local and systemic steroids, thyroid drugs, anti-hypertensives, antacids, cardiac glycosides, antiemetic and antidiarrheal agents and others.

CHA Biol. 532-6. Problem Solving in Medical-Surgical Pediatrics. *Fall.* Discussion of various medical and surgical pediatric conditions covering pathophysiology, diagnosis, and management, followed by case presentations requiring application of this knowledge in problem solving. Areas covered fall semester include infectious disease, hematology, oncology, neurology, renal disease, neonatology, and genetics. Moore.

CHA Biol. 533-6. Problem Solving in Medical-Surgical Pediatrics. *Spring.* Discussion of various medical and surgical pediatric conditions covering pathophysiology, diagnosis, and management followed by case presentations requiring application of this knowledge in problem solving. Areas covered spring semester include pulmonary disease, dentistry, endocrinology, ophthalmology, pediatric surgery, gynecology, cardiology, orthopedics, gastroenterology, and laboratory medicine. Moore.

CHA Biol. 537-6. Pediatric Clinical Preceptorship. *Fall.* Involves approximately nine hours of time per week in one-on-one assignments with preceptors in various clinic sites (general pediatrics, adolescent, allergy, emergency rooms) and the proficiency laboratory. Students under the tutelage of individual preceptors must perfect clinical skills, establish assessments, and derive management plans, thus developing problem solving capabilities of common pediatric problems. In the laboratory, they must demonstrate proficiency of 35 essential clinical psychomotor and laboratory procedures necessary for primary care practice. Moore.

CHA Biol. 538-6. Pediatric Clinical Preceptorship. *Spring.* See CHA Biol. 537-6 for course description. Moore.

CHA Psych. 512-2. Psychosocial Problem Solving. *Fall.* Emphasizes problems in communication which occur in working with patients, rather than in the details requested in obtaining a history. Role playing, videotapes, and other specialized techniques are utilized. A paper or project is done by graduate students concerning patient(s) with a social or emotional problem. Prer., CHA Biol. 337 and consent of instructor.

CHA Psych. 517-1. Graduate Seminar. *Fall.* Provides time to discuss topics of interest which could not be included elsewhere in the curriculum. Unstructured time is also provided for topics students desire to explore in greater depth. Emphasis is more on the art of pediatrics and practical pediatrics rather than on the science of pediatrics. A presentation to the class or a short research paper may be done on a topic of general pediatric concern.

CHA Psych. 518-2. Psychosocial Aspects of Pediatrics. *Fall.* Discussions of the evaluation and management of commonly encountered emotional psychosomatic disorders in pediatric practice. Topics to be discussed include healthy emotional development, "normality," colic, behavior modification techniques, discipline, sleep and eating problems, toilet training and soiling, dependency problems, responsibility problems, and family crises. A paper may be done in this course.

CHA Psych. 527-1. Graduate Seminar. *Winter.* See CHA Psych. 517 for course description.

CHA Psych. 528-2. Psychosocial Aspects of Pediatrics. *Winter.* Discussions of commonly encountered emotional psychosomatic illness in pediatrics which emphasize their evaluation and management. Topics to be discussed include child abuse and neglect, enuresis, poisoning repeaters, psychosocial indications for pediatric hospitalization, side effects of hospitalization, managing difficult parents, obesity prior to adolescence, adjustment to acute disease,

and adjustment to chronic static disease. A paper is done in this course. Prer., consent of instructor.

CHA Psych. 532-1½. Pediatric Sexual Problems. *Spring.* Discussions of the evaluation and management of commonly encountered sexual problems in a pediatric practice. Topics to be discussed include normal and abnormal psychosexual development, masturbation, psychosexual aspects of the genital examination, menstrual problems, contraception, out-of-wedlock pregnancy, abortion counseling, venereal disease, and rape. Prer., consent of instructor.

CHA Biol. 534-2. Emergency Medicine in Practice. *Winter.* Provides students with the knowledge and skills to handle various types of emergency situations. Didactic sessions will be held and application emphasized by the use of demonstrations, simulations, manikins, animal laboratories, and audiovisual support. Each student will spend about 10-15 evenings rotating in four different emergency rooms.

CHA Psych. 537-1. Graduate Seminar. *Spring.* See CHA Psych. 517 for course description.

CHA Psych. 538-2. Psychosocial Aspects of Pediatrics. *Spring.* Discussions of commonly encountered emotional and psychosomatic illnesses which emphasize their evaluation and management. Topics to be covered include: an approach to pain in general, recurrent headaches and abdominal pain, school phobia, office anticipatory guidance to prevent emotional problems, patient satisfaction and compliance, a review of pediatric emotional therapy, and when and how to refer to a mental health clinic. A paper is done in this course. Prer., consent of instructor.

CHA Biom. 520-1. Advanced Quantitative Methods. *Spring.* Stresses the epidemiological approach to various medical problems and the interpretation of medical data and journal articles as well as drug advertisements, thereby relating quantitative methodology to the practice of pediatrics. Prer., consent of instructor.

DIVISION OF HEALTH ADMINISTRATION

Students wishing to pursue graduate work in health administration leading to candidacy for the M.S. degree should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

The following courses are offered at the Medical Center by the Division of Health Administration. Additional elective courses for students in this graduate program leading to an M.S. degree are available through other divisions of the Department of Preventive Medicine and Comprehensive Health Care, as well as in other departments of the University. Contact the instructors for the following courses available as electives to students not enrolled in the health administration program. (All are semester courses.)

H.A. 601-3. Medical Care Organization. *Fall Semester.* An introduction to the structure and function of the medical care delivery system. Discussion will focus on basic concepts of medical care organization; values, needs, and utilization; issues in health care manpower, institutions, and system organization; general issues in public policy, reimbursement, and regulation; international comparisons; and broad community and organizational considerations in medical care organization. Dr. Luke.

H.A. 602-3. Health Economics. *Spring Semester.* An intensive analysis of issues in health economics, with primary emphasis on microeconomic considerations. Discussions will focus on the demand, supply, distribution and production of health services; inflation; and the economics of health care policy. Dr. Luke.

H.A. 603-2. Regulation I: Cost Containment and Reimbursement. *Fall Semester.* Provides students with a working knowledge of major cost containment and reimbursement programs and their effect on major providers. Particular emphasis on future trends in cost containment and reimbursement, how students can acquire knowledge in this area in the future, and how these mechanisms can be used by either institutional or policy managers to foster or impede health system innovations. Dr. Schlenker.

H.A. 604-2. Regulation II: Quality Assurance. *Spring Semester.* An in-depth examination of policy issues in quality assurance; conceptual and methodological considerations involved in the various methods of appraisal; organizational requirements for establishing the quality assurance function in health delivery institutions; and values, legal considerations, etc., in quality assurance. Dr. Luke.

H.A. 606-2, 607-2. Policy Analysis I, II. A sequence of electives dealing with the formulation and analysis of health policy at the national and state levels. Students participate in the analysis of health issues with the state legislature and assist in the formulation of appropriate legislation. Staff.

H.A. 610-3. Quantitative Methods I. *Fall Semester.* An in-depth study of scientific problem-solving/decision-making techniques through lecture and laboratory time. Includes the statement of the problem, data collection considerations, electronic data processing, parametric and nonparametric statistical analysis, and interpretation of the results of the analysis. Mr. Eversole.

H.A. 611-2. Quantitative Methods II. *Spring Semester.* Focuses on particular problem-solving skills including, but not limited to, statistical analysis through packaged programs, data base and management information systems, forecasting, queuing, inventory management, and decision making under uncertainty. A laboratory session is part of this course. Mr. Eversole.

H.A. 614-2, 615-2. Topics in Quantitative Methods I, II. An elective sequence for students choosing this area of emphasis. Consists of project-directed work. Mr. Eversole.

H.A. 619-2. Seminar in Research Methods. An introduction to the theory and practice of research with a focus on health care delivery. Students develop a project consisting of a research protocol as part of the course. Dr. Orleans.

H.A. 620-2. Health Sciences. *Fall Semester.* An introduction to concepts of holistic health and high level wellness as well as disease, for the student without prior health professional education. Introduces students to the terminology and interventions of health and medical care. Epidemiological methods are explained as tools useful not only for explaining disease phenomena but also for the planning and evaluation of health services. Provides students with a better understanding of the scope of health services, health professionals, and levels of care. Dr. Slater.

H.A. 621-3. General Systems Theory. *Spring Semester.* General systems theory is presented as a conceptual tool in health administration. Health is viewed as a subsystem of society, and interfaces among health and other social subsystems are analyzed. Broad social and cultural issues form a context for meaningful discussion of health planning and administration in the current and future decades. Dr. Kaiser.

H.A. 622-2. Health Planning I. *Spring Semester.* The student is introduced to a variety of theoretical models useful in health planning. Planning theory is correlated with planning methodology. Data collection, analysis, and interpretation are viewed in a planning context. The student is prepared for the summer planning residency which permits application of planning theory and skills. Dr. Slater.

H.A. 623-3. Health Planning II. *Fall Semester.* The primary focus of this course is institution-based health planning. Students will gain skills in formulating long-range plans for an individual institution, relating these plans to other health institutions in the community, and assisting in the development of area-wide health plans. Dr. Stuehler.

H.A. 624-3. Health Planning III. *Spring Semester.* The primary focus is area-wide health planning. Students will gain skills in developing an area-wide health plan, relating this plan to the needs of consumers and providers of health care, and developing a broad base of community support for health planning. Staff.

H.A. 625-2. Health Planning Practicum. A field work project elective which provides an opportunity for the student to gain skills in health consulting, community studies, area-wide health planning, institutional planning, and specialty health planning. Staff.

H.A. 626-2. Research Seminar in Needs Assessment. An elective course which provides the opportunity for carrying out a needs assessment, in part to prepare health planning students for compliance with Certificate of Need and 1122 regulations, and also to introduce the concepts and methods of survey research required to assess consumer needs and perspectives as to health services. It will

be conducted as a practicum with an actual need assessment as its subject matter. Dr. Orleans.

H.A. 627-3, 628-3. Program Evaluation III, IV. *Fall and Spring Semesters.* A sequence designed to equip the student with the basic skills and methods involved in health program evaluation and research. The development of both conceptual and quantitative evaluation techniques is based on examples, then projects, with the intent of motivating general methods through specific illustrations. Dr. Shaughnessy.

H.A. 630-2. Principles and Practices of Community Health Education. An introduction to the basic concepts and implementation strategies for health education and behavior change on one-to-one, small group, and mass levels. The interaction of the individual, the family, and the community is stressed, as well as corresponding interactions among health professionals. Some of the topic areas covered are the health care system from the consumer's viewpoint, with special emphasis on cost-containment measures that can be developed through community education; trends in consumerism, i.e., self-care and prevention-oriented systems; governmental policy making regarding consumer health issues; and the administrator as change agent within the health care system. Staff.

H.A. 640-3. Economics. An elective introducing basic concepts of micro and macroeconomics, including demand and supply, labor and capital markets, and general monetary and fiscal policy. Ms. Tynan.

H.A. 641-2. Administrative Communication. *Fall Semester.* Concerned with the communication skills needed by a modern health administrator. Students will increase their proficiency in written communications, verbal communications, public presentations, audiovisual methods, grantsmanship, and office correspondence. Staff.

H.A. 642-3. Organization and Management I. *Fall Semester.* A historical overview of organizational, management and change concepts, principles, and practices. The contributions of the classical, behavioral, and management science schools of thought are examined in an attempt to show that the contemporary health administrator can benefit by understanding and blending the approaches offered by all three. The student will be able not only to manage but also to design innovative health care organizations. Dr. Kaiser.

H.A. 643-2. Organization and Management II. *Spring Semester.* An analysis of organizational structure, processes, and the behavior of individuals and groups within organizations. Other areas examined include organizational climate, organizational change, and organizational effectiveness. Dr. Kaiser.

H.A. 644-2. Legal Problems in Health Care Administration. *Fall Semester.* Designed to acquaint the student with legal issues experienced by the health administrator. Special emphasis is placed on issues such as malpractice, informed consent, medical staff appointments, directors' and administrators' liability, medical records, and refusal of treatment. The course should make the student aware of the multitude of legal problems which confront the health administrator on a daily basis. Staff.

H.A. 645-2. Manpower Management and Labor Relations. *Spring Semester.* A survey of the manpower management field, including personnel administration and labor relations, with an emphasis on the health field. Specific attention is directed to recruiting techniques, wage and salary administration, career development programs, labor negotiations, and union/management relationships. Mr. Patterson.

H.A. 650-2. Research. Practicum in health administration. Staff.

H.A. 662-2. Finance I. *Fall Semester.* Focuses on the financial management process in health care organizations. Attention is placed on the management of assets, the budget process, and sources of funds for short- and long-term needs. A comprehensive case serves as the focal point. Dr. Suver.

H.A. 663-3. Finance II. *Spring Semester.* Explores in depth the accounting systems utilized in hospitals, with emphasis on the decision making process. Financial and management accounting techniques are thoroughly covered. Such current topics as uniform accounting and reporting are explored, along with their impact on the health care environment. Problems serve as the primary pedagogical tool, with a comprehensive case serving as the integrative device. Dr. Suver.

H.A. 664-3. Finance III. *Fall Semester.* Further develops the tools available to the financial manager for decision making. Considerable emphasis is placed on the practical application of these tools and the limitations of their use. Current articles, guest speakers, and cases are used to stimulate discussion. Dr. Suver.

H.A. 665-3. Finance IV. *Spring Semester.* Primary focus is an in-depth research report on a current problem. Students will be responsible for identifying their own research area and will brief both the client and the class on the interim progress and the final recommendations. Dr. Suver.

H.A. 670-3. Institutional Management I. *Fall Semester.* Examination of the structure, organization, and management of health care institutions including ownership, administration, professional and nonprofessional departments, and personnel. Mr. Olson.

H.A. 671-3. Institutional Management II. *Spring Semester.* A capstone course which synthesizes and summarizes the material presented in all previous course work and applies it to real problems. Designed for students preparing for graduation, this course will help the students review material and will integrate various aspects of the curriculum through seminars in which students will be encouraged to actively participate, often in a role-playing situation. Mr. Olson.

H.A. 672-2. Ambulatory Care Administration. The health administration student is exposed to the rapidly developing career area of ambulatory care. Various ambulatory care settings are studied. Problems in the planning, implementation, administration, and evaluation of ambulatory care are highlighted in this course. Field trips are an important aspect of the student's learning experience. Guest Faculty.

H.A. 674-2. Multi-institutional Management. Multi-institutional management is a developing trend in health administration. Students are exposed to both profit and nonprofit hospital networks. Shared services, merger, management contracts, and satellites are studied and discussed. Guest faculty.

H.A. 676-3. Rural Health Systems I. *Fall Semester.* Introduces the student to the history and evolution of rural health care in the United States. Also examined are past attempts to improve rural health and the impact of past national programs affecting rural health. The present status of rural health in the United States is explored. The course ends with a review of private, local, state, and federal programs directed toward solutions for rural health problems. Mr. Warren.

H.A. 677-3. Rural Health Systems II. *Spring Semester.* Begins with a close look at existing programs and funding sources which can serve as resources to the student in developing a rural health system. The student also participates in the establishment of new sites around Colorado. This experience includes feasibility studies, selection of practice model, provider recruitment, community organization, organization of a practice, program financing, and private management. Various federal, state, local, and private resources are applied to the creation of this health system. Mr. Warren.

H.A. 678-2. Health Care Marketing. An introduction to the application of marketing concepts and techniques to health care. Discussion focuses on implications of a changing regulatory environment for marketing health services, specific concepts and tools, and marketing applications to various types of health delivery systems. Dr. Luke.

MICROBIOLOGY

Candidates for admission to graduate work in microbiology should have theoretical and laboratory training in general biology, inorganic and organic chemistry, physics, physical chemistry, calculus, and statistics. Some knowledge of genetics and the history of biology is desirable.

The Graduate Record Examination is required.

Students wishing to pursue graduate work in microbiology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

The Department of Microbiology has no specific Ph.D. foreign language requirement, but proficiency in at least one foreign language is required.

All courses in microbiology are quarter-hour courses.

Microbiol. 520-5. Properties of Bacteria, Viruses, and Protozoa and Their Interaction With Their Hosts. *Fall.* A one-quarter course of 11 weeks, introducing students to certain fundamental features of microorganisms and their ability to cause disease. Includes a description of the properties of various pathogenic bacteria, viruses, fungi, and parasites and the diseases caused by these organisms. Patients will be presented to illustrate a number of these diseases. Also included will be a description, at the cellular and molecular level, of bacterial physiology, microbial genetics, virus structure, and virus reproduction. Four lect. per wk., one hr. of Infectious Disease Clinic. Dr. Pizer and staff.

Microbiol. 521-3½. Microbiology Laboratory. *Fall.* A seven-hour lab. course accompanying Microbiol. 520 and 524 and concerned with the growth and properties of microorganisms and fundamental techniques of immunology. Dr. Roberts and staff.

Microbiol. 524-2. Immunology. *Fall.* A two-hour lect. course. The field of immunology will be presented, covering properties of antigens and antibodies and their interactions, serological theory and applications, cellular aspects of immunology, immediate and delayed hypersensitivity, theories of antibody response and tolerance. Drs. Claman, Cohen, Crowle, and Talmage.

IDPT 612A and B-5. Modern Techniques in Cell Biology. *Winter and Spring.* A series of two- to three-week experiments in cell biology. Experiments will include bacterial genetics, column chromatography, DNA and RNA analyses, animal tissue cell techniques, DNA replication and hybridization, analyses on cyclic AMP, viral morphogenesis, immunology and electron microscopy of DNA and tissue specimens. Dr. Cummings and staff.

IDPT 624-3 to 6. Microbial and Molecular Genetics. (See Bioph. 624.) *Fall.* Four lect. per wk. A lecture course with emphasis on classical genetic procedures, microbial genetics, and molecular interpretations. Prer., consent of instructors. Drs. Sadler, Sauerbier, and Taylor.

Microbiol. 625-3. Topics in Microbial Physiology. *Winter, odd-numbered years.* Three lect. per wk. Macromolecular synthesis and regulatory processes governing them. Biosynthesis of small molecules and their regulation. Differentiation: sporogenesis and germination. Dr. Borek and staff.

Microbiol. 627-3. Basic Mechanisms in Virology. *Spring, even-numbered years.* (Path. 726.) Lectures will be concerned with the molecular events that take place following the virus infection of animal cells. The topics covered will include virus structure, the adsorption, uncoating, replication, and maturation of animal viruses, mechanisms of action of tumor viruses and cytopathic viruses, and the action of interferon. Drs. Cummings, Erikson, Lehman, and Roberts.

Microbiol. 631-credit to be arranged. Delayed Hypersensitivity. *Winter.* A series of lectures and discussions on cellular antibody-based phenomena such as delayed hypersensitivity to infectious agents and to contactants, homograft rejection, autoimmunity, acquired immunity, and the pathogenesis of certain chronic diseases. Prer., Microbiol. 520 or equivalent. Dr. Crowle.

Microbiol. 632-3. Advanced Cellular Immunology. *Winter.* Recent knowledge about the cells involved in the immune response will be covered, e.g., the roles of the thymus and bone marrow and bursa of Fabricius, cell interactions, cell receptors, etc. The format will be seminars with faculty and student discussion of selected papers. Two hours a week. Dr. Claman and staff.

Microbiol. 650-credit to be arranged. Research in Microbiology. *All quarters.*

OBSTETRICS AND GYNECOLOGY

Students wishing to pursue graduate work in obstetrics and gynecology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

Candidates for admission to the Master of Science program in obstetrics and gynecology will be required to have completed three years of hospital training in obstetrics and gynecology after the internship. A year spent in research separate from the three-year residency training is required for a master's degree. In special circumstances a candidate may take a separate year of research in obstetrics and gynecology or an allied basic science before he has completed a three-year residency in the specialty. The special year of research may be taken in residence or at another university if special arrangements are made. This year of research may be applied toward a Master of Science degree. A thesis, based on original investigation either in cooperation with one of the preclinical departments or in the Department of Obstetrics and Gynecology, is required.

Ob.Gyn. 603-2. Steroid Enzymology and Metabolism. (Biochem., Interdep. 603.)

Ob.Gyn. 650. Research in Obstetrics Gynecology. *All quarters.* Time and place to be arranged.

Ob.Gyn. 700-6 to 9. Master's Thesis. *All quarters.*

Pathology

Students wishing to pursue graduate work in pathology leading to candidacy for advanced degrees should read Requirements for Advanced Degrees and School of Medicine Admission Requirements.

Candidates with the B.S. or B.A. degree as well as those with the M.D. degree are considered for the Ph.D. in pathology.

The Ph.D. program requires a minimum of 30 hours of graduate work, including anatomy, biochemistry, biophysics, cytology, genetics, advanced organic chemistry, physical chemistry, and a selection of the graduate courses given by the Department of Pathology. In addition, extensive experience leading to a thesis is required.

The Department of Pathology has no Ph.D. tool foreign language requirement.

A stringent two- to three-year program for postdoctoral students who wish to attain a real understanding of and research competency in modern biology is also available. In addition to regular course work, the first year can be spent in rotating through three or four research laboratories of varied interests. The second and possibly third years are then spent in one laboratory, determined by the experience and interest of the individual toward the close of the first-year rotation.

Detailed brochures are available.

Path. 501a-11½. General and Systemic Pathology. *Winter, Spring.* A survey of human disease with emphasis on clinical-pathologic correlation in preparation for the practice of medicine. A short introduction covers disease mechanisms. This is followed by a series of lectures and laboratory sessions devoted to each of the organ systems. The laboratory sessions entail small group study of selected cases. The last two weeks include a series of C.P.C.'s and seminars covering specific topics in pathology.

Path. 501b-11½. General and Systemic Pathology. *Winter, Spring.* As in Path. 501a, this course presents a survey of human disease in preparation for the practice of medicine. In addition, the biologic bases and mechanisms of disease are presented in depth and are integrated with clinical-pathologic manifestations. Lectures, seminars, and small group study of cases are used.

Patto 605-2. Topics in Experimental Oncology. *Spring.* Lectures and seminars covering selected topics of interest in the field of experimental oncology. This year's topics will include cytogenetics in cancer, surface changes in cancer cells, onco-fetal antigens, and fine structure of cancer cells. Sophomore medical students and graduate students. Prer., first quarter of Path. 501. Dr. Rendi and staff.

Path. 613-1. Research Seminars and Journal Club. *Fall, Winter, Spring.* Dr. Rendi.

Path. 650. Research in Pathology. *All quarters.* Credit to be arranged.

Path. 700-6 to 9. Master's Thesis. *All quarters.*

Path. 800-24 to 36. Doctor's Thesis. *All quarters.*

PHARMACOLOGY

Students wishing to pursue graduate work in pharmacology leading to candidacy for the Ph.D. degree should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

Prerequisites. The preliminary training of students desiring to major in pharmacology should include the following college courses:

1. Biology: introductory biology or general zoology, or their equivalent. Work in invertebrate and comparative zoology and genetics is desirable.

2. Chemistry: at least two years of college chemistry, including inorganic, organic, and physical chemistry.

3. Physics: general introductory. Advanced physics, particularly in mechanics and electricity, is desirable.

4. Mathematics: differential and integral calculus.

5. Language: A reading knowledge of a foreign language is required. This may be demonstrated by satisfactory performance on an examination or by satisfactory completion of the second semester of a second-year college language course. The department strongly recommends German as the most appropriate foreign language for pharmacology.

PHCL 510-7½. Pharmacology. *Fall, Winter.* Second year. Intensive study of the drugs used in medical practice. Lectures, conferences, seminars and demonstrations. Prer., biochemistry and physiology. Dr. Weiner and staff.

PHCL 511-1. Laboratory in Pharmacology. *Winter.* Second year. Laboratory exercises are designed to provide a basis for discussion of basic pharmacologic principles in a laboratory setting. Prer., biochemistry and physiology. Dr. Weiner and staff.

IDPT 609-2. Drugs and Development. *Fall, even-numbered years.* Provides an understanding of basic physiologic mechanisms in pediatric pharmacology. Topics will include: liver enzymes, renal function, placenta, and blood-brain barriers. Child disorders such as hyperkinetic syndromes, epilepsies, and newborn addiction will be discussed. Presented by the Departments of Pharmacology and Psychiatry. Dr. Vernadakis.

IDPT 610-2. Hormones and Development of CNS Function and Behavior. *Fall, odd-numbered years.* The role of hormones in the prenatal development of the CNS and their influence on the behavior of the offspring. Drug hormonal interactions also will be discussed. Presented by the Departments of Pharmacology and Psychiatry. Dr. Vernadakis.

PHCL 601-2. Spectroscopic Methods. (Biochem. 601.) *Spring.* Problem-solving course using optical rotary dispersion; circular dichroism; and infra-red, ultra-violet, nuclear magnetic resonance, and mass spectroscopic techniques to determine structures of organic molecules of biochemical interest. Prer., organic chemistry and Biochem. 500. Drs. Murphy and Fennessey.

PHCL 602-3. Methods in Pharmacology. *Winter.* Designed to introduce the student to laboratory techniques and procedures pertinent to the study of pharmacology. Prer., pharmacology. (May be taken concurrently.) Mosimann.

PHCL 606-3. The Regulation of Metabolic Pathways. *Winter.* Detailed discussion of the mechanisms by which cells regulate metabolic processes. Emphasis on the regulation of enzyme activity by allosteric mechanisms and the regulation of enzyme levels by alterations of the rate of protein synthesis. The role of hormones in the regulation of metabolism will be considered. Prer., biochemistry or equivalent. Drs. Langan and Wicks.

PHCL 607-2. Principles of Drug Receptor Interactions. *Fall, even-numbered years.* Basic principles of absorption, distribution, and excretion of drugs; concentration-effect relationships; the chemistry of drug-macromolecular interactions, and mechanisms of agonist-receptor and antagonist-receptor interactions will be examined. Dr. Weiner.

PHCL 609-3. Biochemistry of Neurotransmission. *Spring.* Lecture topics will include the synthesis, metabolism, storage, and release of norepinephrine, acetyl choline, and other putative transmitters in the peripheral and central nervous systems; the identification and assay and properties of receptors; and CNS neuropharmacology, including the biochemical mechanisms of actions of CNS active drugs and current knowledge of the biochemical basis for neurologic and psychiatric disease. Drs. Weiner, Hoffer, and Molinoff.

PHCL 610-2. Experiential Basis of Pharmacology. *Fall, Winter.* Consists of special tutorials in which the material covered in the medical school introductory course in pharmacology (PHCL 510) is expanded on, with special emphasis on the historical aspects of the development of the information summarized and the experimental evidence supporting the conclusions presented in PHCL 510. In this course, student presentations of selected original literature will be stressed. Dr. Weiner and staff.

PHCL 612-3. Drug Metabolism and Drug Interactions. *Winter, odd-numbered years.* Mechanisms by which drugs are chemically altered in the body will be discussed. Emphasis will be given to drug interactions. Prer., biochemistry. Drs. Deitrich and Murphy.

PHCL 618-3. Neurophysiological Techniques. *Winter.* Principles of, and practical experience in, microelectrode construction, iontophoresis, measurement of responsiveness of excitable cells, use of computers in this research, and other techniques relevant to neurophysiology and neuropharmacology will be presented. Prer., PHCL 510. Dr. Hoffer.

PHCL 620-3. Introduction to Pharmacology. *Fall.* Principles of pharmacology, including pharmacokinetics, receptor-ligand interactions, dose-response and structure-activity relationships, and drug metabolism are presented.

PHCL 650. Introduction to Research in Pharmacology. *All quarters.* Credit to be arranged. Prer., pharmacology. Dr. Weiner and staff.

PHCL 700-6 to 9. Master's Thesis. *All quarters.*

PHCL 800-24 to 36. Doctor's Thesis. *All quarters.*

PHYSICAL MEDICINE AND REHABILITATION

Students wishing to pursue graduate work in physical medicine and rehabilitation leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

Graduate instruction in physical medicine is offered to meet the great need for qualified practitioners and teachers in this growing specialty.

An integrated program of training is presented over a two- or three-year period. Training for a one-year period may be arranged.

Phys.Med. 601-6. Basic Physical Medicine and Rehabilitation. One year. First six weeks of this period are devoted to didactic instruction and demonstrations. Instruction is given in basic physics

and physiology of agents used in physical treatment: electrotherapy, electromyography, radiant energy therapy, thermotherapy, hydrotherapy, and mechanotherapy. Anatomy, kinesiology, biophysics, physiology, and other basic sciences are presented in relation to physical medicine. The remainder of this year is devoted to principles and techniques of occupational therapy and rehabilitation. Physical, psychosocial, educational, and vocational readjustment of the severely disabled is stressed.

Phys.Med. 602-6. Clinical Physical Medicine and Rehabilitation. One year. Physiatric management of disease, with special relation to general practice, internal medicine, surgery, orthopedics, pediatrics, and neuropsychiatry. Utilization of occupational, physical and speech therapy, and psychological and vocational services in overall care of the disabled is presented in relationship to paraplegia, hemiplegia, arthritis, cerebral palsy, the child with motor and perceptual problems, etc.

Phys.Med. 603-6. Advanced Physical Medicine and Rehabilitation. One year. Responsibility in treatment, administration, and teaching is stressed. Ample opportunity to assist in conduct of the Department of Physical Medicine and Rehabilitation will be available, as well as opportunity to assist in teaching of undergraduate medical students, interns, and allied health personnel.

Interdep. 615-1. Physiology of Skeletal Muscle and Bone. Fall. Cellular contractile mechanisms, functional and exercise aspects of muscle and bone. Jointly with Departments of Physiology, Physical Medicine and Orthopedics. Lectures and demonstrations. Prer., Phys. 501. Two to 25 students. Drs. Sexton, Gersten, and Miles.

Phys.Med. 650. Research in Physical Medicine and Rehabilitation. Fall, Winter. Credit to be arranged.

Phys.Med. 700-6 to 9. Master's Thesis.

Physical Therapy

Prerequisites. Students contemplating graduate work in physical therapy must have completed an undergraduate major in the field or an approved professional course in physical therapy. Undergraduate courses must have included general biology, physics, organic chemistry, algebra, trigonometry and introductory statistics. Additional biological sciences, such as histology and embryology, and inorganic chemistry, are desirable.

A reading knowledge of one foreign language is recommended.

Physiol. 501-9.5. Physiology. Spring. Mammalian function and integration of organ systems. Lectures, conferences, demonstrations, and laboratory projects. This course is the required basic course for freshman medical students.

P.T. 631-6. Physical Therapy Seminar. Summer, Fall. Students will prepare oral reports based on a comprehensive survey of literature on assigned topics. Both the content and the presentation of the reports will be evaluated by an audience of faculty, staff, and graduate students. Cenkovich.

P.T. 632-5. Advanced Physical Therapy. Summer, Winter. Practice teaching in curriculum in physical therapy. Advanced skills in patient evaluation and treatment in selected areas, i.e., muscle testing and training, electrical diagnosis and treatment, gait, functional training, neurodevelopmental evaluation, therapeutic exercise. Treatment program planning and course construction. The student also has an opportunity to do a clinical affiliation in his area of interest. Pediatric and cardiopulmonary rehabilitation are among the areas available. Brammell.

P.T. 633-2. Physical Principles in Physical Therapy. Fall. Application of principles of physics and mechanics in physical treatment. Gait analysis, physiology of skeletal muscle, dynamics of respiration, and cardiovascular dynamics. Cenkovich, Orr, Sexton, Gersten.

P.T. 634-2. Introduction to Research. Winter. Methods in research. Problem areas in basic and clinical research. Writing a grant request. Selection of an individual problem and preparation of research design. Statistical principles in biological research. McDaniel, Archer.

P.T. 650-6. Research in Physical Therapy. Spring, Summer. Independent research under guidance of a staff member. Gersten, Sexton, Brammell.

P.T. 700-6. Thesis in Physical Therapy. Fall.

PHYSIOLOGY

Students wishing to pursue graduate work in physiology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and School of Medicine Admission Requirements.

The Department of Physiology has no Ph.D. tool foreign language requirement.

Prerequisites. The preliminary training of the student desiring to major in physiology should include:

1. One year of advanced biology (genetics, embryology, invertebrate or comparative zoology, general or cellular physiology).

2. Physics (one year), chemistry (including physical), and mathematics (including calculus and statistics).

Physiol. 501-9.5. Principles of Mammalian Physiology. Lectures, demonstrations, and laboratory. Graduate students may elect to omit laboratory for 8.0 credits. Dr. Martin and staff.

Physiol. 603-credit to be arranged. Physiology Seminar. Prer., Physiol. 501. Dr. Martin and staff.

Physiol. 604-3. Cellular and Molecular Endocrinology. Physiological and biochemical aspects of hormone synthesis, storage, secretion and action. Discussion sections and student presentations from assigned journal articles. Prer., consent of instructor. Drs. Eipper and Mains.

Physiol. 609-2. Physiology of the Eye. Informal lectures and discussion of ocular structures and their physiology. Prer., consent of instructor. Dr. Paterson.

IDPT 609-3. Membranes and Transport. Biochemical and biophysical properties of mitochondrial and cell membranes; epithelial transport. Drs. Neville, Sinensky, and Harold.

Physiol. 613-3. Cellular Neurophysiology. Membrane properties of excitable cells, sensory receptors, synaptic transmission and cellular organization of the visual system. Drs. Betz, Martin, and Wickelgren.

Physiol. 614-2. Cardiorespiratory Physiology. Selected topics in mammalian cardiovascular and/or respiratory physiology with special emphasis on fundamental principles. Lectures and demonstrations. Prer., Physiol. 501 or equivalent. Dr. Banchemo.

IDPT 621-2. Functional Basis of Cardiovascular Disease. Covers the pathophysiology of several common clinical cardiovascular disorders. Prer., Physiol. 501. Drs. Tucker and Reeves.

Physiol. 650-credit to be arranged. Research in Physiology.

Physiol. 700-6 to 9. Master's Thesis. Study for the master's degree is not encouraged except in special situations.

Physiol. 800-24 to 36. Doctor's Thesis.

PREVENTIVE MEDICINE AND COMPREHENSIVE HEALTH CARE

In addition to courses in general preventive medicine, this department has course offerings leading to a graduate degree in health administration. Programs in human ecology and environmental health are being developed jointly with other schools of the University of Colorado and with other universities in the area.

IDPT 515-3. Conversational Medical Spanish. Fall, Spring. Aim of the course is to enable students to do a history and physical and talk to patients in Spanish with moderate success. The content is carefully limited to pertinent material. The method of the course

involves the students from the outset in active conversation in groups of four to six. Six hours of such laboratory a week, with very little homework. Dr. Dawson.

Prev.Med. 508-2. Ethical Decisions in Patient Care. *Winter, Spring.* The purpose of this interdisciplinary course is to explore various ethical and legal problems which arise in the delivery of health care. The aim is to assist the student in developing his own decision process which he can use in resolving ethical problems. Dr. Marine.

Prev.Med. 512-2. Concepts of Health. *Fall.* A seminar on the implications of various concepts of health on the responsibilities of health professionals and the future of medical practice. Positive health, as opposed to mere absence of disease or statistical normality, will be discussed in reference to man's environment, body, mind, and perception of ultimate reality or being—and the relationships between them. Students will lead discussions of assigned readings, with resource people present.

Prev.Med. 650. Research. *All quarters.* Amount of credit allowed will depend on work accomplished. Facilities of the department are open to qualified persons who desire to carry out research in preventive medicine and comprehensive health care, or related subjects. Dr. Cobb.

Prev.Med. 700. Master's Thesis.

PSYCHIATRY

The Department of Psychiatry carries on active research programs in psychopharmacology, neuropharmacology, sleep physiology, infant development, cognition, brain-behavior relations, subhuman primate experimentations, etc. Facilities include appropriate laboratories, laboratory computers, and structured courses and seminars in psychomatics, development, biometrics, and research design for psychiatry.

Psy. 650. Research in Psychiatry. *All quarters.* Participation in ongoing research projects in the department. Dr. Metcalf.

Psy. 700-6 to 9. Master's Thesis. *All quarters.*

RADIOLOGY

Graduate study leading to candidacy for the M.S. degree is offered in the fields of medical physics and radiation biology.

Departmental Requirements. Students working to pursue graduate work in radiology should read carefully the section Requirements for Advanced Degrees.

Prerequisites. The undergraduate training of students wishing to major in radiology should include one year of biology, one year of physics, physical chemistry, and differential and integral calculus. Additional undergraduate requirements include one year of advanced physics or its equivalent, differential equations, and introductory probability theory and statistics for students wishing to study physics; and one year of advanced biology or its equivalent and organic chemistry for students wishing to study radiation biology.

Course Requirements. For students interested in medical physics, two plans of study are available. Plan I includes a thesis, certain required courses, and electives. Plan II includes required courses and electives but does not require a thesis. Only Plan I is available to students wishing to study radiation biology.

Language. The department has no tool requirement in foreign languages.

Qualifying Examination. Students must pass a written qualifying examination during the first 14 weeks of the first semester of graduate study.

Comprehensive-Final Examination. After other requirements for the master's degree are completed, each candidate must take an oral comprehensive-final examination. If the student is following Plan I, in which a thesis is required, the examination will include the thesis.

Radiol. 600-1 to 8. Radiology. *All quarters.* Laboratory and clinical training in the diagnostic, therapeutic, and research applications of ionizing and nonionizing radiation, limitations and hazards of the modalities and their reduction. Emphasis may be placed on radiologic diagnosis, therapeutic radiology, nuclear medicine, medical physics, radiation biology, or any combination thereof, according to the interests and background of students.

Radiol. 610-1. Introduction to Clinical Radiology. *Fall.* Lect. one hr. per wk. Selected clinical procedures performed in diagnostic radiology, nuclear medicine, ultrasound, and radiation oncology will be described in detail by clinicians in each specialty. Terminology, anatomy, and physiology relevant to these procedures will be explained and the interactions between physicists and physicians in improving the procedures will be explored.

Radiol. 612-5. Radiol isotopes in Medical and Biological Research. *Spring, even-numbered years.* Lect. three hrs. per wk., lab. four hrs. per wk. Production and decay of radioactive nuclides, interactions of radiation, specific activity, availability and synthesis of labeled compounds, purity, analysis and stability of labeled compounds, design of radiation sources, radioactive pharmaceuticals, gaseous detectors, solid and liquid scintillation detectors, counting systems, counting statistics, scintillation spectrometry, standard samples, quantitative counting, background reduction, autoradiography and radiochromatography, sample preparation for external detectors, sample preparation for liquid scintillation, quench corrections, solubilization procedures, radiological safety, waste disposal, laboratory design, body burdens, maximum permissible concentrations, internal absorbed dose, institutional, state and federal regulations.

Radiol. 613-3. Radiation Physics. *Fall, Winter, Spring.* Lect. one hr. per wk. Structure of matter, radioactive decay, decay schemes, transient and secular equilibrium, production of radioactive nuclides, production of X rays, X-ray tubes and circuits, teletherapy units, high-energy machines, interactions of particulate and electromagnetic radiation, attenuation of X and gamma rays, radiation intensity and exposure, ionization measurements, absorbed dose and its measurement, calibration of X-ray, gamma-ray and electron beams, Bragg-Gray principle and its applications, radiation quality, radiation protection.

Radiol. 614-3. Radiation Biology. *Fall, Winter, Spring.* Lect. one hr. per wk. Emphasizes the effects of irradiation on human tissues. Fall quarter deals with physics of radiation biology and cellular and molecular radiation biology; winter quarter deals with mammalian radiation biology; spring quarter deals with late-effects of irradiation.

Radiol. 615-2. Physics of Therapeutic Radiology. *Spring.* Lect. one hr. per wk., conf. one hr. per wk. Interactions of X and gamma rays in the body, backscatter, depth dose, tissue-air ratio, single-field, multi-field and rotational isodose distributions, corrections for surface obliquity and body inhomogeneities, wedge and tissue-compensating filters, field separation, beam direction, integral dose, interstitial and intracavitary radium implants, surface molds, radium substitutes, permanent implants, ophthalmic irradiators, maximum permissible dose, protection from external radiation sources.

Radiol. 616-2. Physics of Nuclear Medicine. *Winter.* Lect. one hr. per wk., conf. one hr. per wk. Ionization chambers, proportional counters, GM tubes, solid and liquid scintillation detectors, semiconductor, radiation detectors, counting systems, determinate and indeterminate errors, counting statistics, pulse height analysis, radiochemical and radionuclidic purity, radioactive pharmaceutical, radionuclide generators, measurement of accumulation and excretion rates, dilution studies, rectilinear scanning, multi-detector scanners, positron scanning, stationary imaging devices,

body burdens, maximum permissible concentration, absorbed dose from internally deposited radionuclides.

Radiol. 617-2. Physics of Diagnostic Radiology. *Fall.* Lect. one hr. per wk., conf. one hr. per wk. Attenuation of X rays in fat, soft tissue and bone, contrast media, high-voltage and low-voltage roentgenography, X-ray film, intensifying screens, grids, conventional and image-intensification fluoroscopy, television fluoroscopy, cineradiography, cinefluorography, kinefluorography, videotape, stereoscopic and subtraction radiography and fluoroscopy, contrast harmonization, enlargement radiography, tomography, physical and statistical influences on image quality, determination of image quality, quantum levels and conversion efficiencies, radiation dose in diagnostic radiology.

Radiol. 618-3. Particle Accelerators and Their Applications to Radiation Therapy and Nuclear Medicine. *Fall, odd-numbered years.* Lect. three hrs. per wk. Topics in atomic and nuclear physics, electric and magnetic fields, relativistic dynamics, theory of betatrons, cyclotrons, linear accelerators and other particle accelerators, ion sources, rf and microwave power sources, nuclear reactors, intensity and energy calibration of mega-voltage X-ray and high energy electron beams, interactions of high energy X-ray and electron beams in tissue and their use in radiation therapy, applications of negative pions, protons, fast neutrons, and heavy ions to radiation therapy, isotope production and isotopic and elemental analysis for medicine using neutrons and charged particles, radiation shielding and safety.

Radiol. 622-2. Introduction to Radiation Oncology and Treatment Planning. *Winter, odd-numbered years.* Lect. one hr. per wk., conf. one hr. per wk. An introduction to the biology of some of the more commonly treated malignant neoplasms and the radiation biology of surrounding normal tissues with emphasis on the influence of these factors on radiation treatment planning.

Radiol. 623-2. Introduction to Radiopharmacy. *Winter.* Lect. one hr. per wk., lab one hr. per wk. Properties of radionuclides and use in nuclear medicine of specific radiopharmaceuticals and their chemical and biological properties, use in nuclear medicine studies, principles of competitive protein binding assays.

Radiol. 625-2. Biological Effects of Low-Level Irradiation. *Spring, odd-numbered years.* Lect. one hr. per wk., conf. one hr. per wk. Natural and artificial environmental radiation, physical and biological transport processes, medical exposure, occupational exposure, induction of leukemia, bone sarcoma and other neoplasms, developmental abnormalities, radiation aging, genetic effects, experience with environmental radiation and radioactive contamination, radiation protection standards and regulatory practices.

Radiol. 629-2. Instrumentation and Clinical Applications of Nonionizing Radiation. *Summer, even-numbered years.* Lect. two hrs. per wk. Introduction to ultrasonic waves; propagation of ultrasound in tissue; reflection and absorption; the Doppler effect; ultrasound transducers; ultrasound methodology; signal processing and display techniques; intensity measurements; clinical systems and data interpretation; common artifacts; biological effects of diagnostic and therapeutic power levels; introduction to infrared radiation; emissivity and absorption of infrared in tissue; infrared receptors; thermographic systems and methodology; signal processing and display techniques; clinical systems and data interpretation; introduction to microwaves; absorption, transmission and biological effect of microwaves in tissue; microwave generators and therapeutic applications; clinical efficacy; introduction to C-W and pulsed lasers; safety precautions; clinical applications; holography; use of holography in image reconstruction.

Radiol. 630-2. Imaging Systems in Medical Diagnosis. *Fall, even-numbered years.* Lect. two hrs. per wk. Introduction to information theory, image formation and information capacity in optical and radiological systems, transfer functions, imaging systems in series and parallel, linear and nonlinear spatial filtering, image processing, image reconstruction, random processes, noise limitations, visual perception and processing, image storage and retrieval.

Radiol. 631-1. Special Topics in Radiation Therapy Physics. *Winter.* Lect. and seminar one hr. per wk. Radiation quantities and units; measurement of exposure; measurement of absorbed dose for photons and electrons by ionization chambers and chemical, calorimetric, photographic, and solid state dosimeters; computer programs for patient dosimetry; shielding and design studies for X-ray and gamma-ray facilities; other topics of interest to students.

Radiol. 632-1. Special Topics in Nuclear Medicine Physics. *Fall.* Lect. one hr. per wk. Primarily an expansion of topics introduced in Radiol. 616, with the addition of current research topics in nuclear medicine.

Radiol. 633-1. Special Topics in the Physics of Diagnostic Radiology. *Spring.* Lect. one hr. per wk. Calibration and evaluation of roentgenologic equipment; quality control in diagnostic radiology; recent advances in X-ray imaging systems.

Radiol. 650-1 to 6. Research in Radiology. *All quarters.* Available as an elective to students with interests and training appropriate for participation in radiologic research.

Radiol. 700-6 to 9. Master's Thesis in Radiology. *All quarters.*

GRADUATE NURSING PROGRAM

Master of Science Degree

The Master of Science program in nursing provides advanced education in five specialty areas of nursing: community health nursing, medical-surgical nursing, nursing administration, parent-child nursing, and psychiatric-mental health nursing. Study of clinical nursing focuses on the utilization of existing theories and the development and testing of nursing theories. Study of systems through which nursing is delivered includes the theories, policies, and processes which shape and maintain practice environments and assess the outcomes of nursing practice. Introductory preparation in teaching is offered. Research education and advanced clinical nursing are integral parts of all of the programs. Substantive knowledge of critical supporting fields is included in the specialty areas. Flexibility is provided to allow students to pursue individual interests within the specialty areas.

Curricula in the various programs are based on the following assumptions:

1. The study of known theories, the testing of theories, and the development of new theories are basic to the acquisition of knowledge.
2. Competent practice is based on depth and breadth of knowledge.
3. Teaching in nursing is based on clinical competency.
4. Each specialty area in nursing requires a synthesis of advanced knowledge of nursing theories and processes.
5. The student will take primary responsibility for self-growth through planning, implementing, and evaluating learning experiences.
6. The nurse with graduate education will take responsibility to initiate, implement and evaluate changes in health care delivery.
7. Theories and concepts of social change and processes which influence health care are shared with other disciplines.

The primary goal of the master's degree program is to provide educational preparation for specialization in selected areas of nursing. Graduate education offers opportunities for students to:

1. Pursue knowledge in depth in a selected field of interest.
2. Develop competencies in a selected field which, with experience, will qualify the student as a specialist in that area of practice.

3. Acquire and extend competencies in the assessment, use, and conduct of research.

4. Pursue further course work in related areas.

5. Collaborate with members of other disciplines in their endeavors in education, research, and delivery of health care.

6. Develop the ability to conceptualize and abstract from clinical data.

Time required for program completion varies with the individual program of study. Students may be admitted for full-time study in either summer or fall. Students may pursue part-time study with approval of academic advisers.

Nursing majors must take a minimum of three hours of non-nursing credits. If a minor is elected, the number of hours in the minor field is determined by the selected department and may vary with departmental requirements. Possible fields include health administration, education, business, philosophy and social, behavioral, or biological sciences, depending upon the student's interest and undergraduate background for study in the minor areas. If a student does not elect a minor, the credit hours in non-nursing courses may be distributed throughout several related fields.

The master's program in nursing, like the undergraduate program, is accredited by the National League for Nursing.

Additional information and application materials are available on request from the Office of Student Services, Graduate Nursing Program, University of Colorado Medical Center, C-288, 4200 East Ninth Avenue, Denver, Colorado 80262.

Nurs. 503-2. Women's Role and the Health Care System. *Fall.* A graduate-level seminar for nursing students and other eligible Medical Center students. The focus is on the feminine role in leadership and decision making. Emphasis is on interactions within the health care systems. Role playing, simulation, and other projects are designed to support these concepts and afford an opportunity for developing effective strategies for acquiring and using power in leadership roles. McKay.

Nurs. 504-3. Social Science in Nursing.¹ A study of the implications of concepts and theories from the social sciences for the practice of nursing. Content and discussion are focused on the social-psychological factors that operate in the interaction systems within which nursing is practiced.

Nurs. 505-3. Applied Epidemiologic Methods for Infection Control Practice. *Fall, Spring.* Applies epidemiologic theory to acute and ongoing problems of infection control practice. Includes brief review of identification of epidemic hazards, inter-agency referral of communicable diseases, and microbiological tools used in acute infectious disease epidemiology. Emphasizes the application of research methods for evaluation of the infection control programs and the application of epidemiologic research modalities to assess the effectiveness of prevention and control procedures and policies in the hospital community. Chavigny.

Nurs. 506-2. Foundations of Professional Nursing.¹ Current issues in nursing and their relationship to present social situation, and implications for future planning. Blair.

Nurs. 508-3. Transcultural Health. *Fall.* Deals with health status of populations, examining factors which influence the adaptation of groups to their environment. Specifically, cultural belief systems and biological variation are examined as adaptive processes. Glittenberg, Lewis.

Nurs. 509-3. Measurement and Evaluation in Nursing. *Spring.* Presents a theoretical and practical introduction to measurement and evaluation in nursing. Emphasizes the construction and use of

tests to assess classroom learning and clinical competency. Redman, Langford.

Nurs. 520-2. Issues in Clinical Nursing.¹ The nurse's role in increasingly complex patient care and current concepts in professional nursing practice.

Nurs. 600-3. Research in Nursing. *Fall.* Required of all master's degree candidates. Consideration of the philosophy and application of scientific investigation to nursing. Ebert and Staff.

Nurs. 601-2. Seminar in Nursing Research. *Spring.* An elective seminar with opportunity to explore and critically evaluate clinical nursing and the improvement of patient care. Prer., Nurs. 600.

Nurs. 602-2. Theory of Nursing. *Fall.* Focuses on the philosophical, cognitive, and methodological issues related to the development of theories of nursing and their utilization. Carter.

Nurs. 603-2. Theories of Developmental Aging. *Fall.* Seminar on theories and research relevant to developmental transitions and changes in adulthood and aging. Topics will include normal biophysiological, psychological, and sociocultural changes; developmental tasks; socialization processes and psychosocial theories of successful aging. Quayhagen.

Nurs. 604-2. Aging and Pathology. *Spring.* Seminar on pathophysiological and psychiatric symptomatology prevalent in later adulthood. Additional topics will include complexity of illness in later life, stress and pathology, coping resource levels, behavioral adaptations, and age-related nursing interventions. Prer., Nurs. 603. Quayhagen.

Nurs. 605-3. Seminar in Transcultural Health. *Spring.* Designed to build on the theoretical base of Nurs. 508 (Transcultural Health). A field experience will provide an opportunity for the student to acquire skill in gathering transcultural data on health-related issues and to develop conceptual models central to the emerging area of study of transcultural health. Prer., Nurs. 508. Glittenberg, Lewis.

Nurs. 612-2. Legal Components of Clinical Nursing Practice. *Spring, Summer.* Analysis of selected legal and clinical issues underlying the practice of the nurse clinician.

Nurs. 618-3. Clinical Nurse Specialist Seminar.¹ A systematic study and assessment of the role, professional practices, educational preparation, and major issues and problems of the expert nurse clinician in the field of nursing.

Nurs. 620-3. Pathophysiology I. *Fall.* Abnormal function of neural and endocrine structures: etiology, pathologic alteration, and management.

Nurs. 621-3. Pathophysiology II. *Spring.* Abnormal function of cardiovascular, renal, and respiratory structures: etiology, pathologic alteration, and management.

Nurs. 623-4. Adult Primary Care I. *Fall.* This first semester of the two-semester adult nurse practitioner track consists of two major components: primary health-care management of common adult chronic disorders; adult life cycle and life style concepts, including psychosocial assessment and management. Prer., Nurs. 475 or its equivalent. Stephens.

Nurs. 624-4. Adult Primary Care II. *Spring.* This second semester of the two-semester adult nurse practitioner track consists of three major components: interpretation and evaluation of common signs and symptoms of adult acute and chronic, major and minor health problems with management, health care outcomes and nurse practitioner role adaptations. Prer., Nurs. 623. Medical-surgical nursing faculty.

Nurs. 625-2. The Adult: Illness Management and Health Maintenance I. *Fall.* An integrated approach to nursing assessment and management involving the person, his or her health status and life circumstance, the practitioner, and the health care delivery system. Conceptual and phenomenologic aspects will be explored in relation to selected clinically oriented health-illness problems (exclusive of critical and intensive care) and will include biological and behavioral dimensions. Lecture and clinical practice. Prer. or coreq., pathophysiology. Kaufmann.

Nurs. 626-2. The Adult: Illness Management and Health Maintenance II. *Spring.* Continuation of Nurs. 625. Kaufmann.

Nurs. 627-3-4. Pulmonary Nursing I. *Fall.* Skill in performing and/or interpreting basic pulmonary function testing including blood gases; current concepts in epidemiology and pathophysiology of

¹Not offered on a regular basis.

more common respiratory disease including medical and nursing management (drug and physical therapies administered by nursing). Conceptual models of management of the chronically ill will guide discussions of nursing care. Consideration will be given to integration of conceptual models for practice by various practitioners toward the end of promoting coordinated care for pulmonary patients. Harrison.

Nurs. 628-4. Pulmonary Nursing II. *Spring.* Seminar and practicum in pulmonary care. Participants will participate in the management of cases requiring respiratory care. Seminar presentations by students will include clinical evaluations, pathophysiology, psychosocial needs and management. Prer., Nurs. 627. Harrison.

Nurs. 630-3. Advanced Parent-Child Nursing I. *Fall.* The primary focus is the study, analysis and application of concepts, theories and practices specific to family life. Research and current social issues having impact on family life are studied in detail. Each student selects and works with a family throughout the year utilizing a conceptual framework as basis of practice. A clinical nursing problem is identified and systematically investigated by each student. Ford.

Nurs. 631-3. Advanced Parent-Child Nursing II. *Spring.* Continuation of Nurs. 630. Parent-child nursing faculty.

Nurs. 632-2 to 6. Health Assessment and Maintenance in Maternity and Perinatal Nursing. *Fall, Spring.* Multiple modules. Enables the student to assess and help maintain an optimal level of wellness within a client population of parents expecting a child and/or children. Parent-child nursing faculty.

Nurs. 633-2 to 6. Health Assessment and Restoration in Maternity and Perinatal Nursing. *Fall, Spring.* Multiple modules. Enables the student to assess and to help maintain an optimal level of wellness within a client population of parents expecting a child and/or children. Parent-child nursing faculty.

Nurs. 634-2 to 6. Health Assessment and Maintenance in Pediatric Nursing. *Fall, Spring.* Multiple modules. Concentrates on the assessment of states and stages of wellness and concepts related to maintenance and promotion of health of children. Parent-child faculty.

Nurs. 635-2 to 6. Health Assessment and Restoration in Pediatric Nursing. *Fall, Spring.* Multiple modules. Concentrates on the assessment and intervention in various stages and states of pediatric illness. Parent-child nursing faculty.

Nurs. 636-2 to 6. Current Issues in Parent-Child Nursing. *Fall, Spring.* Multiple modules. Provides the student opportunities to enrich and gain greater depth of inquiry in areas directly related or contributing to the philosophy and practice of parent-child nursing. Parent-child nursing faculty.

Nurs. 639-2 to 6. Special Studies in Parent-Child nursing. *Fall, Spring.* Individual students, with guidance and sponsorship of qualified graduate faculty member, may elect to study in depth a particular area of parent-child nursing. Parent-child nursing faculty.

Nurs. 640-2. Theories of Behavior Development and Behavior Deviation. *Fall.* Advanced study of normal growth and behavioral development and of the development of psychopathology as formulated by Freud and Sullivan. Other personality and psychiatric theories will be compared with the focal theories. Psychiatric nursing faculty.

Nurs. 641-2. Seminar in Theories of Group Process and Group Therapy. *Spring.* Examination of theories of small group behavior, group dynamics, and group therapy and their application to the therapeutic process. Prer., Nurs. 640. Psychiatric nursing faculty.

Nurs. 644-5. Psychiatric Nursing I. *Fall.* The therapeutic process in psychiatric nursing. Examination of the application of theories from psychiatric, behavioral, and social sciences and psychiatric nursing to clinical practice. Individually supervised, selected clinical experiences in individual patient work. Coreq., Nurs. 640. Psychiatric nursing faculty.

Nurs. 645-4. Psychiatric Nursing II. *Spring.* Continuation of Nurs. 644 with extension of the therapeutic process to groups of patients. Examination of the application of theories of small group behavior, group dynamics, and group therapy to clinical practice. Individually supervised clinical experience with groups. Coreq., Nurs. 641. Psychiatric nursing faculty.

Nurs. 651-2. Teaching Nursing in Associate Degree Programs.¹ Organization of content characteristic of associate degree programs in nursing.

Nurs. 652-3. Teaching in Continuing Education.¹ A seminar course designed as an elective for graduate students in nursing to develop and enhance their teaching skills in the area of continuing education. The major focus will be on principles and theory of continuing education and the development and implementation of continuing education programs. Theories and principles of adult education will be emphasized throughout the course. Field and simulated experiences on a selected basis will be provided. Prer., Nurs. 657.

Nurs. 653-3. Nursing Leadership of Discussion Groups. *Fall, Spring.* Provides theory and practice in nursing leadership in group education. Emphasis is on leadership techniques and skills, group process, learning through group discussion, and development of nursing content. Ford.

Nurs. 654-2. The Family: Concepts, Theories and Research. *Fall.* In-depth reading, lecture, and discussion on research and theory relevant to the nursing care of families. Hooley.

Nurs. 656-3. Curricula in Nursing. *Fall, Spring.* Current curriculum principles and patterns in nursing education; the development of curricula in nursing; consideration of problems in implementation of curriculum changes. McKay.

Nurs. 657-3. Teaching Nursing. *Spring, Summer.* Theory and practice in classroom and other learning activities designed to prepare students for teaching in schools of nursing in institutions of higher learning. Prer., Nurs. 656 and a graduate course in advanced clinical nursing. Ebert.

Nurs. 658-3. Nursing Administration I. *Fall, Spring.* A lecture-seminar course in which organizational theory and basic concepts of management are explored as they relate to nursing. Topics include administrative function and process, leadership, management ideologies, human relations, and organizational goals. Blair, LeRoux.

Nurs. 659-3. Nursing Administration II. *Spring.* A lecture-seminar course which continues the study of theories as applied to nursing administration. Complex aspects of the administrative process such as power, change, evaluation, integration of research, and political influences are included. Prer., Nurs. 658 and 660. Blair, LeRoux.

Nurs. 660-3. Field Study in Nursing Administration. *Summer.* A field experience designed to afford students the opportunity to integrate administrative theory and practice through participation in selected aspects of the administrative process within a health care system. Weekly seminars which are coordinated by the faculty of the School of Nursing are a part of the field study experience. Prer., Nurs. 658. Blair, LeRoux.

Nurs. 661-3. Seminar: Issues in Nursing Administration. *Fall.* A seminar to examine issues, problems, and responsibilities associated with the administrative role in nursing. Prer., Nurs. 659 and 660. Blair, LeRoux.

Nurs. 665-3. Community Health Nursing I. *Fall.* Seminar discussion of theoretical frameworks from the biological and behavioral sciences and their application to the nursing of family groups in their neighborhood settings. Includes analysis of practice in community settings. Stember, Segall, Glittenberg.

Nurs. 666-2 to 6. Community Health Nursing II. *Spring.* Focuses on community health needs, strategies of community change, theory and methods of planning and evaluating delivery systems, and multidimensional forces which influence community health nursing. Included is a practicum to help students develop a style of professional practice which is based on substantive knowledge and research. Prer., Nurs. 600, 654 and 665. Stember, Segall, Glittenberg.

Nurs. 668-3. Epidemiology. *Fall, Spring.* Epidemiological concepts and methods with emphasis on critical thinking in matters of health and disease. Chavigny.

Nurs. 680-1 to 2. Independent Study. *Fall, Spring, Summer.*

Nurs. 690-1 to 4. Selected Topics in Graduate Study.¹

Nurs. 700-2 to 4. Master's Thesis. *Fall, Spring, Summer.* Identification of a problem, design and conduct of the investigation of

¹Not offered on a regular basis.

the problem, and a written report. Opportunity to discuss and test thesis plans with a group of colleagues.

Nurs. 740-2. Community Psychiatry I. *Fall.* An introduction to community mental health development, including relevant psychiatric, social, economic, and political issues. Survey of crisis intervention theories. A study of community family work with consideration of relevant family research and theories of family psychotherapy. Prer., Nurs. 641. Psychiatric nursing faculty.

Nurs. 741-2. Community Psychiatry II. *Spring.* Continuation of Nurs. 740 with further consideration of community and social psychiatric studies and theories. Issues in the field of mental health and trends in patient care, with consideration of implications for therapeutic teaching and administrative responsibilities of the clinicians. Prer., Nurs. 740. psychiatric nursing faculty.

Nurs. 742-4. Community Psychiatric Nursing I. *Fall.* The psychiatric nurse clinician's roles in the community mental health movement. Application of the theories and concepts of social and community psychiatry in family work and short-term treatment

modalities. Individually supervised clinical experiences. Prer., Nurs. 645. Psychiatric nursing faculty.

Nurs. 743-4. Community Psychiatric Nursing II. *Spring.* Continuation of Nurs. 742 with further consideration of the theories relevant to community study. Examination of consultative process, community assessment, comprehensive health planning, and preventive theories as they relate to community mental health work. Supervision of consultative and community projects. Prer., Nurs. 742. Psychiatric nursing faculty.

Nurs. 744-2. Elective Clinical Psychiatric Nursing I. *Fall.* Individually tailored clinical experience developed around a specific clinical interest of the student and guided by a faculty mentor. Prer., Nurs. 645. Psychiatric nursing faculty.

Nurs. 745-2. Elective Clinical Psychiatric Nursing II. *Spring.* Individually tailored clinical experience relative to a student's particular interest and need. The clinical project may be a continuation of the study started in Nurs. 744 or a separate project. Prer., Nurs. 742. Psychiatric nursing faculty.

School of Journalism

Russell E. Shain, Dean

INFORMATION ABOUT THE SCHOOL

Office in Macky 229

History and Purpose

Formal instruction in journalism began at the University of Colorado, Boulder, in 1909. Journalism was made a department of the College of Arts and Sciences in 1922 and became a College of Journalism within the College of Arts and Sciences in 1937. The Board of Regents authorized a separate School of Journalism effective with the fall semester of 1962.

The School of Journalism provides a sound academic foundation for the student who plans a career in some phase of journalism. The school offers its majors superior professional instruction with a broad education in the liberal arts. It provides service to the journalistic media, to other state educational institutions, including the high schools, and to the public at large. The School of Journalism makes courses available to other than journalism students within the limits of space and other facilities upon which journalism majors properly have first claim.

Career Opportunities

Career opportunities are available in both print and electronic journalism. Graduates work for newspapers, magazines, radio, television, advertising and public relations firms, science, industry, government, and in teaching. The School of Journalism assists graduates in job placement.

Accreditation

The School of Journalism is accredited by the American Council on Education for Journalism, specifically for the news-editorial and advertising sequences. It is a fundamental principle of the ACEJ that education for journalism be broadly based. Accordingly, undergraduate journalism students at the University of Colorado take not less than three-fourths of their college work in the arts and sciences and approximately one-fourth in professional journalism courses.

Accredited journalism programs, as described by the American Council on Education for Journalism, are distinguished by the following characteristics:

1. They maintain a professional curriculum with one or more special sequences, leading to a bachelor's degree and/or advanced degree or degrees in journalism.

2. They carry on the professional training of general practitioners for the field of journalism while giving due consideration to services, the profession, and research.

3. They strive to serve national media as well as media of their own states.

4. They are committed to a philosophy of professional training that places strong emphasis on liberal arts studies.

5. They provide close relationships between students and teachers.

Facilities

Laboratories. Journalism students work in a reporting laboratory, a news editing laboratory that includes the Associated Press wire service, an advertising laboratory, a radio-television laboratory, and a photo-journalism laboratory.

Reading Room. A reading room for journalism students contains daily and weekly newspapers for Colorado and elsewhere, professional and general magazines, and other material.

Internships. Majors in journalism are encouraged to seek internships, and the school assists in internship placement. Majors work for campus media, weekly and daily newspapers, advertising and public relations agencies, social service agencies, radio and television stations, and others.

Honors

Journalism students may graduate with General Honors and/or School of Journalism Honors. To apply for General Honors, students must have a grade-point average of 3.0 or higher and must complete at least four honors courses. The General Honors program is administered by the Honors Council and application must be made at the beginning of the senior year. To apply for School of Journalism honors, a student must have a 3.0 cumulative grade-point average and a 3.25 in journalism courses, must complete independent work, and must demonstrate a high degree of professional skill. Application for School of Journalism Honors must be made to the dean at the beginning of the student's final semester.

Scholarships and Awards

The following scholarships, loan funds, and awards are available annually to officially admitted journalism majors.

Applications must be submitted to the dean of the School of Journalism by February 15 of the year in which the scholarship is to become effective.

Christopher Michael Burns Memorial Scholarship (\$300) to a man or woman in the advertising sequence.

Cervi Memorial Scholarship (\$400) to a senior man or woman.

Colorado Advertising Education Foundation Scholarship (\$300) to a man or woman student.

Colorado Daily Scholarships (tuition and fees). Two scholarships given to men or women students who are journalism or pre-journalism majors not yet seniors.

Colorado Press Women Scholarship (\$150) to a woman student.

Denver Press Club Scholarship (tuition and fees) to a senior man or woman from the Denver metropolitan area.

Denver Press Club-Mile High Kennel Club (tuition and fees) to a senior man or woman from the Denver metropolitan area.

Denver Woman's Press Club, Frances Belford Wayne Merit Award (\$250) to a woman student.

Raymond B. Johnson Award (\$150) to an outstanding student.

Journalism Faculty Scholarship (\$400).

Michael James Edwards Memorial Scholarship—Denver Newspaper Guild (\$300).

L. C. Paddock Memorial Scholarship (tuition and fees) to a man or woman student.

Raymond B. Johnson Memorial Fund for loans to needy students.

William M. Long Memorial Fund for loans to needy students.

A. A. Paddock Memorial Student Aid Fund for emergency-type aid.

Blumberg Prize (\$200). Award given to outstanding graduating senior in the broadcast sequence.

KMGH-TV Special Merit Award (\$100). Award given to outstanding broadcast major.

Student Organizations

Through an elected Student Council, students conduct a wide range of activities and assist in formation of policies of the school.

The school has chapters of the Society of Professional Journalists, Sigma Delta Chi; Women in Communication; Alpha Delta Sigma, professional advertising fraternity; and Kappa Tau Alpha, honorary scholastic society in journalism.

Study-Aboard Programs

The School of Journalism along with the Office of International Education urges journalism students to participate in the University's study-abroad programs. Since the year of study abroad usually is undertaken during the junior year, prospective journalism majors are advised to plan early and seek counseling from the journalism faculty. Programs are offered in Costa Rica, Egypt, France, Germany, Great Britain, Israel, Italy, Mexico, Peru, Spain, and Taiwan. In addition to a journalism degree, students

can earn an area-studied degree in the College of Arts and Sciences during a five-year period. Information and application forms are available at the Boulder Campus Office of International Education, University Administrative Center, 914 Broadway.

UNDERGRADUATE DEGREE PROGRAMS

Requirements for Admission

The undergraduate degree offered is the Bachelor of Science degree in journalism.

Students planning to major in journalism at the University of Colorado normally enroll as prejournalism freshmen in the College of Arts and Sciences or complete their freshman and sophomore years in some other collegiate institution.

Students wishing to transfer into the School of Journalism should file an application for intrauniversity transfer with the school early in the second semester of their sophomore year.

Students may be admitted to the school if they:

1. Complete a minimum of 60 semester hours with a grade-point average of at least 2.25.

2. Fulfill the requirements in the College of Arts and Sciences as outlined below under Requirements for Graduation.

3. Complete both Jour. 100 and Jour. 250 (transfer credit may be accepted for Jour. 100).

4. Establish a grade-point average of at least 2.5 in all journalism courses attempted prior to applying for transfer.

Meeting the minimum requirements does not guarantee a student admission to the School of Journalism.

Prejournalism

- 1: Prejournalism students are enrolled in the College of Arts and Sciences until eligible to transfer into the School of Journalism, normally at the end of the sophomore year. These students must consult with advisers in the School of Journalism.

2. Prejournalism majors normally take courses that meet area requirements in the College of Arts and Sciences, listed below under Requirements for Graduation. They should take English composition, Jour. 100, and Jour. 250. Jour. 100 is a prerequisite for Jour. 250 and both are required of all journalism majors. Jour. 250 requires a minimum of sophomore standing.

A language skills test will be given in Journalism 100. Scores on this test will be considered in evaluations of applications for transfer into the school.

Transfer Credits

Credit in subjects transferred from other institutions to the University of Colorado is limited to the amount of credit given for similar work at the University of Colorado. The transfer of credits in journalism is limited to 12 semester units and is subject to approval of the dean of the School of Journalism. A

proficiency examination in journalistic writing and language skills will be required of those who wish to transfer credit equivalent to Jour. 250.

Requirements for Graduation

A total of 124 semester hours with a grade-point average of not less than 2.25 overall and 2.50 in journalism courses is required for the B.S. degree in journalism. Of these 124, at least 40 must be upper division credits, 24 must be in the social sciences, and 28-34 must be in journalism. No student may take more than 34 hours of journalism in the 124 hours required for graduation. The upper limit is imposed to insure wide exposure of journalism majors to liberal arts courses. No minor is required. Students who wish to develop expertise in a particular journalistic specialty are advised to take courses in science, business, political science, or the relevant area.

Humanities two 2-semester courses
 Natural science two 2-semester courses
 Social sciences two 2-semester courses

DOUBLE-DEGREE AND COMBINED-DEGREE PROGRAMS

Some students complete requirements in two fields and in some cases receive a second degree from the University. Students planning such a program should consult both the School of Journalism and the other college or school about requirements and procedures.

RESIDENCE REQUIREMENTS

A candidate for a degree from the School of Journalism must earn the last 30 hours in residence in the school. This may include courses taken on the campuses at Boulder, Denver, and Colorado Springs.

SENIOR REQUIREMENTS

At the beginning of the semester of graduation, seniors are required to file a diploma card with the School of Journalism, giving notice of intention to complete graduation requirements. Diploma cards are available at the office of the School of Journalism.

Journalism and prejournalism majors are required to consult an adviser at each registration period. However, the student alone is ultimately responsible for the fulfillment of all degree requirements.

Journalism Sequences

Three sequences of professional study are available in the School of Journalism.

ADVERTISING SEQUENCE

The advertising sequence is designed to prepare students for careers with newspapers, magazines, radio and television, and advertising and public relations firms.

<i>Required Courses</i>	<i>Semester Hours</i>
Jour. 100. Contemporary Mass Media	3
Jour. 250. Reporting	3
Jour. 377. History of Journalism	3

Jour. 490. Journalism and Public Opinion	3
Jour. 340. Principles of Advertising	3
Jour. 345. Advertising Copy and Layout	3
Jour. 440. Advertising Media and Campaigns	3
Jour. 443. Retail Advertising	3
Journalism electives	4-10
Mk. 300. Principles of Marketing	3
Econ. 201. Principles of Economics I	3
Econ. 202. Principles of Economics II	3

NEWS-EDITORIAL SEQUENCE

The news-editorial sequence is designed to prepare students for positions as reporters, editors, and writers for newspapers, news services, magazines, trade and technical publications, company publications, government, and public relations.

<i>Required Courses</i>	<i>Semester Hours</i>
Jour. 100. Contemporary Mass Media	3
Jour. 250. Reporting	3
Jour. 377. History of Journalism	3
Jour. 490. Journalism and Public Opinion	3
Jour. 350. Reporting of Public Affairs	4
Jour. 355. News Editing	3
Jour. 450. Advanced Reporting	3
Jour. 465. Journalism and the Law	3
Journalism electives	3-9

RADIO-TELEVISION NEWS SEQUENCE

The radio-television news sequence is designed to prepare students as news directors, reporters, editors and writers for radio or television stations.

<i>Required Courses</i>	<i>Semester Hours</i>
Jour. 100. Contemporary Mass Media	3
Jour. 250. Reporting	3
Jour. 377. History of Journalism	3
Jour. 490. Journalism and Public Opinion	3
Jour. 350. Reporting of Public Affairs	4
Jour. 360. Radio and TV News	3
Jour. 462. Radio and TV News Editing	3
Jour. 465. Journalism and the Law	3

<i>Recommended Courses</i>	<i>Semester Hours</i>
Jour. 463. Broadcast News Projects	3
Comm. 362. Radio-Television Production	3

MASTER'S DEGREE PROGRAM

A Master of Arts degree in journalism is awarded after the student has demonstrated an understanding of the role of the mass media in society as well as competence or potential as a journalist. Students may come into the graduate program with or without a foundation of educational or practical experience in journalism. Upon completion of the program, students may enter or return to journalism, teach, or continue graduate studies in a doctoral program.

Graduate students should read carefully Requirements for Advanced Degrees in the Graduate School section of the catalog.

Journalism courses are available as a minor in other fields of advanced study to which journalism is a logically related subject.

Requirements

Students without adequate educational or practical experience in the profession may be required to take basic courses in journalism without graduate credit as prerequisites for advanced courses, or they may be asked to pass a proficiency exam in journalistic writing and language skills. Such requirements will be determined individually.

Candidates for the master's degree in journalism pursue either of two plans, depending upon the journalistic background of the student at the time of admission. In either case, the student must present a minor of at least two courses in a supporting field. A minimum of 24 to 30 semester hours of graduate-level work is required.

Every effort is made to suit the course work, both within the journalism curriculum itself and in supporting fields, to the interests and goals of each candidate. For details about the program write the Graduate Committee Chairman, School of Journalism, University of Colorado, Boulder, Colorado 80309.

ACADEMIC POLICIES

Attendance Regulations

Students are expected to attend classes regularly and to comply with the attendance regulations specified by their instructors. At the beginning of each semester, students will be informed by each instructor

of policies governing attendance in his classes. A student who does not attend any of the first week's sessions of a class during a term may be dropped from the class.

Uniform Grading and Pass/Fail, Drop/Add, and Withdrawal Procedures

The University has adopted a standard policy concerning grades and pass/fail, drop/add, and withdrawal procedures. These policies are outlined in the General Information section of this catalog.

Scholastic Suspension

Majors (students who have transferred into the School of Journalism) are subject to suspension if they do not maintain a cumulative University grade-point average of 2.25 and a cumulative journalism grade-point average of 2.5.

Scholastic records of students will be reviewed as soon as possible after the close of spring semester, and the student will be informed in writing if he is to be suspended.

The normal period of suspension is two regular semesters (one academic year, excluding summer sessions). The period of suspension will be stated in the suspension notice to the student. A student suspended a second time will be reinstated only on the basis of unusual circumstances, which the student should state in a petition to the dean of the school.

School of Law

Courtland Peterson, Dean

INFORMATION ABOUT THE LAW SCHOOL

History and Purpose

The School of Law of the University of Colorado was organized in 1892. It has been a member of the Association of American Law Schools since the AALS's first annual meeting in 1901 and has been on the list of approved law schools of the American Bar Association since the first publication of such a list in 1923. Such approval is based upon high scholastic standards, the maintenance of a three-year law course requiring full-time resident study, a well-qualified faculty, adequate library facilities, and high admission standards. The law school is fully accredited by all agencies, and graduates are qualified academically to take the bar examination in all 50 states.

Affirmative Action

It is the policy of the University of Colorado School of Law not to discriminate on the basis of sex, handicap, race, color, religion, or national or ethnic origin in its educational programs, admissions policies, employment policies, financial aid, or other school-administered programs, except as provided for under affirmative action programs. This policy is enforced by federal law under Title IX of the Education Amendments of 1972, Title VI of the Civil Rights Act of 1964, and section 505 of the Rehabilitation Act of 1973. Inquiries regarding compliance with these statutes may be directed to the Assistant Dean, School of Law, University of Colorado, Boulder, Colorado 80309 (telephone) 492-8047, or to the Director of the Office for Civil Rights, Department of Health, Education, and Welfare, Washington, D.C.

Law Building and Law Library

The School of Law is housed in the Fleming Law Building, located in the southeastern part of the campus. Classrooms, seminar rooms, and a complete trial and appellate courtroom have been designed with student convenience and educational utility in mind. The building also contains suites for the Legal Aid and Defender Program and *The University of Colorado Law Review*, faculty and administrative offices, a student lounge, and an excellent library. With the completion of several new additions in 1974, the building now has ample space to accommodate the student body of 450 now enrolled.

The central feature of the Fleming Law Building is the law library, containing one of the best legal reference collections in the western United States. One of the 1974 building additions was the attractive Rothgerber Memorial Library, which almost doubled the size of the library facilities. At the present time the collection consists of approximately 140,000 volumes, including a comprehensive collection of American case law from all jurisdictions, statutes of all of the states (in annotated form when available), and the major digests, encyclopedias, and texts dealing with American law. The English and Canadian materials are almost as complete, and there are substantial holdings in other Commonwealth materials and in international law. A selected group of books in German and French provides a basis for comparative law studies. The legal periodical collection is outstanding.

To facilitate use, almost all of the collection is on open shelves.

Methods of Instruction

The case system, or the study of principles of law as illustrated in judicial opinions, is the chief method of instruction. Research, lecture, text, and problem methods are also employed. Many seminars are offered, presenting opportunities for close contact between faculty members and students, and joint faculty-student examination of certain problems in depth.

Although the curriculum is concerned primarily with the intellectual aspects of the law, students have ample opportunity to explore the practical applications of what they learn in the classroom. A practice court, conducted in the fashion of the state district courts, has long been a feature of the required work in the School of Law; the practice work of the Legal Aid and Defender Program is described below.

Career Opportunities and Placement

The School of Law has an active placement service. Liaison is maintained with law firms, government agencies, courts, and businesses that seek the services of students and young lawyers. Although it is difficult to predict future prospects for legal employment, most graduates currently must engage in an extensive job search.

The graduating class for the academic year 1976-77 included 139 graduates. Of the 107 who reported their

employment status, 89 percent (95) were employed and, of these, 97 percent (92) were working in law-related areas. The largest group, 44 percent (40), are in private practice, 20 percent (18) are clerking for judges, 14 percent (13) are in legal services, and 18 percent (17) are employed by government on local and federal levels. The remaining 4 percent (4) are working in business and the military service. A beginning average salary of \$15,021 was determined from the reports of the 37 law-employed graduates who submitted salary figures. Graduates of this class have located in Arizona, Colorado, District of Columbia, Florida, Idaho, Illinois, Michigan, Minnesota, Montana, Nebraska, New York, Ohio, Pennsylvania, South Dakota, Tennessee, and Wyoming.

Prelegal Preparation

Students expecting to enter law school usually want to know how they can best prepare themselves to study law.

Unquestionably, there should be careful consideration of prelegal courses and the formulation of a definite plan of prelaw study covering the college years. However, the School of Law of the University of Colorado does not prescribe a rigid prelaw curriculum since students' plans should be based on their own strengths and weaknesses, their interests, the offerings of their particular colleges, and their personal objectives in studying law. In general, the prelaw student should place primary emphasis on the acquisition of excellent methods of study, thought, and communication rather than on factual knowledge. Obviously, these skills can be acquired in a number of different areas, and successful law students and lawyers have college majors in almost every conceivable field.

Some specific comments as to a choice of courses can be made. Sufficient English must be studied to insure competence in grammar, spelling, composition, and speech. Latin, Greek, and other foreign languages tend to reinforce this competence. Mathematics is very helpful in developing a capacity to think analytically, as are certain courses in philosophy. The natural sciences provide instruction in scientific method and an appreciation of the importance of detailed accuracy, and some study in this area is desirable. The social sciences most frequently provide the major undergraduate field for the prelaw student. American and English constitutional history, political science, economics, sociology, and psychology may be excellent choices.

Students who already have specific career interests or objectives should plan accordingly. For example, students interested in patent law may wish to acquire a background in engineering. Those interested in commercial law should consider accounting or other business courses. Students planning careers in international law should consider acquiring one or more foreign languages and the possibility of study abroad.

In summary, then, college courses should be chosen with care to produce a balanced pattern of skills and

insights. The undergraduate major field should be one of some difficulty, which requires careful advanced study.

Part-Time Employment

The study of law is essentially a full-time task. Most students devote from 50 to 70 hours a week to classroom attendance, preparation for class, and other activities directly related to their legal education, such as participation in appellate briefing and argument competition, and the work of the Legal Aid and Defender Program. As a consequence the opportunity for self-support through employment while attending law school is limited. A number of students, however, find it necessary to do some part-time work, and law-related employment for a limited number of hours may actually enhance the educational experience of some second- and third-year students. Students who must work in their first year, or those working an excessive number of hours, must expect this to affect the quality of their educational experience. Students with advanced standing should avoid committing themselves to employment of more than 20 hours per week, or to any schedule of employment which will interfere with class attendance.

The Law Placement Office assists students who wish to secure law-related part-time employment. The University's Career Development and Placement Services and the Office of Student Employment Services aid those who wish to find conventional employment or work-study placement.

Special Lectures and Professorships

The Charles Inglis Thomson Trust Fund, created in 1913 through the generosity of Olivia Thomson in memory of her husband, enables the School of Law to bring to Colorado as guest professor for the summer term in each year one of the world's leading authorities in a selected field of law. Recent Thomson professors have been Herbert Wechsler of Columbia University; David Daube, Paul J. Mishkin of the University of California, Berkeley; Rudolf B. Schlesinger, formerly of Cornell University; and S.F.C. Milsom, Professor of Law and Fellow, St. John's College, Cambridge University, England.

In 1955 the late Adrian S. Coen established a trust fund in memory of her husband, the late John R. Coen, to bring to the School of Law once each year a prominent jurist or statesman to deliver a lecture to the students and faculty of the School of Law. Lecturers in this series have included Guido Calabresi, professor of law, Yale University; Richard A. Posner, professor of law, University of Chicago; Brigitte M. Bodenheimer, professor of law, University of California at Davis; Leonard Boudin, senior partner, Rabinowitz, Boudin, and Standard, New York City and Rex E. Lee, Dean, Brigham Young University School of Law and former U.S. Assistant Attorney General.

In addition to the Coen lecturer, a number of speakers are presented annually.

Financial Aid: Grants, Scholarships, Loans, and Work/Study

Grants-in-aid and scholarships are available on a limited basis to deserving students in the School of Law and are awarded on the basis of financial need and academic performance. However, due to a drastic curtailment of state funds for law school grants-in-aid, available funds may be further limited in future years. Nonresident students may not be awarded grants from state funds under present state policy. Scholarship aid from private funds within the Law School is restricted to those students with substantial need and strong academic standing. Separate financial aid funds are available for support of students eligible for admission under the Law School's Special Academic Assistance Program described below.

Limited loan funds are also available through the National Direct Student Loan (NDSL) and the Federally Insured Student Loan (FISL) programs. Financial need must also be demonstrated in order to qualify for these loans.

Part-time employment under the Work/Study Program is available on a limited basis. However, because the demands of the study of law are rigorous, employment is not encouraged, particularly during the first year.

A carefully estimated budget for education costs of graduate students at the University of Colorado is fixed each year. Assets and resources of students and parents (if the student is dependent) are measured against the budget to compute financial need. Grants, loans and Work/Study are then awarded on an availability basis.¹

An entering student who applies for financial aid must file either a Family Financial Statement with the American College Testing Program or the Graduate and Professional School Financial Aid Service Application. These forms are available on most major college campuses or applicants may write ACT, Operations Division, P.O. Box 808, Iowa City, Iowa 52240, or for GAPS FAS, Graduate and Professional School Financial Aid Service, Box 2614, Princeton, New Jersey 08540. In addition, students seeking grants-in-aid from available state funds must complete the University's application form which will be sent to all students upon their application for admission. The deadline for completion and submission of this form, as well as the deadline for completion and submission of the ACT or GAPS FAS forms, is February 15.

Students who are awarded financial aid have the right to decline any part or all of their financial aid. Students who accept financial aid awards have the responsibility of reporting to the Financial Aid Office all changes in their financial, marital, or tuition status. They must be registered as full-time students in a degree program at the institution during each term aid is accepted. Students receiving financial aid must affirm that these funds will be used solely for expenses related to attendance or continued attendance at the institution.

Any inquiries regarding financial assistance may be directed to the Assistant Dean, School of Law, University of Colorado, Boulder, Colorado 80309; telephone, 492-8047.

ADMISSION PROCEDURES

Requirements and Standards

The School of Law grants admission to qualified applicants who have received a baccalaureate degree from a properly accredited institution, based on at least 90 semester hours or 135 quarter hours of credit (exclusive of credit earned in nontheory courses such as hygiene, domestic arts, physical education, vocal or instrumental music, studio art and ROTC, and exclusive of work taken by correspondence).

The applicant must also show substantial intellectual promise and give evidence of high moral and ethical standards. Admission standards are based heavily on undergraduate grade-point average and the Law School Admission Test score. The Admissions Committee may also take into consideration other factors such as trend in transcript, character and difficulty of the applicant's academic program, letters of recommendation, and significant experience of the applicant.

Because of the large number of highly qualified applicants, the standards have been set at a high level, particularly for nonresidents. For the fall 1977 entering class, average grade point was 3.45 on a 4.0 scale and the average Law School Admission Test score was 648. The qualifications for the entering class in fall 1979 will depend upon the applications received and completed, and upon the credentials of the applicants.¹

Beginning students are admitted in the fall semester only. Normally, students are admitted on a full-time basis, but where special circumstances are shown to exist, a limited number of students may be permitted to take a reduced course load, subject to the requirement that they complete their course of study within four years. The law school does not have an evening division of study, nor does it offer any joint degree programs.

A small number of places are expected to be available in the second- and third-year classes for admission by transfer of applicants who have achieved very strong performances at other accredited law schools.

Because of the large number of applications which must be processed, the deadlines hereinafter set out are strictly adhered to, and candidates should be careful to observe them. Personal interviews are not required or encouraged. Applicants are encouraged to submit in writing any additional information or statements which they wish to have considered by the Admissions Committee.

¹The attrition rate for all students over the past three years has averaged out to 10 percent. This attrition rate reflects all reasons for withdrawal.

Special Academic Assistance Program

The School of Law recognizes the need for increasing the number of minority group lawyers. Accordingly, a special program has been established for members of minority groups who hold or will have earned the baccalaureate degree but whose credentials are below those ordinarily required for admission. This program includes a special eight-week summer program immediately preceding the first year of study, as well as additional academic assistance during the first year, if needed. It is designed to assist students who are members of identifiable groups which have not had adequate educational and cultural opportunities available to them and which are seriously underrepresented in the legal profession. The program enables these students to study and to take examinations on equal terms with their classmates. Financial assistance is available in conjunction with this program.

Applicants who may be eligible for admission to the School of Law under this program should contact the School of Law Admissions Office for further information.

How and When to Apply

1. Request application blanks and instructions from the School of Law, Fleming Law Building, University of Colorado, Boulder, Colorado 80309.

2. Complete both Part 1 and Part 2 of the application for admission, making certain *both* parts are signed. *The completed application for admission must be received by January 15* and must be accompanied by a nonrefundable application fee of \$20. In addition, the following credentials must be completed and received by February 15. (The student should have each item mailed directly from its source to the School of Law.)

- a. *All applicants* for regular admission must utilize the Law School Data Assembly Service provided by the Educational Testing Service for the purpose of providing an evaluation of all college and non-law school postgraduate work undertaken. Such evaluation must be based on not less than the equivalent of six semesters or nine quarters of regular undergraduate college work. To obtain registration forms, applicants should write directly to LSDAS, Educational Testing Service, Box 944, Princeton, New Jersey 08540. A registration form to utilize the service must have been received by LSDAS no later than January 15.
- b. The student must present the results of the Law School Admission Test. This test is administered by the Educational Testing Service, P.O. Box 944, Princeton, New Jersey 08540. It is given five times each year at a number of places in the United States. Applicants must take the test no later than October or December in the year prior to the term they expect to attend law school. For

further information and arrangements contact the Educational Testing Service.

- c. All applicants are strongly encouraged to submit at least one letter of evaluation from a college instructor from whom a course has been taken and, if the applicant has entered into postgraduate employment, from a person having supervision over the applicant's work. The evaluator should be someone who has had the opportunity to observe and can write about the applicant's abilities and performance.

The applicant is responsible for arranging for submission of the above supporting documents, including materials from the Law School Data Assembly Service, and for ensuring the materials are received by the School of Law prior to established deadlines.

Transfer Students

Transfer students must meet all standards and requirements set forth above for students who have not previously attended law school.

Applicants must arrange to have sent, in addition to the above items: (1) two copies of transcripts on all work undertaken at such other law school and (2) upon completion of all work at that law school, a letter from its dean stating that the applicant is in good standing and eligible to continue without condition.

Students who have been accepted for admission and who have attended a law school not on the approved list of the American Bar Association nor a member of the Association of American Law Schools will receive no credit for any work completed in that law school.

Students who have previously attended other fully accredited law schools may receive advanced-standing credit for work done in such law schools in an amount and on such conditions as determined by the Office of the Dean. In no event will credit be given toward graduation for any course taken in another law school in which a grade of less than C or its equivalent has been recorded.

Confirmation

As credentials are completed, the Admissions Committee will act upon applications. In most cases notification should be received between mid-April and mid-June. Applicants who are accepted for admission must send a nonrefundable deposit (which will be credited toward tuition for the first semester) to the School of Law no later than the time stated (normally within two weeks) in the letter giving notice of admission.

Transcripts—Withdrawal of Admission

At least one week prior to enrolling in the School of Law, all students who have been admitted and have confirmed their admission must submit two official transcripts from *each* college and law school attended showing all college and postgraduate work completed.

Such transcripts must show the student has received a baccalaureate degree from a properly accredited institution. These transcripts must also show any subsequent work which was undertaken whether or not the work was included in the LSDAS evaluation. If such subsequent work is not of substantially similar quality to that included in the LSDAS evaluation, or if the transcripts fail to show the student has received the required baccalaureate degree, the student's prior admission may be withdrawn.

Summer Session

Students with advanced standing from accredited law schools may register for the summer session upon presentation of a letter of good standing from their respective schools together with a completed summer application form. Students may register for courses carrying a maximum of 10 semester hours of credit.

The summer curriculum is designed for students with advanced standing. All courses offered in the School of Law will run for the full session unless otherwise announced. A *Schedule of Summer Courses* with an application form may be obtained by writing to the Assistant Dean for Admissions, School of Law, University of Colorado.

GRADUATION REQUIREMENTS

The right to change the academic performance requirement and the graduation requirement is expressly reserved to the dean and faculty.

The degree Juris Doctor (J.D.) will be conferred on students who have satisfactorily completed the six-semester curriculum in accordance with faculty regulations. The time allowance may be proportionately reduced for those who enter with advanced standing, but at least the last two semesters of study must be completed at the University. All law school work must be taken in residence—that is to say, in the classroom or under direct personal supervision of the instructor—and not by correspondence or extension.

No credit toward graduation from the School of Law will be given for any prelaw courses.

The School of Law does not offer work leading to advanced degrees in law. In particular, the requirements for the J.D. degree are:

1. Completion of 86 semester hours of credit with a numerical average of 72 or better.
2. Completion of all required courses. These are listed under Law School Curriculum and are marked by an asterisk.
3. Completion of one seminar.
4. Study for at least six semesters or equivalent in residence at this or some other accredited law school, with the last two semesters in residence at the University of Colorado School of Law. A semester in residence is earned where the student has been enrolled in a minimum of 10 hours of course work and has passed a minimum of 10 hours.

The normal course load is about 14 or 15 hours per semester. Students may not register for more than 16

hours or fewer than 10 hours without special permission, and first-year students must obtain permission in order to register for less than a full schedule.

Half a semester's time and residence credit may be earned in a summer session. By enrolling in two summer sessions and taking a minimum of 5 hours of work in each, the student can obtain a full semester of residence credit and earn a degree one semester earlier than normal.

5. Satisfaction of any conditions imposed at the time of admission.

ACADEMIC POLICIES

Honor System

On the premise that academic dishonesty is incompatible with the dignity and responsibility of the legal profession, the School of Law operates under an honor code. The honor code is a system of rules administered by student officers and forbids certain described offenses, including resort to unauthorized sources in examinations. The School of Law requires, as a prerequisite to admission, that applicants state their willingness to conform to the honor code.

Grading and Point System

Grades in the University of Colorado School of Law are indicated by *A, B, C, D, F*. Nonfinal grades are given under circumstances described in the Rules of the Law School.

The School of Law also grades on a numerical basis. The numerical grade is shown in parenthesis after each letter grade: *A* (100-90); *B* (89-80); *C* (79-70); *D* (69-60); *F* (59-50).

One semester hour of credit represents one 50-minute class period per week through a semester.

The courses in the School of Law designated as pass/fail or pass/graded courses are graded as follows: The grade of *pass* is given when in the judgment of the instructor the quality and quantity of work is such that on a graded basis the work would be the equivalent of at least a *C* (72). If the instructor judges the work not the equivalent of a *C* (72), the work is assigned that letter and numerical grade between the *F* (50) and *C* (71) which the instructor determines is appropriate.

Drops

A student who discontinues a course at any time without notifying the Office of the Dean and processing the necessary papers will receive an *F* (50). All first-year students must obtain the permission of the dean's office prior to dropping any course.

No student shall be permitted to drop without discredit any seminar or other course with enrollment limited below the maximum at any time after enrollment for the course has reached capacity, except by approval of the dean's office for good cause shown by written petition. No second- or third-year student shall be permitted to drop any seminar or course with enrollment limited below the maximum which did not

reach capacity without discredit after the end of the fifth week or any other course without discredit after the tenth week of any semester or the fourth week of the summer session, except by approval of the dean's office for good cause shown by written petition.

Withdrawals

Students may withdraw from the School of Law at any time up to two days before the beginning of final examinations by obtaining permission of the dean's office.

Transcripts of Credit

Official transcripts of credit should be ordered from the Office of Admissions and Records transcript section, Regent Administrative Center 125. Official transcripts are prepared only at the student's request submitted in person or in writing. Requests for letters of certification indicating class standing, numerical averages, and attendance dates may be made in person or in writing to the Law School Registrar, Fleming 208.

Classification of Students

To be ranked in the second-year class, a student must have passed 28 semester hours of work; to be ranked in the third-year class, 56 hours of work.

Academic Performance Requirements

Subject to certain qualifications, for which the rules of the Law School should be consulted, students with a cumulative average below 72 at the end of any session or semester are normally excluded at the end of the next semester of attendance, unless by such latter time the cumulative average has been raised to 72.

Attendance

A rule of the School of Law provides that a student who has been absent from more than 20 percent of the total number of classes in a course will be excluded from the final examination, and will not receive a passing grade in the course, unless the rule is waived in advance by the instructor.

LAW SCHOOL CURRICULUM

The curriculum of the School of Law is designed to give students a thorough training in fundamental principles of English and American law, to permit moderate specialization in personal interest areas, and to prepare them to practice their profession with credit in any state or country where Anglo-American law prevails.

Students have the responsibility of planning their second- and third-year schedules so as to complete all required courses and obtain a full schedule of work in each semester. The Office of the Dean will always be available for consultation but will not relieve the students of their primary responsibilities in course planning.

The value of the course in semester hour credits is indicated by the figure following the identifying department number. For example, in Law 510-3, Law 510 is the identifying department number, and the -3 indicates that the course is for 3 hours of credit.

The right to change the schedule of courses and instructors is expressly reserved to the dean and faculty.

In addition to the courses listed below, students who have completed three full semesters may enroll in advanced University courses offered outside the School of Law and receive up to 6 semester hours of credit toward the law degree, provided such courses are law-related or related to the professional objectives of the student.

Program for the Fall Semester

FIRST-YEAR STUDENTS

Law 510-3. Contracts I¹
Law 520-1. Legal Writing¹
Law 530-3. Civil Procedure I¹
Law 540-3. Torts I¹
Law 550-4. Criminal Law¹

SECOND-YEAR STUDENTS

Law 618-4. Commercial Transactions
Law 631-3. Water Resources
Law 632-3. Land and Mineral Resources
Law 635-3. Evidence
Law 651-3. Criminal Procedure I
Law 652-3. Unfair Competition and Intellectual Property
Law 660-4. Income Taxation
Law 661-4. Constitutional Law
Law 664-3. State and Local Taxation
Law 665-1. Professional Responsibility¹
Law 672-1. Legal Aid
Law 673-2. Legal Aid—Civil Practice
Law 674-2. Legal Aid—Criminal Practice
Law 699-2. Wills and Trusts

THIRD-YEAR STUDENTS

Law 702-2. Immigration Law
Law 710-3. Domestic Relations
Law 715-3. Federal Estate and Gift Taxation
Law 722-3. Legal Philosophy
Law 732-3. Land Use Planning
Law 734-2. Employment Discrimination
Law 735-3. Real Estate Planning
Law 740-1. Interviewing
Law 750-3. Antitrust
Law 755-3. Creditors' Remedies and Debtors' Protection
Law 758-3. Remedies
Law 760-3. Local Government
Law 771-var. Independent Legal Research
Law 772-2. Extern Program
Law 787-3. Federal Courts
Law 790-1. Practice Court¹

Seminars

Law 703-2. Natural Resources and the Environment:
Law, Policy and Economics
Law 707-2. Federal Courts in the American
Political System
Law 720-2. Problems in Comparative Law
Law 729-2. Appellate Adjudication
Law 775-2. Law and Medicine
Law 782-2. Labor Arbitration
Law 785-2. Social Legislation

¹These courses are required; other courses are elective.

Program for the Spring Semester

FIRST-YEAR STUDENTS

- Law 511-3. Contracts II¹
- Law 521-1. Appellate Court Advocacy¹
- Law 531-3. Civil Procedure II¹
- Law 541-3. Torts II¹
- Law 561-4. Property¹

SECOND-YEAR STUDENTS

- Law 605-2. Future Interests
- Law 606-3. Real Property Conveyancing and Security
- Law 610-2. Agency-Partnership
- Law 618-4. Commercial Transactions
- Law 625-4. Corporations
- Law 630-3. Civil and Political Rights
- Law 635-3. Evidence
- Law 650-3. Labor Law
- Law 651-3. Criminal Procedure I
- Law 653-3. Criminal Procedure II
- Law 655-3. Legal Accounting
- Law 660-4. Income Taxation
- Law 662-3. Legal Process
- Law 665-1. Legal Profession¹
- Law 670-2. Extern Program
- Law 672-1. Legal Aid
- Law 683-2. Legal Aid—Evidence Presentation

THIRD-YEAR STUDENTS

- Law 700-3. Administrative Law
- Law 705-3. Conflict of Laws
- Law 710-3. Domestic Relations
- Law 715-3. Estate Planning
- Law 725-3. Jurisprudence
- Law 730-3. Substantive Rights of the 14th Amendment
- Law 745-2. Securities Regulation
- Law 747-3. Environmental Law
- Law 755-3. Creditors' Remedies and Debtors' Protection
- Law 756-2. Bankruptcy
- Law 762-2. Trial Advocacy
- Law 766-3. Business Planning
- Law 769-3. Advanced Tax
- Law 771-var. Independent Legal Research
- Law 772-2. Extern Program
- Law 790-1. Practice Court¹

Seminars

- Law 737-2. American Indian Law
- Law 746-2. Legal Philosophy
- Law 751-2. Law of Corrections
- Law 765-2. Antitrust Procedure
- Law 776-2. Law and Mental Health
- Law 777-2. Collective Bargaining in the Public Sector

¹These courses are required; other courses are elective.

College of Music

Robert Fink, Dean

INFORMATION ABOUT THE COLLEGE

The widely varied functions of music in the world today present many challenging and interesting opportunities in the profession as teachers, performers, creative artists, technicians, and commercial personnel. While these different pursuits require specialized emphases, the faculty of the College of Music recognizes the musical and educational experiences that are common to all. Each curriculum of the College of Music is designed, therefore, to present music as an integrated whole. Solo performance and techniques, ensemble performance, historical and theoretical studies, concert and recital opportunities, and elective courses both inside and outside the college are intended to give the student a balanced approach to musical understanding and musicianship. The faculty has assumed the responsibility of making students aware of this unity in the curriculum and will strive to point out the relevance of each part to the whole. It is the student's responsibility to work, to the best of his ability, to develop all the techniques and approaches presented in the curriculum. Only in this way, with the contributions of both faculty and students, can the aim of the curriculum be achieved: the development of well-balanced musicians. The faculty has set up a program of training which in the first year allows the student to establish himself and to resolve in his own mind the course of study he may wish to pursue. After a first year of study and counseling with a principal professor, the student may determine the particular area in which he is qualified and in which he may wish to work.

The College of Music was established by the Regents of the University of Colorado in 1920 and is a full institutional member of the National Association of Schools of Music.

Facilities

The Music Building and Macky Auditorium contain studios, classrooms, and practice rooms in which students work. In Macky Auditorium the equipment includes seven practice organs, as well as a large, four-manual Austin concert organ for teaching and performance experience.

The Music Library contains 15,000 volumes, 90 current periodicals, and 12,000 recordings. Special rooms and booths are provided for listening to recordings, studying, and score-reading at pianos.

The library provides a basic collection of scores, collected editions and complete works of composers, bibliographies, dictionaries, histories, and treatises. Part of the record collection is housed in the Archives of Sound Recordings which contains many rare music recordings for research and teaching purposes.

The facilities of the Music Building include 79 practice rooms; 49 studios and offices; band, choral, and orchestral rehearsal halls; piano and electronic laboratories; and an auditorium with a seating capacity of 507.

Concerts and Recitals

Student recitals are an integral part of the student's life through both listening and participation. All students must attend appropriate class recitals, which are held each week.

Student Activities

The student body of the College of Music has its own organization which is directed by a student council and a faculty adviser. Honorary music fraternities on the campus are Phi Mu Alpha, Sigma Alpha Iota, Kappa Kappa Psi, and Tau Beta Sigma. Pi Kappa Lambda, the national scholastic honorary music fraternity, is also an active organization on this campus. Music education majors are eligible for membership in the student chapter of the Music Educators' National Conference.

Areas of Study

A student may be interested in professional performance or specialization in the field of teaching in the vocal or instrumental areas, or he may elect to work in history and literature of music or theory, or in church music.

The College of Music is organized to provide:

1. Specialized training in music to prepare for professional work or advanced study.
2. A background in music education that will prepare the student to teach music in the schools.
3. Training in music as the basis for general cultural attainment.

The preceding pursuits are not determined by interest alone but by qualifications and demonstrated

abilities to meet the problems that are concomitant with success in the chosen area of endeavor.

For students interested in ethnomusicology, periods of study abroad are recommended. Students concerned with understanding other languages, particularly those in voice, should also consider study abroad. Consult the Office of International Education.

Major Fields and Degrees

Specifically, the following courses of study are available to students in the College of Music.

Instruction in the undergraduate division of the College of Music leads to the Bachelor of Music degree in voice, piano, harp, violin, viola, violoncello, string bass, organ, flute, oboe, clarinet, bassoon, trumpet, French horn, trombone, baritone, theory/composition, history and literature of music, or church music.

Instruction that culminates in the Bachelor of Music Education degree leads to a field of concentration in the teaching of either general and vocal or instrumental music, or a combination of these interests.

The areas of study culminating in the degree Bachelor of Arts in Music are widely varied—American folk music, music-broadcasting, music-business, music-dance, music history, music-journalism, music-theatre, music theory/composition, piano pedagogy, string pedagogy, voice pedagogy, and wind/percussion pedagogy.

Qualified students may receive both the Bachelor of Music and Bachelor of Music Education degrees by taking the required extra work. Intent to be admitted to candidacy for both degrees should be indicated as soon as possible, preferably in the sophomore year. Written approval of the dean of the College of Music is required.

A candidate for the Master of Music or Master of Music Education degree must be a graduate of a university or college of recognized standing where the requirements for graduation are substantially the same as those required for the degrees Bachelor of Music or Music Education by this University. Examinations will be given to prospective candidates so that the student and his adviser may determine his status and program of future study.

The Doctor of Musical Arts degree, with a field of concentration in musical performance and literature (piano, organ, violin, violoncello, voice), choral conducting and literature, composition, or pedagogy and literature (piano, voice, winds, strings, percussion), is available through the Graduate School to qualified students.

The Doctor of Philosophy degree in music, with music education or musicology as a field of specialization, is available through the Graduate School to qualified students.

Additional information concerning graduate degrees is presented elsewhere in this catalog. Correspondence regarding details not included in this publication should be directed to the associate dean for graduate studies, College of Music.

Scholarships, Grants, Awards

Several scholarships are designed specifically for students in the College of Music, and these are awarded by the College of Music Scholarship Committee:

Performance Scholarships
Herbert T. Clark Scholarships
Berton Coffin Singing Scholarship
College of Music Grants-In-Aid
Carolyn "Puny" Cook Memorial Scholarship
Rowland W. Dunham Memorial Scholarship Fund
Wallace F. Fiske Memorial Scholarships
Graduate Assistantships
Jessie and Albert Henry Scholarships
Kappa Kappa Psi Scholarship
Shirley Mariner Memorial Scholarship
Percy-Roth Memorial Scholarship Fund
Theodore Presser Scholarship
Quaffenyak Scholarship Grants
Sigma Alpha Iota Scholarship
Special Performance Scholarships for Summer
Frank "Crick" Streamer Memorial Scholarship
Tau Beta Sigma Scholarship

ACADEMIC POLICIES

See General Information section.

Normal Course Schedule

The normal academic load for a student in the College of Music is 16 to 18 semester hours. Schedules of fewer than 12 or more than 19 hours must have approval of the dean of the College of Music. (Maximum is 20 hours.)

Pass/Fail Option

Pass/fail hours are to be selected from nonmusic courses, and are in addition to those that may be taken in honors, physical education, and student teaching. Courses so elected will be taken according to the pass/fail policies of the college or school concerned.

For a College of Music major who transferred into this program of study from another University of Colorado school or college or another university the maximum number of pass/fail hours which may be applied toward graduation requirements is 1 hour in every 8 semester hours completed in this College of Music.

Attendance Regulations

Students are expected to attend classes regularly and to comply with attendance regulations as specified by instructors. Unexplained absence from three consecutive class periods must be reported to the student's dean's office by the instructor concerned. Attendance at rehearsals, concerts, and concert trips is also expected under regulations set forth by the conductor of each organization or ensemble.

Scholastic Requirements

Any student who has a cumulative grade-point average below 2.0 at the end of any academic year will

automatically be placed on probation for the following academic year. If, at the end of the probationary year, the cumulative grade-point average is not 2.0 or above, automatic suspension for the following academic year will result.

Any student who has a cumulative grade-point average of 1.5 or below at the end of any academic year will automatically be suspended for the following academic year. (Cumulative grade-point averages are calculated on grades earned at this University.)

The usual regulations regarding summer attendance are *in effect*; that is, any student may attend the summer session to attempt to raise his grade-point average.

Students under scholastic suspension may petition for readmission and may receive a personal hearing before the Administrative Council of the College of Music.

Performance (Private Instruction) and Facilities Fees

Additional tuition for private instruction is \$29 per semester hour, but there is no charge for the first 3 hours for music majors or for graduate students working toward a music degree. The charge for nonmusic majors is the current rate for 2 semester hours of credit per semester, if instruction time is available.

Resident and nonresident music majors at this University registering for private instruction *only* shall not be required to pay regular tuition in addition to the special private instruction tuition.

Required of all students using University music facilities, materials, equipment, and/or University-owned music instruments:

Fall and spring semesters, per semester	\$18
Summer session or term	\$12

Students who use University-owned organs will pay an additional fee based on the following, which entitles them to practice one hour each day, seven days a week, for the period of time designated:

Fall and spring semesters, per semester	\$15
Summer session or term	\$10

UNDERGRADUATE DEGREE PROGRAMS

Requirements for Admission

In addition to the entrance requirements of the University outlined in the General Information section, freshmen and transfer students must meet College of Music entrance requirements.

An audition and/or interview is required for all entering undergraduate music majors (Boulder and Denver campuses). Audition dates for students entering summer 1980, fall 1980-81, spring 1980-81 will be held on the following Saturdays: January 19, February 2, February 23, and March 8, 1980. These auditions will be held only on the Boulder Campus. Applicants may substitute tape recordings. Write to the College of Music, associate dean for undergraduate studies, for audition-interview applications. (Personal auditions or tape recording auditions

should be approximately 10 minutes in length. The tape recording should be made at 7½ ips-monaural.)

It is expected that all students will have had previous experience in a performance area. Two years of piano training are particularly recommended. In addition, a broad general education background is advantageous. The educational objective is an educated mind and an integrated personality, together with specialized training in the field of music. Careful and intelligent planning on the high school level is an integral part of achieving this goal.

SPECIAL PROVISIONS FOR APPLICANTS WHO DO NOT MEET SUBJECT REQUIREMENTS

Students who are unable to meet the specified subject requirements for the College of Music may petition the Administrative Council of the college to enter with provisional standing, provided that such students offer at least three units of English and six additional units in academic fields, and provided also that the provisions of paragraphs one and two under the heading Admission Criteria in the General Information section are met by those presenting such petitions. Such factors as rank in high school graduation class, distribution of subjects, and evidences of preparation for the field of study to which admission is requested will be considered. Audition requirement is applicable.

UNDERGRADUATE TRANSFER STUDENTS

Undergraduate transfer students must meet the requirements of the University. Further, resident students who have taken course work only through the Center for Lifelong Learning must have a 2.0 (C) grade-point average in such work before being eligible to apply for admission to the College of Music. Nonresident students must have a 2.5 grade-point average. See Audition Requirement.

SPECIAL STUDENTS

A special student may request permission to enroll for applied music (private instruction) by signifying in writing to the College of Music dean's office intent to become a degree student during the first semester in which permission is granted for private instruction, or by signifying in writing to the College of Music dean's office his need to renew certification for teaching music in the public schools.

A special student may take any other class with written permission of the instructor concerned. In addition, see Audition Requirement.

Requirements for Graduation

The degrees Bachelor of Music, Bachelor of Music Education, and Bachelor of Arts in Music will be granted by the University, upon recommendation of the faculty of the College of Music, to those who have successfully completed prescribed requirements.

Students must file an appropriate request-to-graduate application form by May 1 in the office of

the administrative officer (Music 145) if they anticipate completing requirements in December, May, or August of the following academic year.

RESIDENCE REQUIREMENT

Of the hours required for graduation, 56 must be completed in residence in this College of Music. This may be reduced by the faculty because of excellent work done in this University and because of high scholarship exhibited at previous institutions attended. In no case shall the minimum be fewer than 40 hours distributed over three semesters. At least 9 hours in applied music (private instruction) must be earned in this college for the degrees Bachelor of Music and Bachelor of Music Education, and 8 hours for the degree Bachelor of Arts in Music.

HONORS

Upon recommendation of the faculty, honors may be awarded to students who show outstanding ability and who have demonstrated superior musicianship and scholastic accomplishment.

MUSIC HISTORY MINOR

The music history minor is open to students in Bachelor of Music and Bachelor of Music Education degree programs except the history curriculum. It should be elected by the student, in consultation with his major adviser, by the beginning of his sophomore year. The minimum is as follows:

<i>Freshman Year</i>	<i>Semester Hours</i>
Introduction to Music (Mus. 180-181)	4
<i>Sophomore Year</i>	
History of Music (Mus. 380-381)	6
<i>Junior Year</i>	
History area courses	4
<i>Senior Year</i>	
History area courses	<u>3</u>
	17

Bachelor of Music Degree

The curriculum leading to the Bachelor of Music degree in performance is a professional training course with concentration upon artistic and/or intellectual performance. One of the following majors may be selected: voice, piano, organ or church music, string instruments, wind and percussion instruments, theory/composition, or history and literature. Performance majors will devote a large portion of their time to developing the vocal or instrumental field of their choice. Adequate courses in music theory and electives in academic subjects give an excellent theoretical and cultural background.

It is presumed that the student will have had basic preparation in a principal field of study before entering the University. A singer should be able to sing some standard songs in English, on pitch, with good phrasing and musical intelligence. Knowledge of the

rudiments of music and an ability to read simple music at sight are expected. Elementary piano study is recommended. Instrumentalists should possess a well-grounded technique sufficient to play music of moderate difficulty. Students with a major in history and literature, or theory, should have a good working knowledge in a performance field.

Alternative majors are available as follows upon recommendation of the adviser and division chairman concerned.

In piano and string instruments, pedagogy may be recommended as a major. This will consist of a demonstrated ability in teaching. Public performance must be of an acceptable standard. There must be several appearances in student recitals as well as one solo recital, a comprehensive knowledge of the particular literature, and two semesters of supervised studio teaching. Other adjustments will be arranged by the division concerned.

A major in the field of church music is available for those qualified. No solo recital will be required. A thorough training in the field of service playing and choir training, with some practical experience in various aspects of church music, must be demonstrated.

COURSES AND CURRICULA

The curriculum for the performance major consists of a four-year program with a major in performance (voice, piano, organ, string instruments, wind instruments). A minor area of performance is required for two years. All students are required to study their principal instrument as long as they are enrolled in the college unless permission for exception is granted by the dean, the adviser, and the chairman of the division concerned.

Electives provide enough flexibility to suit individual needs. The student is encouraged to take as many of these hours as possible in liberal arts. A student and adviser may decide together on these areas of study.

A minimum of 244 credit points (a C overall grade-point average) and 122 semester hours (usually this number is exceeded) must be earned for the Bachelor of Music degree. Of these hours at least 28 must be in the nonmusic academic fields and 32 in the principal field. In the secondary performance field four semesters of study are required.

This degree places a premium upon high musical attainment, scholarship, and either interpretative or creative ability of a high order.

Performance in organizations (orchestra, band, choir) chamber or bell ensemble is expected of all undergraduates. (Five semester hours of credit in chamber music, as defined by each division, is a requirement toward this degree.) Specific requirements in this regard are controlled as part of the degree plan in each principal field and are further subject to the adviser's judgment in the best interest of the individual student. Undergraduate music students are required to attend a literature-performance class in

their respective areas and are held responsible for checking with their advisers regarding these meetings.

History and Literature Major

Students may major in history and literature only with the approval of the chairman of the division. This major should be declared and approved not later than the junior year, and preferably by the sophomore year.

Candidates for the degree must demonstrate proficiency in at least one facet of performance: voice, keyboard, symphonic, or early instruments. The candidate should also be able to use the keyboard as a tool in historical study. The history and literature thesis must meet an approved standard of endeavor; two copies must be satisfactorily bound and presented for permanent filing with the College of Music.

The courses outlined below are required at the discretion of the advisor. It is recommended that electives taken during the junior and senior years be distributed as follows: liberal arts, 20 semester hours; music, 8 semester hours.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	4
Mus. 180, 181. Introduction to Music	4
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
English elective	6
Foreign language	8
Ensemble	2
Electives in liberal arts and/or music	3

<i>Sophomore Year</i>	
Private instruction	4
Hist. 101, 102. History of Western Civilization	6
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music	6
Foreign language	6
Elective in theory	2
Ensemble	2
Elective in liberal arts and/or music	3

<i>Junior Year</i>	
Private instruction	4
Period and topical courses in music history (400-level)	8
Mus. 480. Special Studies	2
Mus. 401, 402. Counterpoint	4
Ensemble	2
Electives in liberal arts and/or music	11

<i>Senior Year</i>	
Private instruction	4
Period and topical courses in music history (400-level)	8
Mus. 406, 407. Analysis I, II	4
Mus. 497. History and Literature Thesis	4
Ensemble	2
Electives in liberal arts and/or music	13

Organ or Church Music Major

The following schedule is a basic plan that may be altered to suit individual needs. The degree Bachelor of Music (Organ-Performance) will be awarded to students of above average ability in performance. Concentration will be mainly on concert literature, and a graduation recital will be accepted in lieu of a

thesis. The degree Bachelor of Music (Church Music-Organ) or Bachelor of Music (Church Music-Voice) will be awarded to students particularly interested in these fields. The major concentration will be on church music repertoire and the development of an appreciation of the finest in the field of sacred music. Courses such as history of religion, educational psychology, philosophy, and English literature which are designed to strengthen the knowledge of aesthetic values and develop the ability to work with people, may be taken as electives.

At the beginning of the senior year, all organ students should be able to transpose at least a major second up or down, play from open vocal score, improvise in simple forms, and accompany selected cantatas (Effinger's *The St. Luke Christmas Story* and Bach's *Christ lag in Todesbaden*). Graduation will not be permitted until such skills have been creditably demonstrated. (Specific yearly requirements may be obtained from the chairman of the Organ and Church Music Division.)

All students will be given a minimum reading study list throughout the course, and majors in church music will be required to complete a thesis in the senior year. The thesis requirement will be interpreted freely at the discretion of the major professor. It may consist of several minor research projects, choral arrangements, composition projects or the preparation and production of a short cantata.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private organ instruction (and literature class)	8
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Choir	2
Electives in liberal arts and/or music	9

<i>Sophomore Year</i>	
Private organ instruction (and literature class)	8
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 207. Instrumentation	2
Mus. 217. Choral Literature and Conducting	2
Mus. 226. Service Playing Techniques	2
Mus. 401, 402. Counterpoint	4
Choir	2
Elective in theory	2
Electives in liberal arts and/or music	6

<i>Junior Year</i>	
Private organ instruction (and literature class)	8
Mus. 380, 381. History of Music (<i>see History Minor</i>)	6
Mus. 326, 327. Improvisation	4
Mus. 428, 429. Organ Survey	6
Choir	2
Electives in liberal arts and/or music	10

<i>Senior Year</i>	
Private organ instruction (and literature class)	8
Mus. 424, 425. Church Music	6
Choir	2
Mus. 496. Thesis (church music majors)	2 or 4
Mus. 499. Recital (performance majors)	0
Electives in liberal arts and/or music	16

Piano Major (Pedagogy)

All pedagogy majors will present a half recital during the junior and senior years.

Additional details concerning minimum standards of periodic comprehensive examinations may be received upon request from the College of Music.

The freshman and sophomore requirements are the same as for performance majors.

<i>Junior Year</i>	<i>Semester Hours</i>
Private piano instruction (and literature class)	8
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 334, 335. Piano Pedagogy II	5
Chamber music ¹	2
Electives in liberal arts and/or music	8-13

<i>Senior Year</i>	
Private piano instruction (and literature class)	8
Mus. 432. Piano Literature	2
Mus. 434, 435. Piano Pedagogy III	5
Mus. 406 or Mus. 407. Analysis I, II	2
Band, orchestra, choir, or ensemble	1
Chamber music ¹	1
Electives in liberal arts and/or music	12-16

Piano Major (Performance)

The student will submit a repertoire list at the end of each year of study. Minimum requirements in content and extent of standard and contemporary piano works will be checked from these lists. In the first two years of study, minimum performance requirements will be examined at the end of the second semester of each year of study. During the junior year, the student's repertoire examination will be a half recital, presented before a faculty committee six weeks in advance of the performance date.

Additional work in piano will be required of the individual student whenever the results of these examinations fall below the minimum standards. Additional details concerning minimum standards may be had upon request from the chairman of the Piano Division.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private piano instruction (and literature class)	8
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Band, orchestra, or choir	2
Electives in liberal arts and/or music	9

<i>Sophomore Year</i>	
Private piano instruction (and literature class)	8
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 235. Piano Pedagogy I	3
Phil. 115. Ethics	3
or	
Phil. 140. Formal Logic	3
or	
Substitution with adviser's recommendation	3
Chamber music ¹	2
Elective in theory	2
Electives in liberal arts and/or music	8

<i>Junior Year</i>	
Private piano instruction (and literature class)	8
Mus. 380, 381. History of Music (see History Minor)	6

Chamber music ¹	2
Electives in liberal arts and/or music	14-18

Senior Year

Private piano instruction (and literature class)	8
Mus. 432. Piano literature	2
Mus. 406 or Mus. 407. Analysis I, II	2
Mus. 499. Recital	0
Band, orchestra, choir, or ensemble	1
Chamber music ¹	1
Electives in liberal arts and/or music	16-20

String Instruments Major (Performance)

Harp, Violin, Viola, Violoncello, and String Bass

Study in the string instruments is designed to build a secure technical foundation upon which the most artistic accomplishment can be established. To this end progressive proficiency in the scales and standard studies is expected, along with the preparation of such works from the concert repertoire as fall within the ability of the student.

String majors are required to audition for the University Symphony Orchestra and the University Chamber Orchestra. (Membership in the University orchestras will be determined by the conductor concerned.)

A full solo recital must be presented publicly during the senior year.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private string instruction (and literature class)	8
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Orchestra	2
Electives in liberal arts and/or music	10

Sophomore Year

Private string instruction (and literature class)	8
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 207. Instrumentation	2
Orchestra	2
Chamber music ²	2
Elective in theory or history of music	2
Electives in liberal arts and/or music	10

Junior Year

Private string instruction (and literature class)	8
Mus. 380, 381. History of Music (see History Minor)	6
Orchestra	2
Chamber music ²	2
Electives in liberal arts and/or music	13

Senior Year

Private string instruction (and literature class)	8
Orchestra	2
Chamber music ²	1
Mus. 499. Recital	0
Electives in liberal arts and/or music	20

¹Chamber music is defined to include participation in activities such as performance or study of art song and other appropriate literature with singers, participation in New Music Ensemble, serving as continuo with University Chamber Orchestra or other appropriate ensembles. Assignment to a one-hour-per-week laboratory is at the instructor's discretion.

²Chamber music is understood to include New Music Ensemble and other small orchestral and ensemble groups including University Chamber Orchestra. Assignment to a one-hour-per-week laboratory is at the instructor's discretion in cooperation with the adviser.

Theory/Composition Major

Approval for the major in theory/composition is based on (1) evidence of aptitude in composition or of exceptional aptitude in practical arranging, (2) an acceptable level of performing proficiency on a musical instrument, and (3) probable success in the teaching of theory.

The thesis for theory/composition majors is subject to approval of the major adviser and may be in the area of original composition, arranging, research in theory or theory pedagogy, or a combination of these endeavors.

All theory/composition majors must register for piano until a requirement of six levels of testing has been passed. These examinations will be given at the end of each semester by the piano and theory/composition divisions. They cover proficiency in technique, repertory, sight reading, score reading, figured bass, transposition, and harmonic progressions. This requirement presumes some prior keyboard experience.

Proficiency in performance is expected of theory/composition majors. Preferably, there should be high attainment in at least one instrument or in voice. Considerable experience in performance areas other than the principal instrument is also expected.

Student's work is reviewed periodically by the theory/composition division faculty with appropriate recommendations as to his continuance in the program.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance	2
Composition Seminar	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Orchestra, band, or choir	2
Electives in liberal arts and/or music	7

<i>Sophomore Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance	2
Composition Seminar	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 401, 402. Counterpoint	4
Mus. 207. Instrumentation	2
Orchestra, band, or choir	2
Elective in theory	2
Electives in liberal arts and/or music	10

<i>Junior Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 400. Contemporary Theory	2
Composition	4
Mus. 307. Keyboard Harmony and Improvisation	2
Orchestra, band, or choir	2
Electives in liberal arts and/or music	10

<i>Senior Year</i>	<i>Semester Hours</i>
Mus. 404. Orchestration	2
Mus. 406, 407. Analysis I, II	4
Composition	4
Mus. 498. Theory Thesis	0

Orchestra, band, or choir	2
Electives in liberal arts	10
Electives in music	8

Voice Major (Performance)

Proficiency in the fundamentals of voice production, i.e., breath, vowel formation, intonation, resonance, and diction, is continually stressed in the four years of study. A repertoire that will eventually include representation in all areas of vocal literature is progressively built. Specific attention is given to the art song, including contemporary composition, the opera, and the oratorio.

The student must meet minimum standards at the end of the freshman year and in the comprehensive examination at the end of the sophomore year. Additional work will be required of the student if the minimum standards are not met. Minimum standards will be judged in performance by the voice faculty; progressive technical proficiency is expected.

A half recital will be required in the junior year and a full recital in the senior year. Students, in their graduation recitals, must demonstrate ability to perform a program of artistic merit in public. Previews of voice recitals must be given before the voice faculty four to six weeks before the final performance.

Transfer students working toward the Bachelor of Music degree in voice shall audition for a proficiency rating prior to their first registration at this University. The student should present a list of six songs from which the voice faculty will choose auditioning numbers.

Students pursuing the bachelor's degree in vocal performance are required to take three years of language study. High school language study may be counted toward these three years but must be validated by taking a second semester of that language at the University of Colorado. Languages may not be taken on a pass/fail basis.

The language requirement may be satisfied in one of two ways:

1. One year each of three languages.
2. Two years of one language and one year of a second language.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private voice instruction (and literature class)	8
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Mus. 144. Italian Diction	1
Mus. 145. English Diction	1
Choir	2
Electives in liberal arts	8

<i>Sophomore Year</i>	<i>Semester Hours</i>
Private voice instruction (and literature class)	8
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 244. German Diction	1
Mus. 245. French Diction	1
Foreign language	10
Elective in theory	2

Elective in liberal arts or music	2
Choir	2

Junior Year

Private voice instruction (and literature class)	8
Foreign language	10
Mus. 380, 381. History of Music (<i>see</i> History Minor)	6
Mus. 446, 447. Art Song I, II	6
Mus. 442. Opera Workshop	2
Choir	1

Senior Year

Private voice instruction (and literature class)	8
Mus. 217. Choral Literature and Conducting	2
Foreign language	6
Mus. 442. Opera Workshop	2
Mus. 477. History of the Opera	3
Mus. 499. Recital	0
Mus. 444. Vocal Pedagogy	2
Choir	2
Electives in liberal arts or music	4

Voice Theatre (Performance)

Proficiency in the fundamentals of voice production (breath, vowel formation, intonation, resonance, and diction) is stressed in the four years of study. General instruction in basic theatre arts is also provided to enable the student to become a better singing actor. The student must meet minimum standards in voice at the end of the freshman year and in a comprehensive examination at the end of the sophomore year. Admission to the voice theatre major is limited to a few students. Voice and theatre faculties will audition those students desiring admission at the end of the sophomore year.

Minimum standards in performance will be judged at the end of each semester by the voice faculty; progressive proficiency is expected. The student must demonstrate in his senior year ability to perform in an artistic manner. A senior project (senior recital, major role, direction or design of a major show) worked out in consultation with the major adviser and approved by the voice and theatre faculties must be presented publicly during the senior year.

Freshman Year Semester Hours

Private voice instruction (and literature class)	6
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Mus. 144. Italian Diction	1
Mus. 145. English Diction	1
Choir	2
Electives in liberal arts (other than theatre and dance)	9

Sophomore Year

Private voice instruction (and literature class)	6
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Choir	2
Th.Dn. 250. Introduction to Oral Interpretation	3
Th.Dn. 273. Acting I	3
Electives in music	4
Electives in liberal arts (other than theatre and dance)	8

Junior Year

Private voice instruction (and literature class)	6
Mus. 380, 381. History of Music (<i>see</i> History Minor)	6
Mus. 442. Opera Workshop	2
Th.Dn. 276. Stagecraft	3
Th.Dn. 373. Acting II	3
Elective in music	3
Electives in liberal arts (other than theatre and dance)	6
Free electives	4

Senior Year

Private voice instruction (and literature class)	6
Mus. 442. Opera Workshop	2
Th.Dn. 377. Costuming	3
Senior project (senior recital—Mus. 499-0, major role, direction or design of a major show)	0
Electives in theatre and dance	9
Electives in liberal arts (other than theatre and dance)	7
Free electives	4

Wind Instruments Major (Performance)

Progressive technical proficiency is expected; and minimum standards in major and minor scales and chords, studies, and solo repertoire are to be met. The student must meet minimum standards at the end of the freshman year and in the comprehensive examination (including a jury recital) at the end of the sophomore year. Additional work will be required of the student if minimum standards are not met.

A public half recital will be required in the junior year and a public full recital in the senior year. The student in his graduation recital must demonstrate the ability to perform satisfactorily a program of artistic merit in public.

Previews of these recitals must be given before a Wind Division faculty committee four to six weeks before the final performance. (All wind and percussion majors in performance are required to participate in an orchestra and/or a band, upon consultation with adviser.)

Freshman Year Semester Hours

Private wind instruction (and literature class)	8
Class minor in performance	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Band or orchestra	2
Electives in liberal arts and/or music	9

Sophomore Year

Private wind instruction (and literature class)	8
Class minor in performance	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 207. Instrumentation	2
Band or orchestra	2
Chamber music ¹	2
Elective in theory	2
Electives in liberal arts and/or music	12

Junior Year

Private wind instruction (and literature class)	8
Mus. 380, 381. History of Music (<i>see</i> History Minor)	6
Band or orchestra	2
Chamber music ¹	2
Electives in liberal arts and/or music	14

¹Chamber music is understood to include New Music Ensemble and other small orchestral and ensemble groups including University Chamber Orchestra. Assignment to a one-hour-per-week laboratory is at the instructor's discretion in cooperation with the adviser.

Senior Year

Private wind instruction (and literature class)	8
Band or orchestra	2
Chamber music ¹	2
Mus. 499. Recital	0
Electives in liberal arts and/or music	20

Bachelor of Music Education Degree

The program leading to the Bachelor of Music Education degree is designed to provide superior preparation for the teaching of music in the schools. The various demands made upon music teachers and the opportunities open to them have been carefully considered in formulating the courses of study.

Although most students may ultimately specialize in either general music, choral, band, or orchestral work, some may be called upon in their first professional positions to teach in two, or even three, of these fields. Even the music educator who teaches in only one of these areas must have a sufficiently broad knowledge of the entire music program to be able to understand the role of music in contemporary American education and interpret the music program to colleagues and laymen. The courses of study are designed to provide a suitable balance between specialization and generalization.

Because it is important that the prospective teacher be a competent performer, provision has been made for extensive performance study. Normally candidates will study their principal instrument (or voice) for seven or eight semesters. Satisfactory proficiency must be demonstrated at the end of each year of study by passing a special examination.

COURSES AND CURRICULA

Three basic curricula are provided for the candidate pursuing the Bachelor of Music Education degree: vocal emphasis, instrumental emphasis—band, and instrumental emphasis—orchestra. Within each basic curriculum, options are provided so that students may vary their programs in accordance with their needs and interests.

A minimum of 130 semester hours with an overall grade-point average of C must be earned for the Bachelor of Music Education degree. Forty semester hours in liberal arts are required.

Performance in organizations (orchestra, band, choir) or chamber ensemble is required of all undergraduates as long as they are enrolled in the College of Music. Specific requirements in this regard are controlled as part of the degree plan in each principal field and are subject to the adviser's judgment in the best interest of the individual student.

Undergraduate music students are required to attend a literature-performance class in their respective areas and are held responsible for checking with their private teachers regarding these meetings.

Liberal Arts Requirements

All students entering the Music Education Division, whether freshmen, transfers, or those holding a degree, shall meet the following requirements in order

to receive a degree and/or a recommendation for teacher certification.

Semester Hours

English composition	4-6
Humanities	6
Social sciences	6
Natural sciences	6
Electives	16-18
Total Required	40

In each of the humanities, social sciences, and sciences, one two-semester course combination shall be required within the prescription of the current *College List* of the College of Arts and Sciences. If any course combination exceeds the minimum requirement of 6 semester hours, the required hours of electives may be reduced appropriately. An elective may be any course outside of music and education with the exception of History of Music (Mus. 380, 381) which may be counted toward meeting the elective requirement in addition to fulfilling the music requirement.

Admission to Teacher Education

Teacher education is a campus-wide function at the University of Colorado. Admission to the music education program in the College of Music does not constitute admission to the Teacher Education Program. Students must apply for admission to this program as indicated by the School of Education. *No student is permitted to take courses in education until he is admitted to the Teacher Education Program.*

Upon admission to the Teacher Education Program, students are expected to meet the following minimum requirements:

1. Completion of 60 semester hours of course work.
2. Completion of 21-23 semester hours toward the liberal arts requirement including 4-6 semester hours of English composition.
3. A minimum overall grade-point average in the range of 2.5-3.0.
4. Evidence of previous successful youth work.
5. Recommendation by the chairman of the Music Education Division.

An interview with each student by members of the Music Education Division is held during the second semester of the sophomore year to review the student's progress and qualifications for recommendation for admission to the Teacher Education Program.

Admission to Student Teaching

Students wishing to receive student teaching assignments must meet the following requirements:

1. Admission to teacher education.
2. Completion of 90 semester hours of course work in the Bachelor of Music Education curriculum.
3. Completion of the prescribed sequence of professional education courses (T.Ed. 410, 411, 412, 442, 443, or 446) and Communication Principles (Comm. 230).

Major courses for a degree in performance include private instruction, historical research, and recitals.

¹ Chamber music is understood to include New Music Ensemble and other small orchestral and ensemble groups including University Chamber Orchestra. Assignment to a one-hour-per-week laboratory is at the instructor's discretion in cooperation with the adviser.

4. A minimum overall grade-point average of 2.5 in all courses attempted at the University of Colorado, all courses attempted elsewhere, all courses in music, and all courses in professional education (not music methods).

5. Recommendation by the chairman of the Division of Music Education.

Vocal Emphasis

Students may elect any performance area as their major in this program, assuming the minimum minor proficiencies in piano and voice are also met.

Performance requirements in a secondary area may be waived by passing the proficiency examination for the particular instrument or voice. Students expecting to student teach in vocal music must pass a prerequisite examination in functional keyboard prior to receiving a student teaching assignment.

Normally students in the vocal emphasis program are expected to meet the performance group requirement through participation in the University Choir. However, up to three semesters of participation in Collegiate Chorale, Festival Chorus, Modern Choir, University Singers, Women's Chorus, Collegium Musicum, Band, or Orchestra may be substituted toward the requirement.

Qualified students with organ as a performance major wishing to prepare themselves for church work take the courses listed in italics either as electives or in addition to those in the normal program.

As a result of pre-student-teaching experience in the schools, in connection with course work in the freshman and junior year, students may wish to concentrate music preparation in such areas as special education, early childhood education, allied arts, or stage production. Variations from the normal program to allow for work in such areas may be approved upon recommendation of the student's adviser and chairman of the Division of Music Education.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Piano Class I, II or Voice Class I, II	2
Mus. 110. Introduction to Music Education	2
Mus. 111. Fundamentals of Conducting	2
English language	6
Th.Dn. 142. Modern Dance	1
Elective in liberal arts	3
Choir, band, orchestra, or Collegium Musicum	2

<i>Sophomore Year</i>	
Private instruction (and literature class)	6
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 213. Instrumental Music in the Schools	2
Piano Class III, IV or Voice Class III, IV	2
Mus. 217. Choral Literature and Conducting	2
Mus. 312. Teaching Humanities	2
Elective in theory	2
Electives in liberal arts	6
Choir, band, orchestra, or Collegium Musicum	2
Mus. 226. Service Playing Techniques	2

Junior Year

Private instruction (and literature class)	6
Mus. 310. Music in the Elementary School	4
Mus. 311. Music in the Secondary School	4
T.Ed. 410. Foundations of American Education	3
T.Ed. 411. Principles and Methods of Secondary Education ..	3
T.Ed. 412. Educational Psychology and Adolescent Development	3
T.Ed. 442 or 443. Developing Reading Skills in Junior and Senior High Schools	3
T.Ed. 446. Teaching Learning Disabled	2
Comm. 230. Principles of Communication I	2
Electives in liberal arts	2
Choir, band, orchestra, or Collegium Musicum	2

Senior Year

Private instruction (and literature class)	3
Mus. 419. Student Teaching Seminar	1
T.Ed. 470, 471. Student Teaching	8
Electives in liberal arts	14
Choir, band, orchestra, or Collegium Musicum	1
Mus. 424, 425. Church Music	6

Instrumental Emphasis—Band (Plan I)

Open to wind and percussion players. Others only by special permission.

Secondary performance requirements may be waived by passing the proficiency examination for that particular instrument or voice.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Piano Class I, II	2
Clarinet Class I	1
Clarinet Class II (or Flute Class I)	1
Band	2
Electives in liberal arts	11

Sophomore Year

Private instruction (and literature class)	6
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Cornet Class I	1
Cornet Class II (or Trombone Class I)	1
String Class I, II	2
Mus. 410. Marching Band Techniques	1
Mus. 411. Instrumental Organization	1
Elective in theory	2
Band	2
Electives in liberal arts	14

Junior Year

Private instruction (and literature class)	6
Applied minor elective (class)	1
Voice Class I	1
Mus. 217. Choral Literature and Conducting	2
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 413. Brass and Woodwind Techniques	3
Mus. 318. Band Literature and Conducting Techniques	3
Mus. 416. Percussion Class and Pedagogy	1
T.Ed. 442 or 443. Developing Reading Skills in Junior and Senior High Schools	3
Band	2
Electives in liberal arts	7

Senior Year

Private instruction (and literature class)	6
Mus. 419. Student Teaching Seminar	1
Mus. 418. Introduction to Student Teaching	2

Comm. 230. Principles of Communication I.....	2
T.Ed. 410. Foundations of American Education.....	3
T.Ed. 411. Principles and Methods of Secondary Education..	3
T.Ed. 412. Educational Psychology and Adolescent Development	3
T.Ed. 446. Teaching Learning Disabled	2
T.Ed. 470, 471. Student Teaching	8
Band	2

Instrumental Emphasis—Band (Plan II)

Open to wind and percussion players. Others only by special permission.

Students who also wish to qualify for teaching vocal music in the elementary grades must elect the following alternate program.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Piano Class I, II	2
Cornet Class I	1
Clarinet Class I	1
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 110. Introduction to Music Education	2
Mus. 180, 181. Introduction to Music	4
Band	2
Electives in liberal arts	9

<i>Sophomore Year</i>	
Private instruction (and literature class)	6
Piano Class III, IV	2
String Class, I, II	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 312. Teaching Humanities	2
Mus. 380, 381. History of Music (see History Minor)	6
Band	2
Th.Dn. 142. Modern Dance	1
Elective in theory	2
Electives in liberal arts	9

<i>Junior Year</i>	
Private instruction (and literature class)	6
Voice Class I	1
Mus. 310. Music in the Elementary School	4
Mus. 413. Brass and Woodwind Techniques	3
Mus. 318. Band Literature and Conducting Techniques	3
Mus. 416. Percussion Class and Pedagogy	1
Band	2
T.Ed. 442 or 443. Developing Reading Skills in Junior and Senior High Schools	3
Electives in liberal arts	13

<i>Senior Year</i>	
Private instruction (and literature class)	6
Mus. 419. Student Teaching Seminar	1
Comm. 230. Principles of Communication I	2
T.Ed. 410. Foundations of American Education	3
T.Ed. 411. Principles and Methods of Secondary Education..	3
T.Ed. 412. Educational Psychology and Adolescent Development	3
Mus. 419. Student Teaching Seminar	1
T.Ed. 446. Teaching Learning Disabled	2
T.Ed. 470, 471. Student Teaching	8
T.Ed. 446. Teaching Learning Disabled	3
Band	2

Instrumental Emphasis—Orchestra

Secondary performance requirements may be waived by passing the proficiency examination for that particular instrument or voice. Candidates wishing to student teach in vocal music education must enroll for the appropriate courses and pass the

prerequisite proficiency examinations in voice and piano given at the end of the sophomore year. All string majors are required to audition for the University Symphony Orchestra and Chamber Orchestra and should participate in chamber music ensembles upon consultation with an adviser. (Membership in the University orchestra will be determined by the conductor concerned.)

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Piano Class I, II	2
Violin and Viola Class I, II (string bass and cello majors) ...	2
Cello Class I and Bass Class I (violin and viola majors)	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 110. Introduction to Music Education	2
Mus. 180, 181. Introduction to Music	4
Electives in liberal arts	9
Orchestra	2

<i>Sophomore Year</i>	
Private instruction (and literature class)	6
Cornet Class I	1
Clarinet Class I	1
Mus. 111. Fundamentals of Conducting	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Elective in theory	2
Electives in liberal arts	16
Orchestra	2

<i>Junior Year</i>	
Private instruction (and literature class)	6
Cello Class I (string bass majors)	1
String Bass Class I (cello majors)	1
String Class I (violin and viola majors)	1
Voice Class I	1
Mus. 316. Techniques of Teaching Strings	2
Mus. 317. Orchestra Materials and Conducting	2
Mus. 413. Brass and Woodwind Techniques	3
Mus. 416. Percussion Class and Pedagogy	1
Mus. 380, 381. History of Music (see History Minor)	6
T.Ed. 442 or 443. Developing Reading Skills in Junior and Senior High Schools	3
Electives in liberal arts	7
Orchestra	2

<i>Senior Year</i>	
Private instruction (and literature class)	3
Comm. 230. Principles of Communication I	2
T.Ed. 410. Foundations of American Education	3
T.Ed. 411. Principles and Methods of Secondary Education..	3
T.Ed. 412. Educational Psychology and Adolescent Development	3
Mus. 419. Student Teaching Seminar	1
T.Ed. 446. Teaching Learning Disabled	2
T.Ed. 470, 471. Student Teaching	8
Orchestra	2

Bachelor of Arts in Music Degree

The degree Bachelor of Arts in Music has as its goal a broad education in music within a liberal arts context. The curriculum is designed to give the student competency and knowledge to deal with music within the cultural milieu of present-day society. Although students may elect within their programs special courses which will permit them to pursue graduate study or a profession in such areas as musicology,

composition, music librarianship, or music-journalism, the major emphasis is on development of basic musicianship, an ability to perform music, and a broad knowledge of principles that will provide an intellectual grasp of art.

A minimum of 124 semester hours with an overall grade-point average of C must be earned for the Bachelor of Arts in Music degree. Of these hours at least 70 must be in nonmusic courses. Thirty must be at the 300 or 400 level. A minimum of 35 hours and a maximum of 54 hours is required in music courses.

The normal pattern for private instruction in this degree is one half-hour lesson per week for 2 semester hours of credit, although some of this study may take place in class instruction. The requirement, except for American folk emphasis, is two academic years of study in one applied area with a minimum proficiency equal to Bachelor of Music (Performance) sophomore level. Not more than 16 semester hours of credit in private instruction may be used toward the degree.

The student may elect to perform in ensembles, but not more than 4 semester hours of credit may be applied toward the degree.

A recital may be given with permission of the chairman of the division concerned and the student's adviser.

Students are required to write a senior thesis in accord with their goals and interests. Preparation and selection of topics is required in a junior research seminar. The thesis is conceived as an academic equivalent to recital, composition, or student teaching requirements in professional music degrees.

The student may choose to complete requirements from a wide selection of courses offered, with no special area of concentration. If the student wishes to select courses forming a concentrated area of interest, this determination must be made in consultation with the major adviser by the beginning of the sophomore year. Areas of interest available are music-broadcasting, music-business, music-dance, music history, music-journalism, music-theater, music theory, organ pedagogy, piano pedagogy, string pedagogy, voice pedagogy, wind/percussion pedagogy, and American folk music.

COURSES AND CURRICULA

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	4
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
English language or literature (see 1 below)	6
Foreign language (see 2 below)	8
Electives in liberal arts	2
<i>Sophomore Year</i>	
Private instruction (and literature class)	4
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music	6
Foreign language (see 2 below)	4
Elective in theory	2
Electives in liberal arts	8
Free electives in liberal arts or music	3

Junior Year

Mus. 406. Analysis I	2
Requirement in liberal arts (humanities) (see 4 below)	6
Requirement in liberal arts (social sciences) (see 4 below)	6
Mus. 399. Junior Research Seminar	1
Elective in music history	2
Electives in liberal arts (see 3 below)	6
Free electives in liberal arts or music	9

Senior Year

Mus. 395. Senior Thesis	2
Requirement in liberal arts (humanities) (see 4 below)	6
Requirement in liberal arts (social sciences) (see 4 below)	6
Requirement in liberal arts (natural sciences) (see 4 below)	8
Electives in liberal arts (see 3 below)	6
Free electives in liberal arts or music	4

Minimum Requirements

Minimum requirements (no concentrated interest area) are:

1. Two semesters of English (composition or literature).
2. Basic proficiency in one foreign language equal to three semesters at university level. This may be fulfilled by presentation of three years of study in high school in one language or by passing a University proficiency examination.
3. Nonmusic electives to fulfill the minimum requirement of 70 semester hours of credit.
4. Ten semesters of natural sciences, social sciences, humanities: four semesters (two-semester combinations) from each of two of these areas; and two semesters (one two-semester combination) from the third area. (All areas must be represented.)
5. A Junior Research Seminar and a Senior Thesis.

Concentrated Interest Areas

These course listings are for the purpose of advising only. There are no special requirements.

Music-Broadcasting

Comm. 360-3. Introduction to Broadcasting. ¹
Comm. 362-3. Television Production. ¹
Comm. 367-2. Television Production II.
Comm. 460-3. Radio-TV Station Organization and Operation.
Comm. 467-1, 4. Television Production III.
Jour. 360-3. Radio and Television News.
Th.Dn. 373-3. Acting. ¹
Th.Dn. 374-3. Directing.
Th.Dn. 471-3. History of the Theatre I.
Mus. 477-3. History of the Opera.

Music-Business

Business courses are frequently closed to non-business students. Permission may be obtained from the College of Music associate dean for undergraduate studies or chairman of the Bachelor of Arts in Music degree for the student to petition the School of Business dean for permission.

Acct. 200-3. Introduction to Accounting.
B.Law 300-3. Business Law.
Econ. 201-3. Introduction to Economics I.

¹Courses fundamental to each interest area and/or prerequisite to other courses. Choice of courses is dependent on student's interests, background, and ability. Classes, especially in the areas of business, dance, journalism, and theatre, should be selected in close consultation with the major adviser and departments and colleges or schools concerned.

Econ. 202-3. Introduction to Economics II.
Mk. 300-3. Principles of Marketing.
Mk. 340-3. Marketing Institutions and Retailing.
Mk. 350-3. Principles of Advertising.
Or.Mg. 330-3. Organization and Management.

Music-Dance

Th.Dn. 270-3. Introduction to the Theatre.¹
Th.Dn. 273-2. Stage Movement.¹
Th.Dn. 276-3. Stagecraft.
Dance techniques course (1 to 6 hours of credit)¹
Th.Dn. 290-3. Beginning Composition and Improvisation.
Th.Dn. 490-3. Dance Composition.
Th.Dn. 492-2. Musical Accompaniment for Dance.
Th.Dn. 493-2. Dance Production.

Music History

Mus. 407-2. Analysis II.²
Mus. 471-2. Renaissance Music.²
Mus. 479-2. Twentieth-Century Music.
Mus. 482-2. Ancient and Medieval Music.²
Mus. 485-2. Seventeenth- and Early 18th-Century Music.²
Mus. 487-3, 488-3. Late 18th- and 19th-Century Music.²

Music-Journalism

Jour. 100-3. Contemporary Mass Media.¹
Jour. 250-3. Reporting.¹
Jour. 427-3. Public Relations.
Jour. 460-3. Editorial Opinion Writing.
Jour. 465-3. Journalism and the Law.
Jour. 470-3. Critical Writing.¹
Jour. 480-3. Magazine Article Writing.
Jour. 490-3. Journalism and Public Opinion.
Jour. 562-3. Mass Communication and the Arts.
Mus. 401-2. Sixteenth-Century Counterpoint.
Mus. 407-2. Analysis II.²
Mus. 432-2. Piano Literature.
Mus. 446-2. Art Song I.
Mus. 447-2. Art Song II.
Mus. 466-3. Chamber Music Literature: Winds and Percussion.
Mus. 468-3. Chamber Music Literature: Strings.
Mus. 476-3. History of Choral Literature.
Mus. 477-3. History of the Opera.
Mus. 481-3. Symphonic Literature.
Selections from history area courses.

Music-Theatre

Th.Dn. 270-3. Introduction to the Theatre.¹
Th.Dn. 273-2. Acting I.
Th.Dn. 276-3. Stage Craft.
Th.Dn. 321-1,2,3. Costuming Practicum.
Th.Dn. 322-1. Techniques in Theatre Practicum.
Th.Dn. 323-1,2,3. Management Practicum.
Th.Dn. 327-1,2,3. Makeup Practicum.
Th.Dn. 424-1,2,3. Acting Practicum.
Th.Dn. 471-3. History of the Theatre I.
Th.Dn. 473-3. Advanced Acting.
Th.Dn. 474-3. Directing.
Th.Dn. 476-3. Stage Design.
Th.Dn. 479-0 to 4. Theatre Practice.
Th.Dn. 486-3. Stage Lighting Design.
Mus. 442-2. Opera Workshop.

Music Theory

Mus. 205-2. Keyboard Harmony and Improvisation.²
Mus. 305-2. Elementary Composition.²
Mus. 400-2. Contemporary Theory.²
Mus. 401-2. Sixteenth-Century Counterpoint.²
Mus. 402-2. Eighteenth-Century Counterpoint.²
Mus. 403-2. Scoring and Arranging.²
Mus. 407-2. Analysis II.²

Organ Pedagogy

Mus. 226-2. Service Playing Techniques
Mus. 326-2. Improvisation.¹
Mus. 327-2. Improvisation.¹
Mus. 401-2. Sixteenth-Century Counterpoint²
or
Mus. 402-2. Eighteenth-Century Counterpoint.²
Mus. 424-3. Church Music.
Mus. 425-3. Church Music.
Mus. 428-3. Organ Survey.¹
Mus. 429-3. Organ Survey.¹

Piano Pedagogy

Mus. 205-2. Keyboard Harmony and Improvisation.²
Mus. 235-3. Piano Pedagogy I.²
Mus. 402-2. Eighteenth-Century Counterpoint.²
Mus. 432-3. Piano Literature.¹

String Pedagogy

Mus. 358-1. Violin Pedagogy.
Mus. 359-1. Cello Pedagogy.
Mus. 468-3. Chamber Music Literature: Strings.
Mus. 481-3. Symphonic Literature.

Voice Pedagogy

Mus. 144-1. Italian Diction.¹
Mus. 145-1. English Diction.¹
Mus. 244-1. German Lyric Diction.¹
Mus. 245-1. French Lyric Diction.¹
Mus. 442-2. Opera Workshop.
Mus. 444-2. Vocal Pedagogy.
Mus. 446-2. Art Song I.¹
Mus. 447-2. Art Song II.¹
Mus. 477-3. History of the Opera.

Wind/Percussion Pedagogy

Mus. 319-1. Woodwind and Percussion Design and Repair.
Mus. 466-3. Chamber Music Literature: Winds and Percussion.
Mus. 481-3. Symphonic Literature.

American Folk Music

Basic requirements in performance: two years of study in voice and/or American folk instruments (30 minutes per week) — banjo, fiddle, guitar, mandolin. Among these five media, the student has one major (two semesters) and two minor areas (one semester each). Continuing Education registrations and fee payment arrangements must be cleared through the College of Music dean's office. Students also select from the following courses in consultation with their adviser in the American folk music concentration:

Anth. 451-3. Ethnography of North America.
Bl.St. 240-2. Ethnic Dance.¹
Bl.St. 280-3. Afro-American Music: History and Appreciation I.
Bl.St. 281-3. Afro-American Music: History and Appreciation II.
Engl. 265-3. Masterpieces in American Literature.
Engl. 266-3. Masterpieces in American Literature.
Engl. 322-3. Folklore.¹
Engl. 365-3. American Literature.
Engl. 366-3. American Literature.
F.A. 270-3. African-American Art History I.
F.A. 271-3. African-American Art History II.
F.A. 486-3. American Art I.
F.A. 487-3. American Art II.
Hist. 151-3. American History I.
Hist. 152-3. American History II.
Hist. 463-3. American Society and Thought I.

¹Courses fundamental to each interest area and/or prerequisite to other courses. Choice of courses is dependent on student's interests, background, and ability. Classes, especially in the areas of business, dance, journalism, and theatre, should be selected in close consultation with the major adviser and departments and colleges or schools concerned.
²It is recommended that students choose 10 to 12 semester hours of credit in history and theory courses in addition to basic music requirements. The courses listed above should be given prime consideration.

Hist. 464-3. American Society and Thought II.
Mus. 205-2. Keyboard Harmony and Improvisation.¹
Mus. 207-2. Instrumentation.¹
Mus. 377-3. World Music.
Mus. 379-3. Twentieth-Century Music and Media.
Mus. 460-2. Instruments in the General Music Class.¹
Mus. 464-2. History of Jazz.¹
Mus. 480-2,4. Special Studies.¹
Mus. 483-3. American Music.¹
Soc. 451-3. Social Institutions.

GRADUATE DEGREE PROGRAMS

The University is approved by the National Association of Schools of Music to offer the Master of Music degree in performance, church music, music literature, or composition; and the Master of Music Education degree with special emphasis in either vocal or instrumental music.

Advanced work is offered leading to these degrees and to the degrees Doctor of Musical Arts in performance, pedagogy, or composition and Doctor of Philosophy with an emphasis in either musicology or music education.

The student's program will be directed by the degree program coordinator or by the student's doctoral advisory committee.

In support of the candidate's application it is recommended that a report of the Graduate Record Examination aptitude test (verbal and quantitative) and the advanced music examination scores be submitted. Arrangements to take these examinations can be made by writing to the Educational Testing Service, Box 955, Princeton, New Jersey 08540; or 1947 Center Street, Berkeley, California 94704. There are no *pass* or *fail* grades; the scores achieved will be regarded as supplementary to the academic record shown in the student's transcript.

Preliminary Examinations. Students who expect to begin work on a master's or doctoral degree must report to the Music Building as indicated below on the two days prior to the beginning of their first term (see appropriate calendar — fall, spring, or summer). (Areas covered in these examinations include theory, aural perception, history and literature, and major field.)

The two days of preliminary examinations will consist of the following:

First Day

8:30 a.m.-12 Music theory, aural perception
1-4 p.m. Music history and literature

Second Day

9 a.m.-12 Master's major field (essay examination)
9 a.m.-12 Doctoral major field
1-4 p.m. Doctoral major field continues if necessary

At least one week before the examinations are scheduled to begin, the student must give written notice to the office of the College of Music associate dean for graduate studies of intent to take the examinations.

Master of Music Degree

Prerequisites. The student is expected to present undergraduate preparation equivalent to that

demanded for the corresponding bachelor's degree at this University. See Requirements for Graduation for description of the requirements for the bachelor's degree.

In advance of admission, performance majors must submit a repertoire list and should arrange for an audition. All performers should be prepared to demonstrate acquaintance with solo literature of the various historical periods.

Composition majors must submit examples of their work to the College of Music, and music literature majors must submit examples of their research papers or projects.

Preliminary Examination. The major-field examination for Master of Music students in performance will cover musical styles as related to the major performing instrument as well as problems of performance and pedagogy. Questions in theory and history will be included to serve as a basis for recommending specific courses and possible further examination in these areas (see Preliminary Examinations).

Residence. The minimum residence requirement for this degree is two semesters, plus one summer. In some divisions it may not be practical for the student to earn the Master of Music degree during summer sessions only. Prospective students should contact the chairman of the division concerned for advice.

Degree Requirements. Artistic performance or the competent composition of music or excellence in research is the basis of requirements for the Master of Music degree. (For the music literature major a keyboard proficiency sufficient to play a Bach chorale at sight and some score reading is required. Music literature majors must demonstrate proficiency in at least one foreign language — French or German.) A normal plan of advancement and maturity is expected of those registered as graduate students, this plan being formulated under the advisement of the student's degree program coordinator and major professor. Only those well advanced in technique and in professional maturity will be granted this degree. A minimum of 30 semester hours of credit is required. The actual number of hours to be presented varies with the needs of the individual student and is determined by examinations given during the course of study. At least 12 hours of the total must be in courses numbered 500 or above. Appropriate courses or examination in music history and theory must be completed satisfactorily before the student will be permitted to take the written *qualifying examination*. An oral *comprehensive examination* will be given near the close of work toward this degree.

Course Requirements. Normal division of work in this program will include approximately two-thirds of the hours in the major field (i.e., the major division) and a minimum of 10 hours outside of the major field, 6 of which must constitute a minor in the College of Music.

¹Courses fundamental to each interest area and/or prerequisite to other courses. Choice of courses is dependent on student's interests, background, and ability. Classes, especially in the areas of business, dance, journalism, and theatre, should be selected in close consultation with the major adviser and departments and colleges or schools concerned.

In piano pedagogy, major courses include instruction in piano, research in piano pedagogy and literature, historical research, and recital. In composition, major courses include theory and composition, historical research, and thesis. In church music, courses include church music, historical research, and thesis. In music literature, courses include historical and analytical research, theory, and two research projects (thesis). In wind and percussion pedagogy, major courses include instruction in the major area of woodwind, brass, or percussion (or combination), research in pedagogy and literature of the major area, and recital. In string pedagogy, major courses include instruction in the major areas of viola, violin, cello, or string bass; research in pedagogy and literature of the major area; chamber music and/or orchestra participation; and recital. Study in the major instrument, or in composition as a major subject, must continue during all terms of registration for work toward the Master of Music degree.

Choral conducting, percussion, string, and wind majors are required to participate in a music ensemble. These students should consult with the respective chairmen of their divisions regarding the specific ensemble in which they will participate.

Thesis Requirements. Thesis requirements are as follows (4 hours of credit):

1. For the major in performance: recital(s) and in some cases research papers, or performance preparation from a repertoire list, or a combination of part or all of these, as required by the major division.

2. For the major in piano pedagogy: research in piano pedagogy and literature and a full-length recital presented before a faculty committee.

3. For the major in composition: the composition, during the period of graduate study, of several works of major proportion, at least one of which must receive public performance. Copies of one or more of these works, together with analysis or other papers relating to the scores, will be filed in the usual manner for master's theses.

4. For the major in church music: the preparation and production of a substantive sacred choral work, or recital(s) and in some cases research papers, or a combination of all three, as required by the major division.

5. For the major in music literature: two written projects for 2 credit hours each, to provide some focus to the candidate's work.

6. For the major in wind or percussion pedagogy: research in pedagogy of the major area and a full-length recital or proficiency examinations in the major area before a faculty committee.

7. For the major in string pedagogy: research in pedagogy of the major area and a full-length recital or proficiency examinations in the major area before a faculty committee.

Master of Music Education Degree

The Master of Music Education program is designed to augment the student's undergraduate

preparation in music education with the more advanced training required for service as both a teacher and a supervisor. This advanced study includes, in addition to contemporary methods and materials, attention to aesthetic, philosophical, and psychological theories and principles of teaching music in today's schools. The student may pursue either Plan I, with the approval of the chairman of the Music Education Division, or Plan II.

Prerequisites. The student is expected to present undergraduate preparation equivalent to that demanded for the corresponding bachelor's degree at this University (see Bachelor of Music Education degree requirements.)

During preliminary examinations students will be questioned regarding general knowledge of philosophy and history of music education; organization and supervision of music education; and methods and materials for the individual area (vocal, strings, or winds). Proficiency examinations in the principal and secondary performance instruments (or voice) will be conducted by appointment during the first three weeks of residence.

Course Requirements. Since students entering the graduate program have a variety of backgrounds and needs, the requirements for the degree are flexible, with only minimum requirements in the broad areas of applied music, history and literature of music, theory of music, and music education. A core of five courses is required of all students: Comprehensive Musicianship for Teachers, Foundations of Music Education I and II, Introduction to Graduate Study, and Teaching Music Through Performance. The remaining course work is determined by students in consultation with an adviser in the light of their strengths, weaknesses, and interests. This course work must include a minimum of 6 semester hours concentrated in a minor area other than music education.

The flexibility of the requirements allows the student to select an area of concentration such as keyboard work in the schools; integrated music studies (allied arts, humanities); teaching music to the exceptional, handicapped, or educationally disabled child; theory of music; history and literature of music; early childhood education; private lessons; and pedagogy, as well as the traditional areas of band, orchestra, choral, or general (classroom) music teaching. The student should be prepared to identify his area of interest (one of the above or another relevant to the degree) so that an appropriate adviser can be assigned.

Plan I. A minimum of 26 credit hours earned in course work plus 4 credit hours for thesis is required. In general the number of credit hours will be in excess of this minimum. Considerable latitude will be allowed in the choice of a thesis subject, but it must involve comprehensive and independent study of some problem relating to music education. The thesis topic and outline must be approved by the chairman of the Music Education Division.

Plan II. A minimum of 30 credit hours is required. In general, the number of credit hours will be in excess

of the minimum. No formal thesis is required, but the preparation of a substantial professional report in music or music education must be submitted at the time of the qualifying examination. This report may be done in connection with any course or as independent study. It must comply in form and style with Graduate School thesis specifications.

All candidates for the Master of Music Education degree must take the course Introduction to Graduate Study during their first term of residence. In addition, all preliminary examinations must be taken and any deficiencies removed, and all core courses taken before the qualifying examination can be scheduled. This examination normally will be given at the close of the third summer term of study, or during the second semester, and will serve as the basis for determination of the student's status (the actual number of credit hours required for graduation).

Normally the course work for the degree can be completed in one academic year plus one summer or during four summer terms. However, since a wide variety of courses in music education is available during late afternoons, teachers within commuting distance of Boulder can earn a significant portion of credit toward the degree during the academic year without taking a leave from their teaching positions.

Doctor of Musical Arts Degree

The Doctor of Musical Arts degree is a professional degree for creative and performing students who possess the talent as well as the breadth of knowledge, background, outlook, and scholarly capacity requisite to a doctoral program. Areas of study include composition; literature and performance of choral music; performance and literature of organ, piano, voice, strings, winds, and percussion; the pedagogy of most of these areas; and group/class piano pedagogy.

Entrance Requirements. Entrance requirements include a master's degree in music or demonstrated equivalency comparable to that of this University, submission of performance tapes or compositions, personal interview, tests in music commensurate to Master of Music level, and demonstration of proficiency in the use of the English language.

Residence Requirements. Residence shall be three semesters or equivalent in summer sessions beyond the master's degree, of which not fewer than two semesters must be in residence at this University and should be consecutive.

Credit Required. No specific minimum number of credit hours beyond the master's degree shall be required.

Preliminary Examinations. See Division Requirements.

Audition. An applicant whose recorded audition has been judged of sufficient promise for admission may be requested to audition in person before a committee appointed by the appropriate divisional program coordinator. Applicants in composition will substitute an interview for an audition.

Divisional Program Coordinator. The dean of the College of Music has appointed a member of the faculty of each division in the College of Music to act as Doctor of Musical Arts program coordinator for that division. His duties involve specifically: (1) advising, on the basis of the preliminary examination, which course work and independent study will lead the student to the comprehensive examination; (2) assisting the student directly in setting up a total degree plan (including preliminary planning of dissertation recitals and repertoire list) for presentation to the permanent advisory committee for approval; and (3) generally facilitating and expediting the student's program and activities until such time as the permanent advisory committee has come into being and has accepted the student's program, and the student is actively pursuing dissertation work toward the degree.

Permanent Advisory Committee. In consultation with the divisional program coordinator, the student will request the dean of the College of Music to appoint a permanent advisory committee, normally by the second semester of residence. This committee will consist of the student's major professor, who will act as chairman, and two other members of the music faculty; one of these three will assume major responsibility for the student's research documents. The permanent advisory committee will review the program of study as recommended by the divisional program coordinator and will recommend any adjustments that seem necessary. It will approve all research documents, the student's degree plan, and recital dates; be the nucleus of the examination committee; and in general guide the student's efforts in accomplishing his objectives.

Language Requirement. Each student must be able to read material related to his special field of study in one foreign language. The choice of the foreign language must be approved by the student's advisory committee. A communication knowledge of the language must be demonstrated by one of four options which the Graduate School allows. (See Doctor of Philosophy, Language Requirement.)

Comprehensive Examination. After the foreign language requirement has been satisfied and two semesters of residence have been completed, the student may, with the approval of the permanent advisory committee, take the Doctor of Musical Arts comprehensive examination. This examination is in two phases, written and oral, and must be passed as a unit. In the case of students whose major area is group/class piano pedagogy, proficiency in specialized keyboard skills is also required. It must be taken at least one semester before completion of degree requirements, including the dissertation.

Students must file their application for candidacy with the Graduate School two weeks before taking the comprehensive examination and must enroll and pay tuition for fall and spring semesters of each year after registration for all dissertation requirements has been completed, until either attaining the degree or formally resigning as a candidate.

Students must be registered at the time they take the comprehensive examination.

Dissertation. Normally, if students show only minor weaknesses on their preliminary examinations, they may be advised to begin work on the dissertation in the second semester of their residence concurrent with preparation for the comprehensive examinations.

The dissertation consists of a specified number of performances (or compositions) and documents. Students' permanent advisory committees will assist them in meeting dissertation requirements. While dissertation outlines for the various major areas are listed below, individual instances may require the permanent advisory committee to exercise discretionary flexibility in tailoring dissertation requirements to the student's artistic and educational advantage.

Students must consult with the appropriate divisional program coordinator to determine their specific requirements.

Performance and Choral Literature Dissertation Requirements

- Mus. 821-3. Dissertation Project I. Solo Recital or Choral Conducting Practicum.
- Mus. 822-3. Dissertation Project II. Solo Recital or Choral Conducting Practicum.
- Mus. 823-3. Dissertation Project III. Chamber Music Recital or choral projects in score reading and rehearsal techniques.
- Mus. 824-3. Dissertation Project IV. Chamber Music Recital or choral projects in editing. Continuo realization and arranging.
- Mus. 825-3. Dissertation Project V. Lecture-Recital.
- Mus. 826-3. Dissertation Project VI. Lecture-Recital.
- Mus. 827-1. Performance-Related Research Document to accompany Mus. 821.
- Mus. 828-1. Performance-Related Research Document to accompany Mus. 822.
- Mus. 829-1. Performance-Related Research Document to accompany Mus. 823. (Not required in choral program.)
- Mus. 830-1. Performance-Related Research Document to accompany Mus. 824. (Not required in choral program.)
- Mus. 831-3. Repertoire Project.

Pedagogy Dissertation Requirements

- Mus. 821-3. Dissertation Project I. Solo Recital.
- Mus. 823-3. Dissertation Project II. Chamber Music Recital.
- Mus. 825-3. Dissertation Project III. Research Lecture-Recital.
- Mus. 825-3. Dissertation Project IV. Pedagogy Lecture.
- Mus. 826-3. Dissertation Project V. Research Lecture-Recital.
- Mus. 826-3. Dissertation Project VI. Pedagogy Lecture.
- Mus. 827-1. Performance-Related Research Project to accompany Mus. 821.
- Mus. 828-1. Performance-Related Research Project to accompany Mus. 823.
- Mus. 831-3. Repertoire Project.
- Mus. 832-4. Major Document based on previous research. (Pedagogy students may elect, upon advisement, Mus. 824-3, Chamber Music Recital, and Mus. 830-1, Document, in place of Mus. 826-3, Pedagogy Lecture.)

Piano Pedagogy: Process of Group Environments Dissertation Requirements

- Mus. 821-3. Dissertation Project I. Recital.
- Mus. 822-3. Dissertation Project II. Teaching performance.
- Mus. 823-3. Dissertation Project III. Teaching performance.
- Mus. 824-3. Dissertation Project IV. Master classes in group setting.
- Mus. 825-3. Dissertation Project V. Teacher effectiveness.

- Mus. 827-1. Document. May be combined with Mus. 828 for a lecture-recital.
- Mus. 828-1. Document. May be combined with Mus. 827 for a lecture-recital.
- Mus. 831-3. Repertoire Project. Administered at two levels: reading and performance.
- Mus. 832-4. Major Document. Implemented with teaching performance.

Composition Dissertation Requirements

- Mus. 821-3. Dissertation Project I. Compositions.
- Mus. 822-3. Dissertation Project II. Compositions.
- Mus. 823-3. Dissertation Project III. Composition Recital (or equivalent in performance of compositions).
- Mus. 824-3. Dissertation Project IV. Composition Recital (or equivalent in performance of compositions).
- Mus. 825-3. Dissertation Project V. Lecture-Recital.
- Mus. 826-3. Dissertation Project VI. Lecture-Recital.
- Mus. 833-6. Major Composition Project.

Upon the recommendation of the student's permanent advisory committee, independent study (Mus. 680) may be substituted for up to a total of 4 hours of performance-related documents (Mus. 827, 828, 829, 830, 1 hour each).

Final Oral Examination. After all dissertation requirements have been met, an oral examination in defense of the dissertation documents and upon related topics shall be conducted.

Candidates must be registered at the time they take the final examination.

Doctor of Philosophy Degree (Music Education)

The Doctor of Philosophy degree in music, with music education as a field of specialization, is offered through the Graduate School for the student who demonstrates maturity, a strong interest in the music education profession, and musical and scholarly promise. The requirements for the degree have been established for the purpose of acquainting the student with practical and philosophical problems confronting contemporary music education, while at the same time providing a solid background in the history, philosophy, and theory of music. A significant portion of the degree work will emphasize research and research techniques. The program may be expected to prepare the student for a career as a teacher of music education at the college level or for a supervisory or administrative position in the elementary or secondary schools.

Educational preparation similar to the Bachelor of Music Education and Master of Music Education degrees awarded by the University of Colorado and two years of successful teaching experience are prerequisite for admission to the Ph.D. program in music education. Although the primary emphasis in the Ph.D. program is on scholarship and research, the candidate is expected to have attained an acceptable level of musical performance.

Since students entering the Ph.D. program have a variety of backgrounds and needs, the requirements for the program are flexible and cannot be stated in terms of credit hours; the degree is awarded on the

basis of proficiency in a broad field of knowledge. Although the rules of the Graduate School require a minimum of 30 semester hours of graduate credit, most students, in order to meet the expected scholarly and musical standards, find it necessary to plan a program of approximately 45-50 semester hours of course work plus the Graduate School requirement of 16 semester hours for the dissertation.

The course work for the Ph.D. degree shall include up to 15 hours in background courses as needed, 14 hours in music education, 8 hours in a primary minor field of history or theory of music, 6 hours in a secondary minor field and electives. Any course work needed to meet the language requirement will be in addition to the above.

The required course work in music education shall include: (1) Contemporary Issues in College Teaching, (2) Research Literature and Techniques I (Historical and Philosophical), (3) Research Literature and Techniques II (Survey and Experimental), and (4) Research Practicum in Music Education. All other course work shall be determined by the candidate in consultation with the advisory committee.

Course work designed to satisfy the secondary and elective requirements may be selected from such areas as history and literature of music and music theory (if not selected as a primary minor), private applied music and pedagogy, composition, administration, supervision, curriculum, psychology of education, sociology of education, group keyboard pedagogy, integrated music studies (allied arts, humanities), handicapped or educationally disabled children, early childhood education as well as the traditional areas of band, orchestra, choral or general (classroom) music teaching.

Minimum requirements for all Doctor of Philosophy programs at the University of Colorado are outlined in the Graduate School section of this catalog. Further requirements for the Ph.D. degree in music education are as follows:

1. The language proficiency must be demonstrated in either French or German.

2. A minimum of two semesters of resident credit must be earned after the language requirement has been met. The semester in which the language test is passed cannot constitute one of these semesters.

3. A minimum of 6 semester hours in courses taken in residence, numbered 500 or above, in which a grade of *B* or above was earned and which are applicable toward the degree shall earn one semester of resident credit.

For information regarding preliminary examinations see that section.

Further information may be obtained by writing to the associate dean for graduate studies, College of Music.

Doctor of Philosophy Degree (Musicology)

The program leading to the Doctor of Philosophy degree in music, with musicology as a field of specialization, is offered as a concept-oriented course

of study embracing areas of musical scholarship from creative theory to historical and experimental research. At present, programs in the various historical epochs, theory, aesthetics, and American music are available.

The basis of the program is the exposure of the student to various concepts of and techniques for looking at music. The object of the program is directed, not at the preparation of the performer, researcher, or classroom teacher, but rather toward the background that a well-rounded musical scholar will require to direct his attention to any of these, or other, goals upon completion of his course of study. Since the basis of all musicology is the stylistic history and theory of music, it is assumed all entrants into the program will have a strong grasp of these areas. Such an understanding can be acquired in a master's program with major emphasis in historical, topical, and theoretical subjects; however, students with exceptional background in these areas at the undergraduate level may be admitted directly to the Ph.D. program without the master's degree.

Prerequisites. Before beginning the graduate program in musicology applicants are expected to comply with entrance requirements for the Graduate School, including submission of an application for admission and all supporting credentials as requested thereon. In addition, they are expected to attain acceptable scores on the Graduate Record Examinations (verbal and quantitative, and the advanced music examination). Finally, they must show evidence of superior individual work in music theory and/or history, this condition to be established by the submission of one or more papers, research projects, or compositions to the chairman of the division.

Preliminary Examinations. Before the beginning of the first semester of residence, the candidate must take the preliminary examinations, and the musicology divisional examination, which includes analysis of a composition; solution of a compositional problem (such as writing a fugal exposition or an invention); score reading; essay questions on historical and theoretical problems; a library research project; and a demonstration of reading ability with or without the aid of a dictionary in at least one foreign language, the passages to be chosen from current periodical literature. All requirements listed under Preliminary Examination must be satisfactorily completed not later than one year after the candidate has begun the program.

Course of Study. Students are responsible for selecting their own course of study with the assistance of their advisers. Because of the basic methodology and techniques involved, Introduction to Music Research (Mus. 570) should be elected as soon as possible in the program. The epoch or period courses constitute general preparation for the comprehensive examination. In addition, the student should have established an area of specialization by the time of the comprehensive examination and have a thorough knowledge of the history and bibliography of the particular area. Therefore, the area of specialization

should be determined as soon as practicable in the student's residence, and will involve the selection of an advisory committee as outlined in this catalog, the chairman of this committee to serve as the student's major adviser.

It is the responsibility of the student to convince the faculty that he or she is qualified to be a candidate for the degree Doctor of Philosophy by demonstrating a basic knowledge of philosophical, historical, and theoretical problems; of styles and performance practices in music; and an ability for oral communication and expository writing about music. Normally, the means to such a demonstration will be active participation in colloquia, courses, proseminars, and the advisory examination (to be taken at the end of two semesters' study) as well as the comprehensive examination.

Requirements for the Degree. For information regarding hours, residence, thesis, and final examination requirements, see the general requirements for the Doctor of Philosophy degree as outlined in the Graduate School section of this catalog.

1. Entrance requirements are discussed under the topics Prerequisites and Preliminary Examinations.

2. In addition to the Graduate School foreign language requirement, students must demonstrate reading proficiency of musical materials in both French and German as tested by the musicology faculty. Additional language requirements may be made, depending upon the student's area of specialization. These requirements must be fulfilled before the comprehensive examination.

3. Near the completion of the second semester in the musicology program, the student will meet with the musicology committee in the advisory examination. This examination will be conducted orally and will be concerned primarily with the progress the student has demonstrated, particularly with regard to determining a major area of specialization. Such an area of specialization is not to be conceived narrowly as a thesis topic, but rather as a broader segment in which the student plans to spend an appreciable

amount of his scholarly career. Advisory examinations may be repeated until such time as the student has satisfactorily defined his area of specialization.

4. Two formal presentations in the Musicology Colloquium are required. Preparation for these presentations may be taken for credit as Seminar in Musicology (Mus. 782-783). Other informal presentations are also expected.

5. The musicology student normally will take both the lecture and seminar sessions of those epoch and topical courses which the adviser and the student consider necessary for the student's program. Lecture sessions may be omitted and seminar sessions only may be taken if in the opinions of the adviser and instructor the student has sufficient proficiency in the area. In such cases the student will register for the seminar session under Special Studies (Mus. 680).

6. The comprehensive examination will be given upon request after completion of a minimum of 30 hours of course credit, three semesters of residence, and fulfillment of the language requirements. Written notice of intent to take the comprehensive must be presented to the musicology faculty through the student's advisory committee at least three months in advance. The written and oral examinations constituting the comprehensive examination will cover both the general areas of music and musicology, and the candidate's special area.

7. Three copies of the thesis must be submitted: one to the Graduate School, one to the musicology faculty for the music library, and one to be returned to the candidate.

Further information may be obtained by writing to the associate dean for graduate studies, College of Music.

NONDEGREE STUDENTS

All nondegree students must secure consent from the instructor and adviser concerned before registering for any course offered in the College of Music.

School of Pharmacy

V. Gene Erwin, Dean

DEGREES

Bachelor of Science in Pharmacy

The five-year course of study in the School of Pharmacy leads to the Bachelor of Science (Pharmacy) degree.

The School of Pharmacy is a member of the American Association of Colleges of Pharmacy and is accredited by the American Council on Pharmaceutical Education.

Bachelor of Science (Business) —Combined Curriculum

Undergraduates in the School of Pharmacy with career interests in business administration may complete all of the requirements for both a Bachelor of Science (Pharmacy) degree and a Bachelor of Science (Business) degree by extending their study program by a minimum of one semester. The 48 semester credits required in the College of Business and Administration may be started in the second year or at the latest in the third year depending upon the pharmacy curriculum arrangements.

Graduate Degrees

The faculty of the School of Pharmacy, through the Graduate School, offers the Master of Science and Doctor of Philosophy in the pharmaceutical sciences.

PHARMACEUTICAL SCIENCES

The Master of Science and the Doctor of Philosophy degrees in the pharmaceutical sciences are offered with the following fields of specialization: pharmacy and biopharmaceutics, pharmacy administration, pharmaceutical chemistry, pharmacology, and behavioral pharmacogenetics.

Although an undergraduate degree in pharmacy is desirable, it is not a necessary requirement for pursuing graduate work in the pharmaceutical sciences. Students wishing to pursue graduate work in the pharmaceutical sciences leading to an advanced degree should read carefully the Graduate School section for minimum requirements, quality of work, residence, application for admission to candidacy, thesis requirements, etc.

MASTER OF BUSINESS ADMINISTRATION

Undergraduates in the School of Pharmacy with career interests in business administration may

satisfy the prerequisites for the Master of Business Administration program by completing the undergraduate courses or the graduate fundamental courses offered by the College of Business and Administration during their undergraduate program. Performance in the undergraduate program and on the Admission Test for Graduate Study in Business are important considerations in regard to acceptance into the M.B.A. program of the Graduate School of Business Administration. Students who intend to pursue this combination should consult with the graduate student adviser in the Office of Graduate Studies, College of Business and Administration, early in their program. This program will require an additional year of study beyond the course of study in the School of Pharmacy.

Honors at Graduation

The School of Pharmacy, in recognition of high scholarship and professional attainments, grants honors at graduation in two grades: honors and special honors.

SCHOLARSHIPS AND LOANS

Several scholarships and loans are designed specifically for students in the School of Pharmacy. These are awarded upon recommendation of the Financial Aid Committee of the School of Pharmacy. Information about any of the financial aid available may be obtained by writing to the dean of the School of Pharmacy.

In addition, several pharmaceutical companies make available funds for scholarships which are administered by the donor companies. Information regarding these may be obtained by writing to the dean of the School of Pharmacy.

The School of Pharmacy has funds awarded by the federal government for scholarships and loans under the terms of the Health Professions Education Assistance Act. There are also funds available for awarding financial assistance to students who qualify for the work-study program.

UNDERGRADUATE DEGREE PROGRAM

Requirements for Admission

Since the School of Pharmacy is located on the Boulder Campus, admission to the School of Pharmacy is restricted to matriculation on the Boulder

Campus only and is not valid for enrollment at the other campuses of the University.

To be admitted to the School of Pharmacy, the applicant must satisfy the requirements of the University as well as specific requirements of the School of Pharmacy. Two academic years of preprofessional study are required to qualify for admission to the School of Pharmacy. The following preprofessional courses or their equivalent as indicated in the first two years of the course of study must be completed satisfactorily with a grade of *C* or better prior to enrollment in the School of Pharmacy and may not be taken under a pass/fail option:

	<i>Semesters</i>	<i>Hours</i>
General chemistry with laboratory (to include qualitative and quantitative analysis)	2	8-10
General biology or general zoology with laboratory	2	8-10
Mathematics (algebra and trigonometry or calculus)	1-2	5-10
English composition, literature, or foreign language	2	6-10
Organic chemistry with laboratory	2	8-10
General physics with laboratory	2	8-10
Principles of economics	2	6

Electives are not required for admission. However, students should plan to complete at least 10 semester hours of elective credit prior to enrollment in the School of Pharmacy.

To be eligible for admission, an applicant must have attained a cumulative grade-point average of at least 2.0 as well as a 2.0 average for any enrollment at the University computed on all courses attempted. However, a 2.0 average is a minimal requirement only and does not assure admission to the School of Pharmacy. Each year the Committee on Pharmacy Admissions will establish the grade-point average to be used in the selection of applicants.

Selection of applicants for admission will be made according to policies established by the faculty of the School of Pharmacy. Applicants who qualify for admission will be placed in categories according to their status at the time of making application. Selection will be made according to the following categories in a descending order:

1. Qualified Colorado residents.
2. Qualified nonresidents enrolled at Colorado institutions.
3. Qualified nonresidents enrolled at out-of-state institutions.

Applications for admission to the School of Pharmacy are considered only for the *fall semester* and must be submitted to the Office of Admissions and Records by *March 1* (or until the quota is filled) of the year for which admission is desired. Students will be notified of their status after their credentials have been evaluated and action on all applications should be completed by June 1. Provisional admission is granted when course work is still in progress. The student has the responsibility to make certain that a supplementary transcript is mailed to the Office of Admissions and Records when the course work is completed. Failure to submit this transcript may result in

refusal of admission. Former students who were enrolled in the School of Pharmacy must meet the readmission requirements of the University and be accepted by the School of Pharmacy.

Students who desire to transfer to the School of Pharmacy from other schools or colleges within the University must submit an intra-university transfer application to the Office of Admissions and Records. The application deadline is March 1 or until quota is filled. Intrauniversity transfers that are approved to the School of Pharmacy are effective for the Boulder Campus only and are not valid at the University's other campuses.

The Pharmacy College Admission Test (PCAT) is required for all applicants and must be completed not later than *February* of the year for which admission is desired. Also a School of Pharmacy Questionnaire is required to be completed by each applicant.

Requirements for Graduation

To be awarded the Bachelor of Science (Pharmacy) degree, candidates must complete the required courses indicated in the curriculum and a sufficient number of acceptable electives to make a minimum of 165 semester hours, with credit points equal to twice the number of hours attempted.

RESIDENCE REQUIREMENTS

To be eligible to receive the degree in pharmacy, students who bring advanced credit from other schools or colleges of pharmacy will be required to complete a minimum of two academic years or four semesters of residence work at this University.

The American Association of Colleges of Pharmacy requires that a minimum of three academic years of residence work must be completed in an approved school or college of pharmacy regardless of the amount of college credit that may be accepted from other types of institutions. It further provides that none of the professional courses in pharmacy may be taken through correspondence.

To qualify for a semester of pharmacy residency, a student must be registered for at least 12 hours for credit in the School of Pharmacy on the Boulder Campus. If a student takes a reduced schedule of less than 12 hours for the semester or attends the summer session, pharmacy residency will be granted in proportion to the number of hours completed and the duration of the term. Pharmacy residency will not be granted for enrollment at the other campuses or through the Division of Continuing Education of the University.

ORDER OF STUDIES FOR BACHELOR OF SCIENCE (PHARMACY) DEGREE

FIRST YEAR (PREPROFESSIONAL)

<i>Fall Semester</i>	<i>Semester Hours</i>
English composition, literature or foreign language	3
Chem. 103. General Chemistry	5
EPOB 101. General Biology I (or MCDB 105)	3

EPOB 110. General Biology Laboratory I (required with EPOB 101)	1
Math. 101. College Algebra (or Math. 110)	3
Electives	<u>2</u>
	17
<i>Spring Semester</i>	
English composition, literature or foreign language	3
Chem. 106. General Chemistry	5
EPOB 102. General Biology II (or MCDB 106)	3
EPOB 111. General Biology Laboratory II (required with EPOB 102)	1
Math. 102. College Trigonometry (or Math. 130)	2
Electives	<u>3</u>
	17

SECOND YEAR (PREPROFESSIONAL)

Fall Semester

Chem. 331. Organic Chemistry	4
Phys. 201. General Physics (or Phys. 111)	5
Econ. 201. Principles of Economics I	3
Electives	<u>5</u>
	17

Spring Semester

Chem. 332. Organic Chemistry	4
Phys. 202. General Physics (or Phys. 112 and 114)	5
Econ. 202. Principles of Economics II	3
Electives	<u>5</u>
	17

THIRD YEAR (PROFESSIONAL)

Fall Semester

Phar. 305. Pharmacy Orientation	2
Ph.Cl. 340. Pharmacology I	4
Ph.Ch. 370. Pharmaceutical Chemistry I	3
Ph.Ad. 381. Laws of Pharmacy	3
Chem. 481. General Biochemistry	3
Electives	<u>2</u>
	17

Spring Semester

Phar. 306. Survey of Prescription Procedures	1
Phar. 308. Pharmaceutics I	3
Ph.Cl. 341. Pharmacology II	3
Ph.Ch. 371. Pharmaceutical Chemistry II	3
EPOB 322. Human Physiology	4
Chem. 482. General Biochemistry	<u>3</u>
	17

FOURTH YEAR (PROFESSIONAL)

Fall Semester

Phar. 410. Pharmaceutics II	4
Ph.Cl. 442. Pharmacology III	4
Ph.Ch. 472. Pharmaceutical Chemistry III	3
Bi.Ph. 490. Anatomy and Pathology	4
Electives	<u>3</u>
	18

Spring Semester

Phar. 411. Pharmaceutics III	4
Ph.Cl. 443. Pharmacology IV	4
Ph.Ch. 473. Pharmaceutical Chemistry IV	3
Ph.Ad. 483. Pharmacy Financial Management	3
Electives	<u>4</u>
	18

FIFTH YEAR (PROFESSIONAL)

Fall Semester

Phar. 412. Clinical Pharmacy I	3
Phar. 420. Ambulatory Care I	2
Phar. 422. Community Pharmacy	2
Clinical Pharmacy Elective	2
Ph.Ad. 486. Pharmacy Management	3
Electives	<u>3</u>
	15

Spring Semester

Phar. 413. Clinical Pharmacy II	3
Phar. 423. Hospital Pharmacy	2
Phar. 424. Drug Information- Poison Control	2
Clinical Pharmacy Elective	2
Electives	<u>3</u>
	12

ACADEMIC POLICIES

Academic Ethics

Students are expected to conduct themselves in accordance with the highest standards of honesty and integrity. The act of or the intent to engage in the act of cheating, plagiarism, illegitimate possession and/or disposition of examinations, alterations, forgery or falsification of records, and similar acts are grounds for suspension or expulsion from the University. Students are advised that plagiarism consists of any act involving the offering of the work of someone else as the student's own.

Course of Study

The course of study in the School of Pharmacy is five academic years, leading to the Bachelor of Science (Pharmacy) degree. The course work is organized in a prescribed sequential manner which provides for an excellent general and professional background.

The normal academic load is 16 to 18 semester hours, and the student must be officially registered for each course to receive credit. Permission to take more than 18 or less than 12 hours may be granted only by the dean. A student must be registered for at least 12 hours for credit on the Boulder Campus to qualify for a semester of residency in the School of Pharmacy.

The proper sequence of both the professional and nonprofessional courses in the curriculum must be maintained. A student on scholastic probation will not be permitted to advance into either the fourth or fifth year of the course of study sequence until at least a cumulative 2.0 grade-point average has been attained in the School of Pharmacy. A grade of *D* is not an acceptable passing grade in a professional course and a student will not be permitted to register for fifth-year professional courses unless all third-year and fourth-year professional courses have been completed satisfactorily with a grade of *C* or better. A student may not register for any third-year or fourth-year professional course unless all prerequisites have been satisfied with an acceptable passing grade.

Grading System, Dropping and Adding Courses, Withdrawal

The University of Colorado has adopted a standard policy on these procedures which is outlined in the General Information section of this catalog.

In the School of Pharmacy a grade of *D* is not an acceptable passing grade in a professional course, and if a grade of *D* is received in a professional course, the course must be repeated until a grade of *C* or better is received. Professional courses are those listed under pharmacy, pharmacy administration, pharmaceutical chemistry, pharmacology and biopharmacy. The pass/fail option is not permitted for the nonprofessional or professional courses that are required for graduation. After enrollment in the School of Pharmacy, a maximum of 6 hours of nonprofessional electives may be taken to apply toward the degree under the pass/fail option.

Scholastic Requirements

A student must maintain a cumulative 2.0 grade-point average for all courses attempted in the School of Pharmacy to remain in good standing. If the average falls below 2.0, a student will be placed on scholastic probation with a mandatory reduction of academic load and extracurricular activities. The scholastic record must be improved each subsequent semester. If a 2.0 average is not attained or satisfactory improvement demonstrated after two semesters, the status of probation will be changed to suspension.

A student under scholastic suspension may attend summer sessions at the University in order to improve the grade-point average; however, credits received by

enrollment at other institutions while under scholastic suspension will not be accepted as transfer credit by the School of Pharmacy. A student under scholastic suspension may apply for readmission after one academic year and if reinstated will be on probation with two semesters to demonstrate satisfactory scholastic improvement. A student suspended a second time will not be reinstated.

A student on scholastic probation will not be permitted to advance into either the fourth or fifth year of the course of study sequence until a cumulative grade-point average of at least 2.0 has been attained in the School of Pharmacy.

Convocations

All students registered in the School of Pharmacy are required to attend convocations and special lectures scheduled throughout the year. Usually the programs will be scheduled during the day, but occasionally it may be necessary to attend an evening program. The purpose of the convocations and special lectures is to augment regular classroom lectures and to give students the opportunity to meet and hear outstanding visitors.

Credits at the Denver and Colorado Springs Campuses

While professional courses are not available at the Denver and Colorado Springs campuses, students may complete the two preprofessional years of study, as well as the nonprofessional and elective courses required in the pharmacy curriculum, at these campuses.

Graduate School of Public Affairs

Robert F. Wilcox, Dean

INFORMATION ABOUT THE SCHOOL

The Graduate School of Public Affairs (GSPA) was established in 1972 to provide an expanded program of educational preparation for public service administration. The school offers three degrees: the Master of Public Administration, the Master of Urban Affairs, and the Doctor of Public Administration. The Certificate in Public Administration, which is administered by the Division of Continuing Education under the guidance of the school, is a nondegree sequence of courses for persons who wish to increase their knowledge and skills in managerial or specialized aspects of public employment.

The M.P.A. degree may be earned on the Boulder, Denver, and Colorado Springs campuses of the University. The M.P.A., M.U.A., and D.P.A. degrees are offered on the Denver campus.

The Graduate School of Public Affairs holds membership in the National Association of Schools of Public Affairs and Administration and in the Council of University Institutes for Urban Affairs.

Functions of the School

The school provides a versatile program of professional education and training for administrative careers in the public sector. It also conducts research on issues of concern to persons in the field of public affairs.

The school offers professional graduate education for both recent graduates and persons who are well into public service careers. Its curricula are designed to prepare men and women for careers in management of the public sector by providing them with the knowledge and skills required for this expanding profession. Curricula and courses are available in a variety of formats, credit and noncredit, for both degree- and nondegree-bound students.

Instruction is provided by a multidisciplinary faculty whose members are experienced administrators and specialists in fields such as organization theory, policy analysis, budgeting, information systems, organization development, city management, labor relations, quantitative analysis, science policy and administration, and urban management. Graduate courses from other University schools and departments are available to students desiring specialized study in areas of advanced knowledge beyond the offerings of the Graduate School of Public Affairs.

The Graduate School of Public Affairs resembles other professional schools in its orientation to decision and action rather than to the accumulation and development of theoretical knowledge.

Faculty members of the school maintain close associations and working relationships with practitioners at all levels of public affairs. Such activities include taking leadership roles in professional associations, conducting executive development programs, and undertaking significant consulting assignments. Continuing, cooperative relationships with responsible public administrators have resulted in a very high rate of placement of graduates. Alumni with an M.P.A. from the University of Colorado hold responsible positions in more than 40 states and in at least 14 countries throughout the world.

Goals of the School

Some of the goals of the school are listed below in order to give prospective students an idea of the environment in which they will be studying if they enroll. The school endeavors to:

1. Emphasize multidisciplinary approaches to public issues.
2. Prepare for careers in administration college graduates having such diverse majors as anthropology, psychology, sociology, economics, biology, business administration, engineering, political science, etc., as well as midcareer specialists (including retired military personnel or veterans) desiring executive development or training.
3. Provide students with the opportunity to study in cross-disciplinary programs designed to link expertise in areas such as engineering, law, science, and public health, with knowledge of such fields as management, policy analysis, and urbanism.
4. Enroll students from minorities which are now severely under-represented in responsible policy and management positions in public service.
5. Expose students to a faculty of scholars who are regularly involved in working relationships with practitioners in all levels of public affairs.
6. Maintain close relationships with federal, state, and local governments and associations of governmental executives.

Career Expectations of Graduates

Students who have earned the M.P.A. from this University have filled a variety of administrative positions in federal, state, and local governments. While it

would be difficult to predict all of the kinds of careers graduates will pursue, several major categories can be defined:

1. Public executive generalists, represented by positions such as city manager, assistant city manager, director of administration, department head, assistant administrator, and administrative assistant.

2. Staff specialists in fields such as urban affairs, policy analysis, administrative planning, financial management, administrative analysis, personnel management, city management and labor relations.

3. Departmental administrators, a category which includes persons who are involved in the management of functional programs in which technical knowledge is required. Examples include research into, analysis of, and planning and direction of human services, such as welfare, health, housing and recreation; direction of programs in areas such as environmental protection, urban planning, research and development; management of natural resources; public works administrators; criminal justice planners and administrators; and administrators of American foreign policy and foreign aid programs.

MASTER OF PUBLIC ADMINISTRATION

The Master of Public Administration is an interdisciplinary program. It combines required core courses, which provide background, with elective courses selected by students to serve their professional interests. An internship is required for students without prior administrative experience.

The University of Colorado at Boulder M.P.A. program emphasizes preparation for general public administration, policy analysis, human resources management, and urban administration. In addition, in consultation with a faculty adviser, a student may develop an individualized degree plan which meets the basic requirements for the M.P.A.

The City Management Option (effective fall 1979) is designed to meet unique requirements of the field not addressed in general M.P.A. programs. This program features the assignment of both academic and practitioner advisers; a practitioner faculty, providing the technical aspects of municipal operation (i.e., wastewater treatment, fire, police, etc.); and an ongoing concern for the assessment of students' skill and knowledge level.

Additional areas of specialization (options) are offered by GSPA on the Denver campus and are listed in the current bulletin for that campus.

Students seeking information regarding the Master of Urban Affairs, Doctor of Public Administration, and the Certificate in Public Administration should consult the University of Colorado at Denver catalog.

Financial Assistance

Students in the M.P.A. program are eligible for several types of financial assistance. Work-study positions and educational loans require application to the Office of Financial Aid. A number of students also obtain paid internships or other part-time positions with

local, state, and federal agencies in the Boulder-Denver area. Minority students may apply for the Minorities in Urban Administration Program Traineeships (supported by the Denver Regional Council of Governments and the U. S. Department of Housing and Urban Development). A few fellowships have been available to full-time students in GSPA under the Education for the Public Service Act. A small number of tuition scholarships is available on each of the three campuses. Law Enforcement Assistance Program funds are available for reimbursement of tuition and books for persons employed in criminal justice. The Graduate School of Public Affairs is actively seeking additional funding for student support in the form of fellowships and additional internship positions.

Professional Organizations

Students in public administration are encouraged to become members of the American Society for Public Administration and to utilize the publications and other services of that professional organization. The monthly meetings in Denver of the Colorado Chapter of A.S.P.A. provide students the opportunity of associating regularly with professional administrators from all levels of government. The Public Affairs Council, which is a University of Colorado section of the Colorado Chapter of A.S.P.A., fosters the professional development of students.

ADMISSION REQUIREMENTS

1. A baccalaureate degree is required from a college or university of accredited standing, with grades sufficiently high to indicate ability to pursue graduate work. An applicant may have majored in any field for the baccalaureate degree. However, students who have not had college or university course work which included the basic elements of American government are required to take either the College-Level Examination in American Government or P.Sci. 110 (or an equivalent course).

2. Applicants for admission should present evidence that they possess the necessary personal qualifications for administrative or other professional positions in public service. Recommendations by four qualified references must be submitted on forms which applicants will receive when they request an application form. (Recommendations may be made by professors and/or others who are acquainted with the prospective student's professional work.)

3. A satisfactory score on the Aptitude Test of the Graduate Record Examination (GRE) or an equivalent test, such as the Law School Admissions Test, Graduate Management Admission Test, Miller Analogy Test, or the UA form of the School and College Ability Test (SCAT) with the scores converted to the equivalent scores of the GRE. Information about the Graduate Record Examination may be obtained from the Testing Office, Willard Administrative Center, University of Colorado, Boulder, Colorado 80309; or from the Educational Testing Service, 1947

Center Street, Berkeley, California 94694. To insure proper reporting of GRE scores, examinees should specify that their graduate major at the University of Colorado will be Public Administration (Graduate School Department Code No. 94 for Item 10, on the application form). The SCAT test can be taken at the University of Colorado at Boulder with two days' prior notice. Students who wish to take the SCAT test must contact the Testing Office, Willard Administrative Annex, University of Colorado, Boulder, Colorado 80309. Applicants should request that their test scores be sent directly to the campus to which they are requesting admission. In the case of the Boulder campus, this would be Assistant Dean, Graduate School of Public Affairs, University of Colorado, Boulder, Colorado 80309.

4. Completed credentials should be received by June 1 for the fall semester, November 15 for the spring semester, and April 1 for the summer semester. Since the Boulder campus is at times subject to restrictions on enrollment, applicants for the fall semester should apply by April 15 whenever possible.

Transfer of Credit

Up to 9 semester hours of appropriate graduate work from an accredited college or university and/or from a Department of Defense-sponsored school (Industrial College of the Armed Forces, Command and General Staff School, Army War College, Naval War College, etc.) may be credited toward the Master of Public Administration degree. Department of Defense courses must be approved by the American Council on Education as qualifying for graduate credit.

Courses completed while students are classified as special students may not be applied toward graduate degrees. However, if a student's status is changed from *special student to degree student*, he may request in writing that up to a maximum of 12 semester hours of work completed while in special student status be applied toward the M.P.A. degree. The request should be made during the semester or term in which the change of student status occurs.

MINIMUM REQUIREMENTS FOR THE MASTER OF PUBLIC ADMINISTRATION DEGREE

The minimum requirements for the M.P.A. change from time to time. Students may graduate under the requirements which were in effect when they were admitted; however, most students prefer to graduate under the latest requirements.

The present minimum requirements for the M.P.A. are listed below.

1. *The completion of a minimum of 36 semester hours of graduate work, including core courses or acceptable equivalents, with a grade average of B or better. At least 30 semester hours of this work must be at the 500 level or above. The required core courses are:*

P.Ad. 500. Fundamentals of Public Administration (required of students who have not had an introductory course in public administration).

P.Ad. 502. Statistics for Public Administrators; or a passing grade on the Quantitative Proficiency Examination.

A student who passes the Quantitative Proficiency Examination is not required to take P.Ad. 502; however, no course credit is given for the examination. This examination consists of multiple choice questions pertaining to statistical concepts and interpretation of statistical analyses, such as frequencies, central values, dispersion, correlation, and two-sample tests. Students who wish to take this examination should consult the GSPA office for further details and a suggested reading list. The examination is usually given near the beginning of each semester.

P.Ad. 504. Organization Theory and Administrative Behavior.

P.Ad. 505. Financial Administration.

2. *American Government Requirement.* All GSPA students are required to demonstrate an understanding of the political aspects of public administration. The GSPA faculty is responsible for identifying and advising new students who have not fulfilled this requirement at the time of their acceptance. However, it is the responsibility of the student to show proof of completing this requirement. This requirement may be met in one of the following three ways:

a. Prior completion, as an undergraduate, of a course on the American political system (from an accredited institution).

b. Completion, as a GSPA student, of a basic course on American government (P.Sci. 110 or course equivalent).

c. A passing grade (55) on the College Level Examination in American Government (CLEP) test, before or during the first semester following admission. Students who wish to take the CLEP test must contact the Testing Office, Willard Administrative Center, University of Colorado, Boulder, Colorado 80309; (303) 492-7067. There is a \$20 registration fee for the CLEP test, which is usually given three times a semester.

3. *P.Ad. 600. Field Study in Public Administration.* Required of students who have not had prior administrative experience. During the summer session the internships will consist of full-time positions in government agencies or government-related agencies. During the fall and spring semesters the internships will consist of part-time positions in government agencies or in government-related agencies. Interns must meet their on-the-job requirements as well as the requirements of the Graduate School of Public Affairs. A minimum of 240 hours of supervised work-and-study is required to earn 3 hours of credit and at least 480 hours for 6 semester hours. Students with administrative experience are not eligible to take P.Ad. 600.

4. *Completion of either a thesis/project or a comprehensive written examination taken during the last semester of enrollment.* The comprehensive examination will test the student's ability to integrate, analyze, and justify the concepts of general public administration. The format of the comprehensive examination varies from time to time but the content consistently includes material from P.Ad. 500, 502, 504, 505, and 507, plus the area of specialization. The student will be expected to identify accurately and discuss the literature of these courses.

The thesis/project option provides the student with the opportunity to investigate administrative subjects that interest them. The thesis/project consists of substantial, independent student research on the chosen subject. Students interested in the thesis/project option are strongly urged to complete U.A. 500 (Research Methods) before starting on their thesis/projects.

5. *Completion of an area of specialization.* The area of specialization consists of required courses in a specialization suited to the student's particular professional needs. Selection of an area of specialization should be made, in consultation with an adviser, during the first semester of full-time enrollment or before the completion of 9 semester hours by part-time students. Examples of area of specialization options are listed below.

In addition to the area of specialization options listed below, students may develop individual area of specialization options which reflect their particular interests and professional objectives. For example, individual degree plans may be developed with emphasis in areas such as urban planning, volunteer management, transportation, and comparative and developmental administration.

Students are also encouraged to include in their degree plan appropriate, specialized courses and seminars offered by other departments and schools of the University. Every course and seminar included in each degree plan is a part of the student's major, i.e., public administration. There is no minor.

The options for area of specialization are:

GENERAL PUBLIC ADMINISTRATION OPTION

	<i>Semester Hours</i>
Core courses (P.Ad. 500, 504)	9
Required courses for this option	9
P.Ad. 505-3. Financial Administration and Policy Formulation	
P.Ad. 507-3. Human Resources Management	
Elective courses for this option	15
Three courses selected from the following:	
P.Ad. 510-3. Urban Administration	
P.Ad. 608-3. Organization Development	
P.Ad. 653-3. Public Policy Analysis and Evaluation	
P.Ad. 696-3. Seminar: Ethics and Professionalism in the Public Service	
P.Ad. 606-3. Public Management Communications System	

URBAN ADMINISTRATION OPTION

	<i>Semester Hours</i>
Core courses (P.Ad. 500, 502, 504)	9
Required courses for this option	12
P.Ad. 505-3. Financial Administration and Policy Formulation	
P.Ad. 507-3. Human Resources Management	
P.Ad. 510-3. Urban Administration	
U.A. 521-3. Politics of Urban Management	
Elective courses for this option	12
Additional courses are to be selected under advisement. The student may wish to choose courses which would provide a concentration in such areas as urban management, urban planning, or urban systems.	
Field study	3-6
P.Ad. 600. Field Study in Public Administration. (Required only of students who have not had appropriate experience.)	

HUMAN RESOURCES MANAGEMENT OPTION

Core courses (P.Ad. 500, 502, 504)	9
Required courses for this option	12
P.Ad. 505-3. Financial Administration and Policy Formulation	
P.Ad. 507-3. Human Resources Management	
P.Ad. 608-3. Organization Development	
P.Ad. 609-3. Group Dynamics	
Elective courses selected under advisement	12
The student may wish to choose courses which would provide a concentration in such areas as human resource management, labor-management relations, or organization development.	
Field study	3-6
P.Ad. 600. Field Study in Public Administration. (Required only of students who have not had appropriate experience.)	

POLICY ANALYSIS OPTION

Core courses (P.Ad. 500, 502, 504)	9
Required courses for this option	12
U.A. 500-3. Research Methods	
P.Ad. 503-3. Introduction to Quantitative Decision Models	
P.Ad. 505-3. Financial Administration and Policy Formulation	
U.A. 653-3. Public Policy Analysis and Evaluation	
One of the following:	
P.Ad. 622-3. Seminar: Public Processes and Priorities	
P.Ad. 623-3. Intergovernmental Fiscal Relationships ¹	
P.Ad. 631-3. Analysis of Environmental Policy	
Field study	3-6
P.Ad. 600-3. Field Study in Public Administration. (Required only of students who have not had appropriate experience.)	
Elective courses for this option	12
Additional courses are to be selected under advisement. Examples of such courses are statistics, computer science, mathematics for economists, economic theory, accounting, financial analysis, management science, independent research in the analysis of specific programs, and P.Ad. 603 or P.Ad. 613.	

FINANCIAL ADMINISTRATION OPTION

Core courses (P.Ad. 500, 502, 504)	9
Required courses for this option	12
P.Ad. 601-3. Administrative Analysis	
P.Ad. 505-3. Financial Administration and Policy Formulation	
P.Ad. 653-3. Public Policy Analysis and Evaluation	
Two of the following:	
P.Ad. 622-3. Seminar: Public Processes and Priorities	
P.Ad. 623-3. Intergovernmental Fiscal Relationships	
P.Ad. 624-3. Governmental Budgeting	
Elective courses for this option	9-12
Additional courses are to be selected under advisement. Examples of such courses include governmental accounting, public finance, economic theory and management science.	
Field study	3-6
P.Ad. 600. Field Study in Public Administration. (Required only of students who have not had administrative experience.)	

HEALTH CARE MANAGEMENT OPTION

(Some of these courses are offered only at the Medical Center)

Those interested in this option *must* consult with the assistant dean, Denver campus, prior to registering for courses.

Core courses (P.Ad. 500, 502, 504, 505, 507)	15
Required courses for this option (parts a and b)	
a. One or two of the following three courses:	3-6
P.Ad. 536-3. Intergovernmental Relations	
P.Ad. 601-3. Administrative Analysis	
P.Ad. 653-3. Public Policy Analysis and Evaluation	
b. Completion of the following sequence of four courses (offered only at the Medical Center)	10
H.A. 601-3. Medical Care Organization	
H.A. 620-2. Health Sciences	
H.A. 602-3. Health Economics	
H.A. 622-3. Health Planning I	

¹P.Ad. 536, Intergovernmental Relations, should be substituted when 623 is not offered.

- Elective courses for this option 2-3
 One of the following (offered only at the UC Medical Center.):
 H.A. 623-3. Health Planning II
 H.A. 624-3. Health Planning III
 H.A. 644-2. Legal Problems in Health Care Administration
 H.A. 670-3. Institutional Management
 H.A. 671-3. Institutional Management II

CITY MANAGEMENT OPTION

(Effective fall 1979)

The City Management Option is a two-year, 39-credit program developed by the GSPA and the Colorado City Managers' Association. Applicants interested in this option should include an essay on a municipal problem, which presents an analysis of the problem situation and potential solutions, with their request for admission.

Orientation

Field placement in a city manager's office, two to four weeks
 Program Orientation Workshop

First Year, Fall Semester 12

- P.Ad. 512-3. City Management
- P.Ad. 502-3. Statistics for Public Administrators
- P.Ad. 504-3. Organization Theory and Administrative Behavior
- P.Ad. 513-3. Municipal Services I

Intercession 3

- P.Ad. 521-3. Politics of Urban Management

First Year, Spring Semester 12

- P.Ad. 505-3. Financial Administration and Policy Formulation
- P.Ad. 507-3. Human Resource Management
- P.Ad. 601-3. Administrative Analysis
- P.Ad. 514-3. Municipal Services II

Assessment Center

Intensive evaluation to be scheduled after completion of the first year of course work.

Second Year 12

- P.Ad. 600-6. Field Study in Public Administration

Elective Courses for this option (6 credits)

- P.Ad. 536-3. Intergovernmental Relations
- P.Ad. 580-3. Labor Management Relations
- P.Ad. 608-3. Organization Development
- P.Ad. 611-3. Local Finance and Analysis
- P.Ad. 623-3. Intergovernmental Fiscal Relations
- P.Ad. 624-3. Governmental Budgeting
- P.Ad. 630-3. Environmental Management
- P.Ad. 650-3. Urban Information Systems
- P.Ad. 653-3. Public Policy Analysis and Evaluation
- ARCH. 520-3. Planning

Field Study Requirement

Students who have not had administrative experience are required to complete P.Ad. 600, Field Study in Public Administration. During the summer session the internship will consist of full-time positions in governmental agencies or in government-related agencies. During the fall and spring semesters the internship will consist of part-time positions in governmental agencies or in government-related organizations.

Limitations on Course Load

The normal course load for a full-time student is 12 semester hours. A student who is employed full-time may not carry more than 6 hours unless an excess load has been approved in advance by an associate or assistant dean. A student employed half-time is limited to a course load of 9 hours unless special authorization for an overload has been granted.

Courses in Other Disciplines

In addition to courses offered by the Graduate School of Public Affairs, students are encouraged to

include in their degree plans appropriate specialized courses and seminars offered by other departments and schools of the University. Examples of such courses are listed below.

Business

- Acct. 454-3. Accounting Systems and Data Processing
- Acct. 455-3. Problems in Systems Analysis
- Acct. 480-3. Accounting for Government and Non-Profit Organizations

Business Administration

- B.Ad. 610-3. Business, Government, and Society
- B.Ad. 620-3. Administrative Controls

Civil and Environmental Engineering (offered only at UCD)

- C.E. 562-3. Urban Transportation Planning
- C.E. 569-3. Urban Traffic Workshop

Communication

- C.T. 524-3. Seminar: Organizational Communication
- C.T. 606-3. Management Communication Systems (P.Ad. 606)

Computer Science

- C.S. 540-3. Computer Decision Modeling (M.Sc. 625)

Economics

- Econ. 601-3. Microeconomic Theory
- Econ. 602-3. Macroeconomic Theory
- Econ. 621-3. Seminar: Public Finance
- Econ. 622-3. Seminar in Fiscal Policy
- Econ. 625-3. Urban and Regional Economics Theory and Methods
- Econ. 691-3. Water Resources Development Management (C.E. 539)

Environmental Design (offered only at UCD)

- U.D. 540-3. Basic Ecology of Environmental Impact Statements (U.P.C.D. 540)
- U.P.C.D. 660-3. Social Factors in Urban Design
- U.P.C.D. 552-3. Legal Aspects of Planning
- U.P.C.D. 710-3. Urban Problems and Issues

Geography (offered only at UCD)

- Geog. 565-3. Location Analysis of Human Activities
- Geog. 601-3. Seminar: Regional Analysis and Planning

Management Science

- M.Sc. 635-3. Mathematical Programming

Political Science

- P.Sc. 539-3. Administrative Problems in Developing Countries

Psychology

- Psych. 440-3. Social Psychology

Real Estate

- R.Es. 401-3. Urban Land Analysis

Sociology

- Soc. 526-3. Seminar In Urban Sociology

Transportation Management

- Tr.Mg. 550-3. Transportation Operation and Management

CERTIFICATE IN PUBLIC ADMINISTRATION

General Information

A program of study leading to the award of the Certificate in Public Administration is offered to those

who seek a higher level of expertise, a new area of specialization or preparation for greater administrative responsibilities, or a combination of these objectives as they relate to the public service. As citizens' demands for more effective performance in the public service increase, men and women who avail themselves of professional education will be in a position to make major contributions to advancing the competence of government. This certificate program is designed to make available professional training with academic credit.

The Public Administration Certificate program, developed by the Graduate School of Public Affairs, consists of a sequence of courses for persons who desire to increase their knowledge of and skills in a number of managerial and/or specialized aspects of public employment. Initially, course work for the certificate will be grouped under one of the options listed below.

- Public management
- Urban affairs
- Human resource management
- Financial administration and program management
- Criminal justice administration

Additional options may be established as top government administrators indicate a need for education of public employees in other specialized areas.

Admission is open to persons who have completed two years of college and have had a minimum of two years of responsible experience in assignments involving research, analytical staff, or operational responsibilities; three years of college and one year of experience; or four years of college.

One year of responsible experience in assignments involving research, analytic staff, or operational responsibilities may be substituted for one year of college.

The certificate will be awarded upon the successful completion of 8 instructional units, an instructional unit being a course offered as a regular part of the certificate program or a comparable seminar, workshop, or course (of at least 40 contact hours) offered by another college or university or by a government agency as part of its advanced training program. Not more than two instructional units from non-University of Colorado sources may be counted toward successful completion of the certificate. The certificate candidate must have a coherent program of study leading to a specifically defined public service-oriented goal.

The candidate must complete the foundation courses listed below or their equivalent. The ad-

ditional four courses will be in the area of specialization. These specially designed upper division (400-numbered) credit courses are made available to candidates for the certificate through the Division of Continuing Education of the University of Colorado. Candidates register for these courses as special students.

Should a student desire to pursue a baccalaureate, the University of Colorado will accept a maximum of 12 semester hours of special student credits toward an undergraduate degree.

Foundation Requirements

- P.Ad. 400-3. The Practice of Public Management
- P.Ad. 401-3. Administrative Leadership
- P.Ad. 402-3. Administration of Financial Resources
- P.Ad. 403-3. Administration of Human Resources

Areas of Specialization

Students are to select one area in which to specialize. An additional four courses are required in the specialized area for completion of the certificate.

Human Resources Management Option

Choose any four of the following:

- P.Ad. 430-3. Labor Management Relations in the Public Sector I
- P.Ad. 431-3. Labor Management Relations in the Public Sector II
- P.Ad. 432-3. Current Issues in Public Personnel Management
- P.Ad. 433-3. Skills Development in Public Personnel Management
- P.Ad. 434-3. Training of Trainers

Financial Administration and Program Management Option

- P.Ad. 440-3. Fundamentals of Quantitative Methods
- P.Ad. 441-3. Elements of Governmental Accounting
- P.Ad. 442-3. Budgeting and Financial Administration
- P.Ad. 443-3. Program Management Techniques
- P.Ad. 444-2. Income Maintenance and Unemployment Insurance

Public Management Option

- P.Ad. 410-3. Decision Making in Public Organizations
- P.Ad. 411-3. Public Information and the Public Administrator
- P.Ad. 412-3. Administrative Analysis
- P.Ad. 414-3. Organization Development
- P.Ad. 416-3. Communication in Public Management

Urban Affairs Option

- P.Ad. 420-3. Fundamentals of Local Government Administration
- P.Ad. 421-3. Contemporary Urban Problems
- P.Ad. 422-3. Urban Political Economy
- P.Ad. 423-3. Modernization of Urban Government

Criminal Justice Administration Option

- P.Ad. 450-3. Executive Development for the Criminal Justice System
- P.Ad. 451-3. Criminal Justice Policy: Assessment and Evaluation
- P.Ad. 452-3. Criminal Justice Information Systems
- P.Ad. 453-3. Contemporary Legal Aspects of Criminal Justice Administration

Reserve Officer Training Corps Programs

AIR FORCE AEROSPACE STUDIES

U.S. Air Force ROTC offers two programs leading to commission in the U.S. Air Force upon receipt of the baccalaureate degree. Graduate students may be commissioned upon the completion of 12 hours of the Professional Officer Course and a six-week summer training program.

Standard Four-Year Course. This program is in three parts: the General Military Course for lower division (freshman and sophomore) students, the Professional Officer Course for upper division students, and Corps Training (attended by all students). Completion of the General Military Course is a prerequisite for entry into the Professional Officer Course. Completion of a four-week Summer Training Course is required prior to commissioning.

Modified Two-Year Program. This program is offered to full-time, regularly enrolled degree students at both undergraduate and graduate levels who will have two years remaining at the University of Colorado at Boulder when they enroll. Selection is on a competitive basis. Applicants should apply directly to the Professor of Aerospace Studies not later than March 15 of the spring semester immediately preceding the academic year in which they desire to enroll in the program. Those selected for this program must complete a six-week field training program during the summer months as a prerequisite for entry into the Professional Officer Course the following fall or spring semester.

Flight Training. Expense-paid ground school and flight training are open to cadets approved and qualified for future USAF pilot training.

Air Force College Scholarship Program. Students participating in Air Force ROTC may be eligible to compete for Air Force ROTC College Scholarships. Students selected for this program are placed on grants that pay tuition, book costs, nonrefundable educational fees, and subsistence of \$100 per month, tax free. All cadets enrolled in the Professional Officer Course receive \$100 per month subsistence during the regular academic year. Students are also eligible to compete for two-, three-, or four-year scholarships open to both men and women.

AFROTC credit for graduation varies with each college. Students should contact the appropriate college or the professor of aerospace studies for determination of credit.

MILITARY SCIENCE (U.S. ARMY)

The curriculum is unified by the subject-matter areas of leadership and management. It cuts across conventional and/or traditional subject boundaries and involved elements of various disciplines with the intent to encourage the students to interrelate their learning experience and apply their knowledge in reflective thinking, goal seeking, problem solving and the decision-making process. In addition, within each year group, the following subjects are offered and as appropriate, enriched by civilian and/or military academicians in the form of guest speakers and seminars. The following subjects must be taken by scholarship students prior to completion of the four-year ROTC program. The enrichment subjects are recommended for nonscholarship students.

Engl. 100. Exposition I

Hist. 480. American Military History or acceptable equivalent

1. *Basic Course.* To be taken during the freshman and sophomore years. The Basic Course is designed to provide a broad educational base which can be used in both civilian and military environments, and to develop a general background in organizational behavior, the interaction of human relations, decision theory, and leadership and management. The course will also familiarize the student with the origins and traditions of the U.S. military services.

2. *Advanced Course.* To be taken during the junior and senior years. The Advanced Course is limited to those who have demonstrated outstanding qualities as good students and potential Army officers. All students, both scholarship and nonscholarship, who are enrolled in the Advanced Course receive \$100 per month during the fall and spring semesters. The course is designed to give an extensive exposure to small unit tactics and operations, U.S. military history, and the historical development of defense planning and national security organization.

Scholarships

The purpose of the Army ROTC Scholarship Program is to provide financial assistance to quality young men and women who are motivated toward an Army career. The scholarship provides tuition, books, laboratory fees, and a monthly subsistence allowance of \$100 for each month of the fall and spring

semesters. Over a four-year period, this could represent assistance in excess of \$12,000.

1. *Four-Year Scholarships.* As high school seniors, students may compete for four-year scholarships. Those interested must take the ACT or SAT not later than the December test dates of the senior year, and must apply for the scholarship not later than December 15. Students can initiate the scholarship procedures by contacting their college counselors, or by writing the Professor of Military Science, University of Colorado, Boulder, Colorado 80309.

2. *Three-Year Scholarships.* After enrollment as a freshman, the student may compete for a three-year ROTC scholarship. This scholarship will commence during the sophomore year and the student will receive the full benefits of a scholarship student. Apply at the Army ROTC office.

3. *Two- and One-Year Scholarships.* For students in ROTC, one- and two-year scholarships are available. Apply at the Army ROTC office.

Leadership Practicum

All ROTC students must participate in a leadership practicum consisting of two dismounted drill periods and several minicourses. Students must select two minicourses each semester to develop their skills in such areas as downhill and cross-country skiing, rappelling, physical conditioning, camping and mountain survival, and rifle marksmanship and safety.

Summer Program

Freshmen or sophomores interested in Army ROTC but unable to schedule the courses because of academic workload or other irreconcilable conflicts may contact the professor of military science concerning summer program alternatives. Juniors, too, may inquire concerning special program options to qualify them for entry into the Advanced AROTC Program.

ROTC Course Credit

The allowable course credit varies by colleges and schools from 6 to 18 credit hours for fulfillment of the requirements for a degree. To ascertain the distribution of credit for your particular degree program, consult the Military Science Program office.

Cross-Enrollment Program

Students from Metropolitan State College, Colorado Women's College, University of Colorado at Denver, and Colorado Community College may enroll in the Army ROTC program as offered by this University. For details, contact any Army ROTC faculty member.

NAVAL SCIENCE

All naval science students enroll in N.S. 101, 102, 201, and 202. Those desiring commissions in the U.S. Navy enroll in N.S. 301, 302, 401, and 402 for upper division work. Those desiring commissions in the U.S. Marine Corps enroll in N.S. 307, 308, 407, and 402 for upper division work.

NROTC offers two-year and four-year scholarship programs, and two-year and four-year college (nonscholarship) programs. Navy scholarships may be earned while the student is enrolled in the college program. Scholarship students receive tuition and fees, books, and a \$100 per month subsistence allowance. College program students receive a \$100 per month subsistence allowance during their last two years in the program.

Naval science scholarship students must complete course work in calculus, physics, computer science, American military affairs, and national security policy. Students should check with their naval science instructor to determine specific course offerings which fulfill the above requirements.

The number of semester hours of credit for NROTC courses toward fulfillment of the requirements for a degree is a matter for determination by the individual colleges. Students should therefore determine their college's policy when formulating their degree plan.

Men and women students interested in other programs leading to commissions in either the U.S. Navy or U.S. Marine Corps are encouraged to contact the NROTC Unit on campus. Opportunities for commissioned service are available in surface, subsurface, aviation, and supply specialties in the U.S. Navy. Opportunities in ground and aviation specialties are available in the U.S. Marine Corps. All commissioned opportunities require that the student be working toward, and receive, a college degree.

Course Descriptions

Following are descriptions of courses offered in the colleges and schools on the Boulder Campus. For degree requirements, students should refer to the departmental listing in the appropriate college or school information section of this catalog.

For information on scheduling of classes, students should consult the *Schedule of Courses* issued at the beginning of each semester.

Courses numbered from 100 to 299 are intended for lower division students and those from 300 to 499 for upper division students. Courses numbered from 500 to 599 are primarily for graduate students but in some

cases may be open to qualified undergraduates. Courses at the 600, 700, and 800 level are open only to graduate students.

The value of each course in semester hour credits is carried as part of the identifying course prefix and department number. For example, in Anth. 103-3, "Anth. 103" is the identifying department number and "-3" indicates semester hours of credit. Abbreviations used in the course descriptions are as follows:

Coreq. — Corequisite	Prer. — Prerequisite
Lab. — Laboratory	Rec. — Recitation
Lect. — Lecture	Wk. — Week

College of Arts and Sciences

ANTHROPOLOGY

Anth. 103-3. Principles of Anthropology I.¹ Evolution of man and his culture from their beginnings through the early metal ages. The course covers human evolution, race, prehistory, and the rise of early civilizations.

Anth. 104-3. Principles of Anthropology II.¹ Survey of the world's major culture areas; culture and its major components, such as subsistence, social organization, religion, and language.

Anth. 201-4. Introduction to Physical Anthropology I.¹ Detailed consideration of human biology, man's place in the animal kingdom, and fossil evidence bearing on human evolution. Laboratory work emphasizes osteology.

Anth. 202-4. Introduction to Physical Anthropology II. Continuation of Anth. 201. Quantitative analysis, genetics, and race are emphasized. Laboratory work consists of problems in quantitative analysis, serological procedures, pedigree analysis, and general problems in human genetics.

Anth. 220-3. Introduction to Archaeology. History, basic concepts, techniques, and theoretical construction of archaeological field and laboratory investigations.

Anth. 221-2. Laboratory Course in Archaeological Methods. Study of analytical methods in archaeological research including those employed both in the field and in the laboratory. Instruction will deal with practical exercises illustrating many of the theoretical principles covered in Anth. 220. Prer. or coreq., Anth. 220.

Anth. 222-3. The Neolithic Revolution. Analysis of the cultural processes involved with man's adjustment to an agricultural-based lifeway in both the Old and New Worlds, and the importance in terms of the subsequent growth of modern societies.

Anth. 223-3. Man in the Pleistocene. Review of evidence pertaining to man's early cultural development. Specific concerns are the interaction of man's physical evolution with the development of culture and man's interaction with his environment.

Anth. 224-3. Urban Revolution. The archaeological evidence available and the theories and methods by which urban civilizations arose in the Old and New Worlds.

Anth. 226-3. Old World Archaeology. Prehistory and protohistory of Eurasia and Africa, emphasizes growth of culture and spread of civilization.

Anth. 227-3. New World Archaeology. Prehistory of North, Middle, and South America, emphasizing peopling of the New World, earliest American Indian cultures, and later regional developments.

Anth. 230-3. America: An Anthropological Perspective. Historical and contemporary aspects of American life are considered from an anthropological perspective including such topics as slavery, immigrants to the United States, the development of cities, American popular culture, and American character.

Anth. 240-3. Introduction to Ethnology. Introduction to the basic concepts and approaches used in the study of peoples and societies.

Anth. 241-3. Comparative Arts and Crafts.

Anth. 244-3. Anthropology of Race Relations.¹ A consideration of the cultural patterns governing the relationships among subgroups in societies in general, especially as these principles relate to the relationship between Negroes and whites in America. Urban settings will be emphasized.

Anth. 280-3. Nature of Language. Survey of the languages of the world. Study of theories of the origin of language, its relationship to other forms of communication, and to systems of writing.

Anth. 300-3. Primate Behavior. Survey of naturalistic primate behavior. Social behavior, behavioral ecology, and evolution emphasized as they lead to an understanding of human behavior.

Anth. 301-3. Man and Culture. Deals with the implications of basic anthropological knowledge and understanding as these apply to contemporary problems confronting mankind.

Anth. 330-3. Elements of Religion. The universal components of religion, as inferred from religions of the world, primitive and civilized.

Anth. 335-3. Ethnographic Writing. Lect. and individual instruction and practice in social science expository writing.

Anth. 340-3. Peoples and Cultures of the World I. Presentation of the major varieties of the world's recent or existing cultural systems, area by area, with their interrelationships and culture-historical backgrounds, and an assessment of their current status.

Anth. 341-3. Peoples and Cultures of the World II. Continuation of Anth. 340.

Anth. 342-3. Peoples of Latin America. The diversity of Latin American cultures: (1) tribal, primitive, or relatively unacculturated peoples; (2) agrarian-rural peoples along a spectrum

¹Also available through correspondence study.

from "traditional" to rural proletarianism; (3) and peoples of complex societies, urban settings, squatter settlements, ghettos, and slums.

Anth. 390-3. Seminar: Physical Anthropology. Intended to offer the student an opportunity to probe more deeply the topics presented in Anth. 201-202. Prer., Anth. 201-202 or equivalent, and consent of instructor.

Anth. 391-3. Seminar: Archaeology. Designed to develop a student's knowledge of theoretical and methodological advances in anthropological archaeology. Prer., Anth. 220 or equivalent, and consent of instructor.

Anth. 399-3. Undergraduate Seminar: Anthropology. Directed investigation of a specific topic of current importance. The topic may be within the subfields of physical anthropology, archaeology, cultural anthropology, or anthropological linguistics. Prearranged topics will be announced each semester. Prer., consent of instructor.

Anth. 401/501-1 to 3. Teaching Anthropology. Practicum by special arrangement only in which students learn to teach anthropology by serving as recitation leaders or tutors in introductory courses or as small group leaders in advanced courses. Prer., consent of instructor.

Anth. 403/503-3. Primate Anatomy. Anatomical correlates of the primate pattern will be investigated through lecture and laboratory dissection of nonhuman primates.

Anth. 404/504-3. Primate Neuroanatomy. Comparative anatomy of the central nervous system in vertebrates, with special emphasis on primates and man. The evolution of the nervous system in relation to function and behavior.

Anth. 405/505-3. Quantitative Methods in Anthropology. A survey of the ways of deriving meaning from anthropological data by numerical means; including, but not confined to, basic statistical procedures. Prer., Anth. 201-202 or equivalent.

Anth. 406/506-3. Nutrition and Anthropology. Dietary differences cause phenotypic differences among and within human populations. Evidence bearing on such differences among contemporary human populations as well as prehistoric populations constitutes the context of this course.

Anth. 407/507-3. Nonverbal Communication. An examination of nonverbal signals which convey information and are believed to be part of the total communication system in human cultures. Biological signals compared with nonhuman primate behavior, culturally derived signals related to cultural variation and evolution.

Anth. 410/510-3. Human Races. The biological variability of man as shown in geographic races and individual differences; the ways in which races may be formed, maintained, and mixed; survey of the living peoples of the world.

Anth. 411/511-3. Human Paleontology. A detailed consideration of the fossil evidence for human evolution. Subjects covered are a history of discovery of important fossils and interpretations, descriptive information about the fossils, and data and theory from Pleistocene studies relating to ecology.

Anth. 412/512-3. Advanced Physical Anthropology. An introduction to population genetics and its application to understanding problems of process in human evolution and the formation of races in man.

Anth. 415/515-3. Human Ecology. A study of demographic and ecological variables as they relate to man. Aspects of natural selection, overpopulation, and environmental deterioration will be considered.

Anth. 416/516-3. Human Ecology II. A descriptive and analytical study of change in demographic and ecological variables within one or more specific cultures undergoing rapid assimilation. Aspects of breeding isolates, population structures, settlement patterns, and family and community institutions will be compared.

Anth. 420/520-3. North American Archaeology. Prehistoric and protohistoric cultures and areas of North America, excluding the American Southwest.

Anth. 421/521-3. Southwestern Archaeology. Prehistoric cultures of the American Southwest, their origins, characteristics, and relationships.

Anth. 422/522-3. Archaeology of Mexico and Central America. Prehistoric and protohistoric cultures and areas of Mexico and Central America, including the Aztecs and Mayas.

Anth. 423/523-3. Settlement Archaeology. Study of the manner in which primitive man adapts his residence to the physical environment and his social needs. Consideration of prehistoric settlement data as well as inferences to be derived — population, community organization, architecture, and land use.

Anth. 424/524-3. Archaeology of South America. Prehistoric and protohistoric cultures of South America, their origins, characteristics, and relationships, including the high civilization of the Andean area.

Anth. 425/525-3. Archaeology of Africa. Study of the archaeology of Africa from its beginning to A.D. 1000, emphasizing the growth of cultures and regional relationships.

Anth. 426/526-3. Biblical Archaeology. (General Classics 426/526.) Old Testament history in the light of archaeological investigation; the Old Testament in the framework of the literature of the ancient Near East.

Anth. 427/527-3. Pre-Classical Art and Archaeology. (General Classics 427/527, F.A. Hist. 427/527.) See General Classics 427/527.

Anth. 428/528-3. Classical Art and Archaeology. (General Classics 428/528, F.A. Hist. 428/528.) See General Classics 428/528.

Anth. 430/530-3. Cultural Evolution. Review of various theories explaining the evolution of culture with particular attention to the Neolithic and Urban Revolutions.

Anth. 431/531-3. Archaeology of Ancient Near East. Emphasis is placed on the similarity and differences between the archaeological material of the nations of the Middle East and the archaeological influences which were exchanged between such nations.

Anth. 432/532-3. Archaeology of Ancient Egypt. (General Classics 425/525.) The archaeology of Ancient Egypt in the light of recent excavations; the link between the history and archaeology of the nations of the Bible in the North, and Egypt, Nubia, Ethiopia, and Yemen in the South.

Anth. 433/533-3. Environmental Archaeology. A survey of the method of culture ecology as it can be applied to archaeological investigations.

Anth. 434/534-3. Archaeological Method and Theory. A review of the methods of culture theories employed in investigating and explaining the archaeological record.

Anth. 435-2 to 6. Archaeological Field and Laboratory Research. *Summer session only.* Students will participate in archaeological field research and conduct laboratory analysis of archaeological materials and data. Open only to University of Colorado anthropology majors. Prer., consent of instructor.

Anth. 441/541-3. Ethnoliterature. Forms, themes, treatments, and cultural context of oral literature in primitive culture.

Anth. 442/542-3. Ethnomusicology. A world survey of music in primitive and exotic cultures, including consideration of problems of ethnomusicology, with emphasis on anthropological rather than musicological elements.

Anth. 443/543-3. Economic Anthropology. Description of economic forms and how they articulate with other social institutions.

Anth. 444/544-3. Urban Anthropology. A comparative study of urban life.

Anth. 445/545-3. Comparative Religious Systems. Comparative study of religious beliefs and practices of nonliterate peoples of the world.

Anth. 449/549-3. Peasant Societies and Revolutions. Begins with a discussion of the social, economic, and political problems faced by peasant societies, and how these problems are viewed by anthropologists. Moves to analysis of revolution and to the role of anthropology in the study of political violence.

Anth. 451/551-3. Applied Cultural Anthropology. Analysis of problems of cultural change due to contacts between people of different cultures.

Anth. 452-3. Senior Seminar: Cultural Theory. Analyzes theoretical issues and controversies in anthropology since World War II, stressing reading and small group discussion of primary materials. Prer., anthropology major, senior status, consent of instructor.

Anth. 453/553-3. History of Anthropology. History of the growth of anthropology from the earliest times, various schools of thought, outstanding contributors and their works, to the mid-20th century.

Anth. 454/554-3. Culture and Personality. Sociocultural factors in personality development, with emphasis on both modal structure and the range of deviation from such modes. Survey of the literature in the field and analysis of selected case materials.

Anth. 455/555-3. Culture Dynamics. Culture change with emphasis on the role of individual motivation in promoting or inhibiting such change. Survey of the literature and analysis of selected case material, including problems of directed change.

Anth. 456/556-3. American Indian Acculturation. Domination of Indian areas and cultures by Europeans and resulting modification of Indian cultures.

Anth. 457/557-3. Social Inequality and Cultural Progress. Analyzes the causes of inequality, poverty, and discrimination in contemporary societies. Discusses whether inequality and social stratification are necessary for cultural progress. Advances and evaluates alternative solutions including radical capitalism, utopian communism, and behavior modification.

Anth. 458/558-3. Power: the Anthropology of Politics. Covers the nature and distribution of power in state and stateless societies, the evolution of political stratification, the political economy of colonialism, and selected aspects of power in modern society.

Anth. 459/559-3. Social Organization. Description of mechanisms of integration in social organization and their roles in the development of societies.

Anth. 460/560-3. Ethnographic Fieldwork: Theory and Method. Considers the development of fieldwork as *sine qua non* in anthropological research, case studies of anthropologists in the field, and research design and logistical planning leading to study in the field. Prer., Anthro. 103 and 104.

World Ethnography (Anth. 461/561-477/577)

Each course listed below will cover the major problems of cultural anthropological interest relating to the peoples and cultural systems within the areas indicated. Following a survey of the geographical background and of relevant data on the physical anthropology and language affiliations of the inhabitants, the culture-history of the area will be reviewed. The ways of life of the indigenous populations, their relations with each other and to other peoples, and effects of culture change in recent centuries will be discussed.

Anth. 461/561-3. Africa: Peoples and Societies in Change.

Anth. 462/562-3. Ethnography of the American Southwest.

Anth. 463/563-3. Ethnography of Mexico and Central America.

Anth. 464/564-3. Ethnography of North America.

Anth. 465/565-3. Ethnography of Europe.

Anth. 466/566-3. Ethnography of the Plains Indians.

Anth. 469/569-3. Cross-Cultural Aspects of Socioeconomic Development. Examines the goals of international agencies which support development in underdeveloped countries. Anthropological perspective is provided for such issues as urban planning, health care and delivery, population control, rural development, and land reform.

Anth. 467/567-3. Ethnography of South America.

Anth. 470/570-3. Ethnography of China, Japan, and Korea.

Anth. 473/573-3. Ethnography of Northern and Central Eurasia.

Anth. 475/575-3. Ethnography of Oceania.

Anth. 476/576-3. Ethnography of Southeast Asia and Indonesia.

Anth. 477/577-3. Ethnography of Australia.

Anth. 480/580-3. Anthropological Linguistics. Methods and results of scientific analysis of languages of nonliterate peoples.

Anth. 481/581-3. Language and Culture. Relationship of language to human behavior; the typological classification of languages; the study of linguistic universals, and the evolutionary implications of such studies. Prer., Anth. 480 or consent of instructor.

Anth. 483/583-3. Egyptian Hieroglyphics I. (General Classics 483/583.) A study of the culture of the ancient Middle East to shed

light on the history of its languages. Reading and translating hieroglyphics into modern languages.

Anth. 484/584-2. Egyptian Hieroglyphics II. (General Classics 484/584.) Reading and translating hieroglyphics into modern languages.

Anth. 485/585-2. Hieratic, Demotic, and Coptic. (General Classics 485/585.) Study of these three languages of Ancient Egypt in different periods of history to aid in understanding the culture of the area, its history, and its archaeology.

Anth. 487/587-3. Semitic Studies and Inscriptions. A study of the Semitic languages of the Ancient Middle East from their original sources: the papyri, inscriptions, and different texts.

Anth. 488/588-3. Etruscan Art and Archaeology. (General Classics 431/531, F.A. Hist. 431/531.)

Anth. 489/589-3. Roman Art and Archaeology. (General Classics 432/532, F.A. Hist. 432/532.)

Anth. 491-2. Departmental Honors in Anthropology. The course work is built around a theme of research design as a means of integrating previous training in the field of anthropology as well as providing an opportunity to perform creative scientific investigations.

Anth. 492-2. Departmental Honors in Anthropology. Continuation of Anth. 491.

Anth. 497/597-3. Pre-Columbian Art. (F.A.Hist. 471/571.) See Fine Arts 471/571.

Anth. 498/598-3 to 6. Archaeological Ruins Stabilization. Practical and administrative aspects of ruins stabilization. Includes "on-the-job" training in this speciality and review of the policies and legal bases which govern ruins stabilization. Prer., consent of instructor.

Anth. 499-variable credit. Independent Study. Hours and credit to be arranged. Consent of instructor is required.

Anth. 508-3. Anthropological Genetics. A consideration of the data and theory of human genetics. Emphasis will be placed upon analytical techniques relating to a genetic analysis of the individual, family, and populations.

Anth. 509-3. Gross Anatomy. Lectures on the gross anatomy of the human species and laboratory dissection of human cadavers.

Anth. 513-3. Advanced Osteology. Detailed study of the human skeleton with special attention to health and demographic conditions in prehistoric cultures and the evaluation of physical characteristics and genetic relationships of prehistoric populations. Prer., Anth. 201 and 202.

Anth. 514-3. Primatology. Survey of the Primate order, including considerations of evolution, morphology, and behavior. Particular emphasis is given to developing perspectives about the origin and evolution of man in the context of the Primate Order.

Anth. 519-3. Conservation Archaeology. Philosophy and legislation involved with conservation (contract) archaeology. Contract negotiations and budgetary involvements of government agencies and university. Analysis of environmental impact statements for archaeological projects.

Anth. 536-2 to 6. Anthropological Field Work. Summer Session. Students will assist in the supervision of archaeological field research and conduct laboratory analysis of archaeological materials and data. Open only to University of Colorado advanced anthropology students enrolled in a regular degree program.

Anth. 537-3. Topics in Roman and Etruscan Art and Archaeology. (General Classics 548, F.A. Hist. 548.) Consideration of various aspects of Roman and/or Etruscan art and archaeology. Topics to be explored may vary and will be announced in advance.

Anth. 538-3. Archaeology of Nubia, Ethiopia, and Southern Arabia. Recent excavations and discoveries provide a fresh study of the Biblical world, ancient Egypt, and Judaism, Christianity, and Islam.

Anth. 539-3. Research Methods in Archaeology I. Methods and theory of archaeology, emphasizing the interpretation of materials and data and the relationships of archaeology to other disciplines.

Anth. 540-3. Research Methods in Archaeology II. Focuses on the design of research, preparation of research proposals, scientific illustration and publication, editing, and research administration. Planned as a companion to Anth. 539, a lab. course in artifactual analysis. Prer., Anth. 539.

Anth. 547-3. Ethnohistory. The use of documents and other external sources in the reconstruction of culture history.

Anth. 568-3. Band and Tribal Cultures of Aboriginal North America. Exploration of the social, technoeconomic, and ecological patterns of ethnographic North America. Emphasizes interdisciplinary approaches in order to explore archaeological, linguistic, physical anthropology, and ethnographic convergences in the study of band and tribal cultures.

Anth. 578-3. The Anthropology of Language Acquisition. Consideration of various cultural and psycholinguistic factors that may determine group behavior or personality.

Anth. 579-3. American Indian Languages. A detailed consideration of the classification and genetic problems and subsequent diffusional and historical changes of the native languages of North America and South America.

Anth. 586-3. Biocultural Foundations of Language. An investigation of species-specific language behavior as it relates to the hominoid fossil record, primate communication, and physiology. Evidence will be drawn from archaeological data and from cultural anthropology.

Anth. 591-3. Advanced Palynology. (EPOB 591, Geog. 537.) Lect. and lab. Advanced Quaternary palynological instruction in seminars and lab. sessions, with emphasis on individual student project field work, lab. work, and microscopy.

Anth. 592-3. Hellenistic Art and Archaeology. (General Classics 515, F.A. Hist. 515.) Topics of emphasis are architecture, domestic decoration, sculpture, terra-cottas, jewelry, and coins of the period following the death of Alexander the Great until the Roman conquest of Greece. Prer., Anth. 428 or consent of instructor.

Anth. 593-3. Classical Greek Art. (General Classics 521, F.A. Hist. 508.) Seminar in Greek art. Topics to be selected from the following: architecture, vase painting, sculpture. Prer., Anth. 428 or consent of instructor.

Anth. 594-3. Archaic Greek Art. (General Classics 523, F.A. Hist. 509.) Prer., Anth. 428 or consent of instructor.

Anth. 595-3. Prehistoric Greek Art and Archaeology. (General Classics 524, F.A. Hist. 510.) Examination of Neolithic, Cycladic, Minoan, and Mycenaean periods. Prer., Anth. 427 or consent of instructor.

Anth. 599-variable credit. Guided Study. Directed individual research based on a specific area of specialization. Hours and credit to be arranged. Consent of instructor is required.

Anth. 600-3. Seminar: Current Research Topics.

Anth. 601-3. Seminar: Ethnological Theory.

Anth. 602-3. Seminar: Physical Anthropology.

Anth. 603-3. Seminar: Archaeology.

Anth. 604-3. Seminar: Anthropological Linguistics.

Anth. 606-3. Seminar: Applied Anthropology.

Anth. 607-3. Seminar: Religion.

Anth. 608-3. Seminar: Ethnography of Selected Areas.

Anth. 609-3. Seminar: Social Anthropology.

Anth. 610-3. Seminar: Cultural Change. An inquiry into current research topics in urbanization, industrialization, modernization, and change among selected primitive, peasant, and modern urban populations. Specific topics and geographical areas to be selected each semester.

Anth. 611-3. Seminar: Culture and Personality. An inquiry into current research topics in the cross-cultural study of socialization, motivation, learning, personality, perception, cognition, and values. Specific topics and geographic areas will be selected each semester.

Anth. 613-3. Interdisciplinary Seminar. A consideration of interdisciplinary problems that involve anthropology and related fields such as history, the behavioral disciplines, and the natural sciences.

Anth. 614-3. Seminar: Archaeology of Selected Areas. (General Classics 614.) Consideration of the archaeology of a specified area, either geographical or topical. Areas to be selected in terms of current research interests.

Anth. 615-3. Seminar: Physical Anthropology of Selected Areas. A detailed consideration of the morphological and genetic range of variability of major continental divisions of mankind.

Anth. 630. Seminar: Research Methods in Cultural Anthropology. Hours and credit to be arranged.

Anth. 650-3. Contemporary Ethnological Theory. Discussion of the nature of theory together with a review of various 20th century theoretical positions and their contributions. An inquiry into modern theoretical models including game theory, general systems theory, and information theory is included.

Anth. 651-3. Research Techniques in Cultural Anthropology. An introduction to the method of controlled comparison as a research design and to the construction of experiments based on its use. A review of the history of the comparative method and a survey of research techniques are included.

Anth. 652-3. Research Methods in Physical Anthropology. A survey of methods and procedures for obtaining and interpreting data in physical anthropology, with practice in selected techniques.

Anth. 699. Independent Research. Hours and credit to be arranged.

Anth. 700-4 to 6. Master's Thesis.

Anth. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

ARTS AND SCIENCES

College Expository Writing Program

A.S. 099-3 (add-on credit). Basic Writing. A review of fundamental grammar and compositional skills. This is a controlled enrollment course which is open only to specially required freshmen. Students who have been notified by mail or who have the course marked on their advisement cards must satisfy the A.S. 099 requirement before enrolling in any other expository writing course.

A.S. 100-3. Beginning Expository Writing—General. Analysis of the essential techniques of exposition and argumentation through practical criticism of student writing and model essays.

A.S. 101-3. Beginning Expository Writing—Humanities. Analysis of the essential techniques of exposition and argumentation through practical criticism of student writing and model essays, with an emphasis on readings and topics in the humanities.

A.S. 102-3. Beginning Expository Writing—Social Sciences. Analysis of the essential techniques of exposition and argumentation through practical criticism of student writing and model essays, with an emphasis on readings and topics in the social sciences.

A.S. 103-3. Beginning Expository Writing—Natural Sciences. Analysis of the essential techniques of exposition and argumentation through practical criticism of student writing and model essays, with an emphasis on readings and topics in the natural sciences.

A.S. 110-3. Intermediate Expository Writing. Continuation of beginning expository writing, with an emphasis on complex forms of exposition. One objective of the course is to train students to research, organize, and compose a lengthy term paper. Prer., A.S. 100, 101, 102, 103, or Engl. 100.

Innovative Education

A.S. 311-2. Practicum: French.

A.S. 312-2. Practicum: French.

A.S. 313-2. Practicum: German.

A.S. 314-2. Practicum: German.

A.S. 315-2. Practicum: Spanish.

A.S. 316-2. Practicum: Spanish.

A.S. 450-1 to 6. Senior Thesis for Individually Structured Major.

Other Courses

A.S. 198-no credit. Preparation for a Career in the Health Professions. A noncredit introduction to careers in the health sciences (medicine, nursing, dentistry, dental hygiene, medical technology, physician's assistant, etc.) designed to provide the basic advice, both academic and vocational, needed by students preparing for a career in the health sciences.

A.S. 490-1 to 6. Investigation Paper.

ASTRO-GEOPHYSICS

A.G. 111-3. General Astronomy. (Phys. 105.) Principles of modern astronomy for non-science majors, summarizing our present knowledge about the earth, moon, planets, the sun, and the origin

of life. In both A.G. 111 and A.G. 112, (which can be taken in either order) emphasis is placed on how our knowledge is obtained, on concepts rather than details, and what problems remain to be solved. In both courses there is considerable use of the Fiske Planetarium, but only limited use of telescopes. Those students desiring more extensive laboratory and observing experience should also register for A.G. 121, or A.G. 122.

A.G. 112-3. General Astronomy. (Phys. 106.) Principles of modern astronomy for non-science majors summarizing our present knowledge about the sun, stars, birth and death of stars, galaxies, and the structure and origins of the universe. A.G. 111 and A.G. 112 can be taken in either order.

A.G. 121-1. General Astronomy Laboratory. (Phys. 125.) Optional lab. for A.G. 111, centered around the solar laboratory but involving other telescope, laboratory, and planetarium experience, emphasizing the solar system. One three-hour period per week.

A.G. 122-1. General Astronomy Laboratory. (Phys. 126.) Optional lab. for A.G. 112 involving observatory, planetarium, and laboratory experience, emphasizing sun, stars, and galaxies. One scheduled hour per week plus additional day- and night-time hours to be arranged.

A.G. 113-3. The Planet Earth. *Fall.* The earth as a planet in the solar system; its rotation, shape, origin, and evolution; internal structure; continental drift plate tectonics.

A.G. 114-3. The Planet Earth. *Spring.* Continuation of A.G. 113. Composition and structure of the atmosphere and oceans. Ocean current systems, waves, and tides. Air-sea interaction. Weather systems and storms. Man's impact on the oceans and atmospheres.

A.G. 115-1. Laboratory—The Planet Earth. *Fall.* Optional lab. covering experiments related to the subject matter of A.G. 113. Coreq., A.G. 113.

A.G. 116-1. Laboratory — The Planet Earth. *Spring.* Optional lab. covering experiments related to the subject matter of A.G. 114. Coreq., A.G. 114.

A.G. 320-3. Topics in Meteorology. (Geog. 320.) *Fall, Spring.* Designed as a supplement to A.G. 113/114 or Geog. 100. Emphasizes developments of topical interest in meteorology. Topics vary from year to year and may include some of the following: weather map analysis and prediction, climatic change, air pollution, weather modification, and severe storms. Non-mathematical, but knowledge of meteorology at the level of A.G. 114 or Geog. 100 will be assumed.

A.G. 321-3. Topics in Modern Astronomy. (Phys. 361.) Designed as a supplement to A.G. 111/112. Emphasizes modern developments in astronomy. Topics change from year to year and may include some of the following: nature and evolution of the sun, stellar evolution, quasars and exploding galaxies; cosmology; life in the universe; origin and nature of the planets; space science; pulsars and black holes. Nonmathematical, but knowledge of astronomy at the level of A.G. 111/112 will be assumed.

A.G. 350, 351, 352-variable credit. Special Topics in Astro-Geophysics. Special topics intended to acquaint undergraduate students with research in astro-geophysics and to teach certain courses of current interest on an irregular basis.

A.G. 391-3. The Earth's Atmosphere and Oceans. (Phys. 365.) *Fall.* The physical structure and processes occurring in the atmosphere and oceans. Radiation and cloud physics. Atmospheric winds and ocean currents. The general circulation. Gulf and jet streams. The formation of severe storms. Prer., general physics and calculus.

A.G. 392-3. Planetary Physics. (Phys. 366.) *Spring.* The evolution of the solar system and formation of the inner and outer planets. The evolution of planetary atmospheres. Results from planetary exploration with space probes. Comparative planetology. Prer., general physics and calculus.

A.G. 393-3. Astrophysics. (Phys. 367.) *Fall.* The physical characteristics of interplanetary material, the sun, other stars, interstellar matter, and galaxies. Physical processes considered include the behavior of ions and electrons in the magnetic fields of the earth and the sun, origin and propagation of the various radiations in space, generation of energy and chemical elements in stars, and cosmic electro-dynamical processes. Prer., general physics and calculus.

A.G. 394-3. Cosmology and Relativity. *Spring.* Special and general relativity as applied to astrophysics, cosmological models, observational cosmology, experimental relativity, the early universe. Prer., general physics and calculus.

A.G. 440-3. Introduction to Controlled Fusion. Overview of research in controlled thermonuclear fusion for peaceful power uses; world energy problems reviewed; fusion compared to other energy sources; elementary plasma physics relevant to fusion reactor concepts; confinement schemes (toroidal devices, magnetic mirrors, magnetic pinches, laser-plasma systems); nuclear reactions; Lawson criterion for demonstration of reactor feasibility; minimum B heating methods. Prer., Phys. 321, 332 or consent of instructor.

A.G. 499-variable credit. Independent Study in Astro-Geophysics. Prer., consent of instructor.

A.G. 505-3. Atmospheric Physics I. Physical processes in the atmosphere. Application of statics, atmospheric thermodynamics, cloud physics, and radiative transfer.

A.G. 506-3. Atmospheric Physics II. Atmospheric motions, geostrophic and thermal wind, elementary turbulence theory, energy transformations, general circulation of the atmosphere. Prer., A.G. 505 or consent of instructor.

A.G. 511-3. Internal Processes in Gases. Thermal, mechanical, and radiative processes in gases with emphasis on those processes that are of interest in the study of planetary and stellar atmospheres.

A.G. 515-3. Introductory Plasma Physics. (Phys. 515.) Basic phenomena of ionized gases; particles in external fields; Debye screening; linear electrostatic and electromagnetic wave dispersion relations, propagation, and instabilities; collisionless wave theory; Landau damping and other interactions between waves and particles; applications to astrophysical and fusion plasmas. Prer., A.G. 554 or equivalent; Phys. 631.

A.G. 516-3. Theoretical Plasma Physics. (Phys. 516.) *Offered alternate years in rotation with A.G. 517* (Phys. 517.) Theoretical analysis of collective phenomena in high temperature plasmas. MHD equilibria and stability, resistive instabilities, microinstabilities, and universal modes. Collisionless shock waves. Prer., A.G. 515 or consent of instructor.

A.G. 517-3. Waves and Fluctuations in Plasmas and Other Dispersive Media. (Phys. 517.) General dielectric theory of electromagnetic and electrostatic waves in linear dispersive media, examples drawn mainly from plasma physics; inhomogeneous wave propagation and energy flow; fluctuations and correlation functions; generalized Kirchoff's law, fluctuation-dissipation theorems, Cerenkov emission; radiation scattering; collisional and transport phenomena; collisionless waves and wave particle interactions in a magnetic field. Prer., A.G. 515 or consent of instructor.

A.G. 520-3. Meteorology of the Upper Atmosphere. The structure and dominant physical processes that occur in the neutral atmosphere from 20-100 km. Radiation, photo-chemistry, general circulation, transport phenomena. Also probing techniques, rockets, satellites, etc.

A.G. 525-3. Planetary Aeronomy. Basic physics of the processes that occur in the upper atmosphere between 80 km and several earth radii. Photodissociation, diffusion, and thermal conductivity of the thermosphere. The structure and composition of the D, E, and F regions of the ionosphere. Escape of gases from the exosphere.

A.G. 530-3. The Magnetosphere and Interplanetary Space. (Aero. 573.) *Alternate years.* Introduction to solar wind and fields and particles in interplanetary space; solar wind interactions with the earth and planets; basic physics of the magnetosphere, auroras.

A.G. 533-3. The Sun. (Aero. 572, Aph. 664.) Physical processes of the sun, including the interior, photosphere, chromosphere, and corona. Topics covered include properties of the electromagnetic spectrum (X-ray, UV, visible and radio wave-length), magnetic fields, velocity fields, and flare phenomena and interpretation.

A.G. 540-3. Fluid Dynamics I. Laws of fluid motion relevant to the earth's atmosphere, the sun, planets, and interplanetary space. Scale analysis, rotational effects, boundary layer theory, nonlinear compressible waves, shocks.

A.G. 541-3. Fluid Dynamics II. Continuation of Fluid Dynamics I. Stratified fluid motions, thermal convection, inertial stability, waves, and transition to turbulence. Prer., A.G. 540.

A.G. 554-3. Mathematical Methods in Astro-Geophysics. A course in applied mathematics designed to provide the necessary

analytical background for courses in plasma physics, fluid dynamics, E and M and radiation transfer. Subjects to be covered: integration techniques, linear and nonlinear differential equations, WKB and Fourier transform methods, adiabatic invariants, partial differential equations, integral equations, and integrodifferential equations. Illustrative examples will be drawn from above areas of physics. Prer., undergraduate or graduate complex variables.

A.G. 555-3. Radiative Transfer. Physical processes involving radiative transfer; radiative equilibrium; mathematical solutions of radiative transfer equation applied to problems such as coherent scattering, line formation, frequency redistribution, gray and non-gray absorption, anisotropic scattering, emission-dominated processes.

A.G. 556-3. Radiative Processes in Planetary Atmospheres. Offered in alternate years. Application of radiative transfer theory to problems in planetary atmospheres, with primary emphasis on the earth's atmosphere; principles of atomic and molecular spectroscopy; infrared band representation; absorption and emission of atmospheric gases; radiation flux and flux divergence computations; radiative transfer and fluid motions; additional applications such as inversion methods, climate models, etc. Prer., A.G. 555 or consent of instructor.

A.G. 580-3. Introduction to Modern Astrophysics. (Aph. 580, Aero. 571.) Physical characteristics, distribution, and space motion of stars and stellar systems; internal structure and evolution of stars; structure of stellar atmospheres; interstellar matter and gaseous nebulae. Prer., senior standing or consent of instructor.

A.G. 581-3. Geomagnetism. Offered in alternate years. Physics of the geomagnetic field with particular reference to variability and its sources external to the earth.

A.G. 590-3. Introduction to Space Science (Aero. 590, Phys. 590.) *Alternate years.* A survey of space technology and space research. Topics include historical developments, the space environment, flight dynamics, rocket propulsion, space vehicle design, communications and control, man in space, and scientific research from space vehicles. Prer., consent of instructor.

A.G. 595-3. Seminar: Climatic Change. (Geog. 523, Geol. 595.) A cross-disciplinary survey of the evidence for and theories of climatic change. Prer., consent of instructor.

A.G. 613-3. Geophysical Fluid Dynamics. *Alternate years.* Brief review of basic ideas of fluid dynamics and radiative transfer relevant to the study of the motions of planetary atmospheres. Dimensional and scale analysis of the governing equations and the general classification of circulatory regimes. Barotropic and baroclinic instability. Finite amplitude effects and the formation of fronts. Large-scale wave interactions and geostrophic turbulence applied to planetary atmospheric and oceanic circulations. Prer., A.G. 540, 541.

A.G. 614-3. Astrophysical Fluid Dynamics. *Alternate years.* Varying topics in modern application of nonlinear fluid dynamics in astrophysics. Topics will include compressible convection in stars, including the coupling to rotation and magnetic fields; acoustic-gravity waves and pulsational modes; dynamics of accretion discs and mass exchange in binary systems; stratified turbulence; stellar winds. Prer., A.G. 540-541; A.G. 613 recommended.

A.G. 615-3. Magnetohydrodynamics. *Alternate years.* Topics will vary somewhat according to the instructor. Hartmann flows and MHD waves; MHD shocks; hydromagnetic equilibrium; stability of field configurations; stability of hydromagnetic flows; hydromagnetic boundary layers; dynamo theory; and hydromagnetic convection and turbulence. Prer., A.G. 540-541.

A.G. 624-3. Physics of Planetary Airglows. *Alternate years.* Theory of the physical processes that lead to the excitation of the airglows. Ground- and space-based observational techniques used to measure the nightglow, twilightglow, and dayglow. The determination of the structure and composition of planetary atmospheres from airglow measurements. Prer., A.G. 511, 525; Phys. 656.

A.G. 630-3. Advanced Magnetosphere and Interplanetary Space. *Alternate years.* Current research problems in the physics of the solar wind, terrestrial and planetary magnetospheres, auroras, space plasmas. Prer., A.G. 515, 530, or consent of instructor.

A.G. 633-3. Advanced Solar Physics. Offered irregularly. Theories of the quiet and active sun reviewed on an advanced level. Topics vary from year to year.

A.G. 640-3. Radio Astronomy. *Alternate years.* Observations and interpretation of the radio emissions from the sun, planets, and galactic and extragalactic sources. Topics include a limited amount of antenna and receiver theory, the representation of random noise, polarization, and the theory of the physical processes which produce radio emission.

A.G. 650, 651, 652, 653-variable credit. Special Topics In Astro-Geophysics. Intended to acquaint students with current research in astro-geophysics. (Topics vary each semester.)

A.G. 683-3. Observational Astronomy. (Aph. 665.) An introduction to the observational techniques of modern astronomy. Topics include the optical, photographic, and electronic instrumentation for astronomical observations and the basic principles involved in their operation.

A.G. 700-4 to 6. Master's Thesis.

A.G. 750-variable credit. Reading and Research In Astro-Geophysics.

A.G. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

BIBLIOGRAPHY

Bib. 301-2. Methods of Library Research. *Fall, Spring.* Development of library research methods in the social sciences and humanities for the undergraduate to achieve proficiency in the use of libraries.

Bib. 401/501-2. Introduction to the Theory and Practice of Bibliography. *Fall.* A study of bibliographic theory with analysis of the basic bibliographic tools and services. For undergraduate and graduate students.

Bib. 403/503-1. Literature of the Sciences and Engineering. *Fall, Spring.* A brief survey of the chief reference sources in the sciences and engineering leading to the development of a bibliography in the student's chosen field of interest under the guidance of the appropriate science librarian.

BIOLOGICAL SCIENCES

Biology—Environmental, Population, and Organismic

EPOB 101-3. General Biology I. *Fall.* A concentrated introduction to molecular, cellular, genetic and evolutionary biology. Emphasis on fundamental principles, concepts, facts, and questions which underlie more detailed consideration later in the core curriculum. Students with a score of 2 on the Advanced Placement Test in biology consult course office; those with scores of 3, 4, or 5, or at 66th percentile or higher on the CLEP test, receive 6 hrs. credit and are exempt from the course. Consult Course Office for schedule of the CLEP test. Students who transfer credit in biology must consult departmental adviser. Coreq., EPOB 110 for students taking advanced EPOB courses.

EPOB 102-3. General Biology II. *Spring.* Lect. A concentrated introduction to organisms, homeostasis, development, behavior, and ecology. Emphasis on fundamental principles, concepts, facts and questions which underlie later, more detailed consideration in the core curriculum. See description of EPOB 101 for information on proficiency tests. Prer., EPOB 101; coreq., EPOB 111 for students taking advanced EPOB courses.

EPOB 107-3. Introduction to Biology I. Three lect., two rec. per wk. An introductory survey for students educationally disadvantaged in biology and other sciences (i.e., students with inadequate or no high school science course). Includes molecular, cellular, developmental, and organismic biology. Emphasis placed on fundamental principles, concepts, facts, and questions. Fulfills one semester of natural science if followed by EPOB 108.

EPOB 108-3. Introduction to Biology II. Three lect., 2 rec. per wk. Continuation of introductory survey provided in EPOB 107. For students educationally disadvantaged in biology and other sciences. Includes introduction to organisms, homeostasis, behavior, ecology, and evolutionary biology. Emphasis on fundamental principles, concepts, facts, and questions. Together with EPOB 107, fulfills one year of natural science.

EPOB 110-1. General Biology Investigation Laboratory I. Lab. course with emphasis on scientific processes, written and oral communication, and library literature search skills. In preparation for

performing independently designed research, students are introduced to the basic steps used in scientific investigation. Research projects include organization, experimental design, observation, statistical analysis, interpretation, tabulation, graphing, instrumentation and communication of investigative results and conclusion. Each student investigation leads to production of a written research report, abstract, and oral report.

EPOB 111-1. General Biology Laboratory II. One 3-hr lab. per wk. Emphasizes a comprehensive survey of lower plants, higher plants, invertebrates and vertebrates with special attention to morphology, anatomy, taxonomy and evolution. Prer., EPOB 101, 110; coreq., EPOB 102.

EPOB 235-3. Ecology for Man. Introduction to principles and methods of ecology for students in disciplines other than biology. Lect., discussion, and field or library individual or group projects. Not for biology majors; will not fulfill natural science requirements unless taken with lab. Prer., consent of instructor. Marr, Bushnell.

EPOB 238-2. Introduction to Biological Statistics. Introduction to statistical methods for the design and analysis of biological research. Includes such topics as development and testing of hypotheses, field research vs. the controlled experiment, and when to use parametric vs. distribution-free statistics. Prer., EPOB 101-102. S. Bernstein.

EPOB 251-2. Introduction to Evolution. Designed to introduce both science and nonscience majors to modern concepts of organic evolution. Traces the historical development of evolutionary thought, which is central to modern life science, and surveys the kinds of substantiating evidence. Prer., EPOB 101-102. J. Bock.

EPOB 283-3. Heredity and Society. Relevance of heredity and evolution to contemporary problems in medicine, behavior, agriculture, and other societal concerns. For freshmen and sophomores. Brues, Crumpacker, Linhart, McClearn, and Wilson.

EPOB 301-4. Biology of Microorganisms. Lect., lab. Survey of microbiology within a broad biological perspective. Emphasis on prokaryotes. Subject matter includes microbiological concepts and methodology; a survey of distinguishing properties of microorganisms based on structural-functional relationships; introduction to taxonomy, growth, metabolism, genetics, and evolution. Prer., EPOB 101-102 and 110-111, and college chemistry. Shulls.

EPOB 302-3. Parasitology. Lect., lab. A survey of animal parasites, including life histories; emphasis on parasites of man. Prer., EPOB 101-102 and 110-111, or college zoology. Bushnell.

EPOB 303-4. Introduction to Entomology. Lect., lab. Insect morphology, survey of orders, insect ecology, and life histories. Prer., EPOB 101-102 and 110-111 or college zoology. Breed.

EPOB 307-4. Introduction to Human Anatomy. Lect., lab. An introduction to the basics of human anatomy. Not for medical technology or premedical students without special permission. Prer., EPOB 101-102 and 110-111. H. Smith.

EPOB 308-3. Principles of Comparative Vertebrate Anatomy. Lect. Phylogeny of vertebrate organ systems. Prer., EPOB 101-102 and 110-111 or college zoology. A. Bekoff.

EPOB 309-2. Laboratory Studies of Comparative Vertebrate Anatomy. Concurrent enrollment with EPOB 308 unless waived by the instructor. A. Bekoff.

EPOB 311-4. Morphology of Nonvascular Plants. Lect., lab. Algae, fungi, and bryophytes. Prer., EPOB 101-102 and 110-111 or college botany. Shushan.

EPOB 312-4. Morphology of Vascular Plants. Lect., lab. Tracheophytes. Prer., EPOB 101-102 and 110-111 or college botany. Shushan.

EPOB 315-3. Plants and Man. *Fall.* Lectures, demonstrations. Introduces botanical studies, and emphasizes role of plants for man. Covers major uses of food and beverage, fiber, shelter, medicinals, and some less fundamental uses — ornamentals, flavoring, and perfumes, etc. Prer., EPOB 101-102, 110-111, or equivalent. D. Rogers.

EPOB 321-4. Essentials of Plant Physiology. Lect., lab. Water relations, photosynthesis, respiration, germination, growth, and movements of plants. Prer., EPOB 101-102 and 110-111 or college botany and college chemistry. Bonde.

EPOB 322-4. Human Physiology. Three lect., one 3-hr. lab. per wk. An introduction to human physiology primarily for students in pharmacy and allied health programs. May be counted towards

EPOB major. Prer., EPOB 101-102 and 110-111, and college chemistry. Staff.

EPOB 324-4. Introduction to Animal Behavior. Various topics of behavior considered include basic concepts and history of ethology, methods of study, the central nervous system and behavior, motivational systems, the development of behavior, social organization, predator-prey relations, eliminative behavior and chemical communication, agonistic behavior, sexual behavior, parental behavior, play, and communication. Prer., EPOB 101-102 and 110-111 or equivalent, or consent of instructor. M. Bekoff.

EPOB 325-4. Comparative Animal Physiology. Lect., lab., rec. Introduction to principles of human physiology, emphasizing physiological control systems and responses to environmental change. Prer., one year of college chemistry and EPOB 101-102 and 110-111. Staff.

EPOB 331-3. Field Botany. Lect., lab. Introduction to identification of plants and study of vegetation. Emphasis on the methods of studying distribution of plants and vegetation in the Boulder area. Prer., EPOB 101-102 and 110-111. Staff.

EPOB 341-3. Principles of Ecology. Principles relating to ecosystem structure and function; properties and interactions of populations; adaptations and environmental influences; organization and development of terrestrial and aquatic ecosystems. Prer., EPOB 101-102 and 110-111. Staff.

EPOB 345-3. Introduction to Arctic and Alpine Environments. (Geog. 330.) See Geog. 330. Prer., two relevant courses in EPOB, geology. H. Nichols.

EPOB 375-3. Principles of Taxonomy. *Fall, alternate years.* Lect. practical exercises. Biological principles, logic, classification, identification, and nomenclature are introduced. Course is intended for all biology majors as a necessary element for a well-trained student. Prer., EPOB 101-102, or MCDB 105-106, or equivalent. Rogers.

EPOB 376-3. History of Biological Communities. History of modern biotic communities; background of climatic history as setting for contemporary studies of evolution, genetics, and ecology; the myth of stable tropical biotas; ecotonal instability in North America; extinction of large mammals; why environmental planning ignores historical perspective. Nichols.

EPOB 383-4. Genetics. Lect., rec. Mendel's Laws, gene action, linkage, chromosomal aberrations, mutation, genetic fine structure, chemical basis of heredity, quantitative and population genetics. For emphasis on molecular, biochemical, and developmental genetics, MCDB 384 recommended. Prer., EPOB 101-102 and 110-111, or equivalent. Staff.

EPOB 400/500-3. Teaching of Modern Biology. Lect., lab. The context in which modern biology should be taught to either high school or college and university students. Required for biological science-education majors. Closed to freshmen and sophomores. Prer., EPOB 101-102 and 110-111, or equivalent, and consent of instructor. Staff.

EPOB 402/502-3. Ethnoecology. Area of study which examines in an ecologically revealing manner man's interaction with and relationship to his ambient environment. Special emphasis is placed on the human role as an ecological factor in prehistoric, historic, and contemporary plant communities, especially in North America and northern Latin America. Prer., EPOB 341 or consent of instructor. R. Bye.

EPOB 403/503-3. Evolution and Ecology of Domesticated Plants. Study of the evolution of plants that are important to man's biological existence with reference to domestication and alteration of ecological tolerances of these plants. Emphasis on comparative morphological, reproductive, and ecological diversities of progenitor and advanced species based on data from archaeological, field, and experimental studies. Term paper/project. Prer., EPOB 315, or consent of instructor. R. Bye.

EPOB 404/504-4. Comparative Invertebrate Physiology. Comparative study of organ systems and behavior in selected groups of invertebrate animals with emphasis on mechanisms to allow adaptation to specific environments. Experimental approach is emphasized. Prer., EPOB 325 and one year of chemistry. Winston.

EPOB 405-2. Teaching Laboratory Biology I. Undergraduate teaching assistant program in EPOB 110 or 111. (To assist in advanced courses see EPOB 507.) Student chooses from a list of special educational activities one or more projects to undertake and attends a weekly meeting. Applications may be obtained from

general biology secretary. Prer., consent of general biology coordinator.

EPOB 406-2. Teaching Laboratory Biology II. Similar to EPOB 405 in organization. Applications may be obtained from the general biology secretary. Prer., EPOB 405 and consent of general biology coordinator.

EPOB 411/526-5. Invertebrate Zoology. Lect., lab. Morphology, physiology, ecology, and phylogeny of invertebrates; emphasis on types not included in EPOB 302 or 303. Prer., EPOB 101-102 and 110-111 or college zoology. Bushnell.

EPOB 414-3. Mycology. Lect., lab., and field work. Morphology, systematics, life cycles, evolution, and economic importance of the fungi. Prer., EPOB 311 or consent of instructor. Shushan.

EPOB 416/516-3. Neurobiological Bases of Behavior. *Spring.* An introduction to the structure and physiology of neurons followed by a neuroethological analysis of how neurons are organized into assemblies which generate behavior. Emphasis is on simple systems, particularly in invertebrates. Prer., one upper division course in physiology or behavior. R. Eaton.

EPOB 420/523-3. Developmental Neurobiology. An intensive survey of mechanisms involved in the development of neurons and neural circuits in both vertebrates and invertebrates. Prer., EPOB 325; EPOB 461 or consent of instructor. A. Bekoff.

EPOB 421/521-3. Dynamics of Mountain Ecosystems. Lect., discussion, field work, and individual library and field projects. Study of ecological processes in mountains. Field work in the Front Range and one other major range in the Central Rockies. Prer., one semester of ecology; or one year of geography, geology, or climatology; or consent of instructor. Marr.

EPOB 422/525-3. Vertebrate Physiology. Lect. Physiology of vertebrate organ systems with special emphasis on regulatory processes providing for adaptation to environmental pressures. Prer., EPOB 325. Snyder.

EPOB 423/566-4. Cell Physiology. Lect., lab. Correlation of structure and function at the cellular level, including biological energetics and kinetics in exchanges between cells and environment, bioelectric phenomena, cellular movement, and bioluminescence. Prer., one year each, general chemistry, organic chemistry, and physics; one semester calculus and animal physiology. Staff.

EPOB 417/517-3. Advances In Sociobiology. Multidisciplinary approach to aspects of social behavior and evolutionary and ontogenetic processes. Prer., EPOB 324 with grade of B and instructor's consent. M. Bekoff.

EPOB 418/518-3. Limnology. Lect. Physical, chemical, and biological properties of inland waters. Fundamentals of lake and stream formation and evolution, water chemistry, biotic composition of freshwater ecology. Prer., EPOB 101-102 and 110-111. Lewis.

EPOB 425-3. Microbial Ecology. Principles of microbial ecology, emphasizing the microbial community and its microenvironment; colonization, succession and climax communities; interspecific relationships; interactions of microorganisms with plants and animals; biogeochemical roles; microbial approaches to the solution of various environmental problems. Prer., EPOB 301 and organic chemistry. Segal.

EPOB 426/529-3. Stream Biology. Geological, physical, chemical, and biological study of flowing water with special reference to streams and rivers as ecosystems. Prer., EPOB 341. Windell.

EPOB 427/530-2. Stream Biology: Laboratory and Field Techniques. An introduction to basic lab and field techniques utilized during the investigation of stream ecosystems. Includes physical, chemical, biological, population, and taxonomic analyses. Prer., EPOB 341. Windell.

EPOB 428/528-2. Animal Behavior Laboratory. Exposes student to methods of data collection and analysis in behavioral studies. Students conduct original research projects. Prer., consent of instructor. M. Bekoff.

EPOB 430-4. Classification of Flowering Plants. Lect., lab. A review of orders and families of angiosperms and consideration of relationships between them. Prer., EPOB 101-102 and 110-111. J. Bock, Bonde.

EPOB 431-4. Insect Taxonomy. Lect., lab., and field work. Principles of taxonomy, techniques of collecting and mounting specimens, classification of insects to families and species. Prer.,

EPOB 101-102 and 110-111, or college zoology, or entomology. Breed.

EPOB 432-3. Biology of Amphibians and Reptiles. Comparative morphology, taxonomy, ecology, and geographic distribution of amphibians and reptiles. Prer., EPOB 101-102 and 110-111, or equivalent. Staff.

EPOB 433-2. Herpetology Laboratory. Study of anatomical and identification characteristics on preserved material. Field studies to be arranged. Coreq., EPOB 432. Staff.

EPOB 434/534-3. Ornithology. Origin, evolution, dispersion, physical and behavioral characteristics, and taxonomy of orders and families of birds of North America; field work with local species emphasizing avian ecology. Prer., EPOB 341 or consent of instructor. Williams.

EPOB 435/535-3. Animal Communication. Considers the various ways in which nonhuman animals communicate with one another. Among the topics to be studied are the evolution of communication signals, ritualization, mathematical approaches to communication, and deception. The ontogeny of communication abilities also will be discussed in detail. Prer., EPOB 324 and permission of instructor. M. Bekoff.

EPOB 436-4. Pathogenic Microbiology. Lect., lab. Discussions of inflammatory process from molecular view and immune reaction, and the molecular reaction in the host of the following: Pyogenic cocci, Corynebacterium, Mycobacterium, Enterics, Rickettsiae, and viruses. Prer., EPOB 301 or equivalent. Shulls.

EPOB 437/533-4. Mammalogy. Discussion, lab., and field studies. Origin, evolution and adaptation, geographic distribution, ecology, and taxonomy of mammals; field and laboratory study of Colorado species. Prer., EPOB 443, or consent of instructor. Williams.

EPOB 438/538-3. Biometry. A demanding, problems-oriented methods course in statistical inference procedures, assumptions, limitations, and applications with emphasis on techniques appropriate to realistic biological problems. Grant.

EPOB 440/540-3. Physiological Adaptations to the Environment. A broad consideration of biochemical, physiological, morphological, and behavioral adaptations of animals to various environments. Emphasis is on mechanisms for extracting energy from the environment and strategies for allocation of energetic expenditures in relation to environmental demands. Prer., EPOB 325. C. Carey.

EPOB 441/541-4. Plant Ecology. Lect., lab., and field work. Characteristics of Colorado ecosystems in detail and of North America in general; adaptation; ecological classification of plants. Prer., EPOB 101-102 and 110-111 or consent of instructor. Marr.

EPOB 444/545-3. Comparative Endocrinology. Lect. Evolutionary analysis of the chemical control and integration of physiology and behavior. Prer., EPOB 322 or 325. D. Norris.

EPOB 445-3. Aquatic Invertebrate Zoology. Acquaints student with major groups of animals. Laboratory emphasis on forms in Colorado lakes and streams. Habitats, community ecology, ethnology, zoogeography, and adaptation discussed. Bushnell.

EPOB 446/537-variable credit. Biological Field Studies. Prer., consent of instructor.

EPOB 450-3. Avian Communities of Colorado and New Mexico. One hour discussion per wk., library research, and 3-week field trip immediately following end of spring semester. Observation and comparison of avifaunas of major ecosystems of the central and southern Rocky Mountains and adjacent plains. Prer., EPOB 341 or consent of instructor. May be taken concurrently with EPOB 434. Williams.

EPOB 459/559-1. Vertebrate Physiology Laboratory. Prer., EPOB 325. G. Snyder.

EPOB 460/560-2. Advanced Classification of Flowering Plants. Advanced or specialized individual laboratory study of pertinent specific topics related to flowering plant classification. Prer., EPOB 430. J. Bock.

EPOB 461-4. Vertebrate Embryology. (MCDB 461.) Lect. and lab. Development stressing vertebrate animals from germ cells through organ systems. Lab. includes embryo anatomy and experimental analyses. Prer., one year of college biology. Runner.

EPOB 476/576-3. History of Biological Communities. Lect. and lab. Pollen analysis as a paleoecological research technique, reconstruction of past environments; application to vegetational and climatic history, geomorphology, archaeology. Prer., consent of instructor. Nichols.

- EPOB 480/580-3. Plant Growth and Development in Sterile Culture.** Lect., lab., and individual projects involving use of sterile culture techniques in study of plant growth and development. Prer., EPOB 101-102; 110-111; EPOB 321 recommended. Bonde.
- EPOB 483-4. Laboratory Genetics.** (MCDB 483.) Laboratory experiments with animal, plant, and fungal species to elucidate principles of Mendelian genetics, cytogenetics, behavior genetics, and population genetics. Part II involves laboratory experiments with bacteria and viruses to elucidate principles of molecular and microbial genetics. Prer., EPOB 383 or MCDB 384 and/or consent of instructor. Mitton and Soll.
- EPOB 492-1 to 3. Independent Research in Biology.** Open to seniors on consultation and with written consent of instructor.
- EPOB 499-1 to 3. Independent Study in Biology.** Open to seniors on consultation and with written consent of instructor.
- EPOB 505-variable credit. Advanced Environmental, Population, and Organismic Biology.** This course reserved to offer irregular courses for which seniors as well as advanced graduates can enroll without resorting to Independent Study. Staff.
- EPOB 506-1 to 3. Independent Study.** Prer., written consent of instructor.
- EPOB 507-2 to 3. Teaching of Advanced Biology.** Practice teaching in an advanced course in biology. One hr./wk. required in seminar coverage of teaching techniques by department faculty and assistants. Not repeatable. Prer., previous enrollment in the course assisted in or equivalent. Staff.
- EPOB 511-3. Birds of the World.** Lect., lab. Taxonomy, ecology, and geographic distribution of bird families of the world. Prer., EPOB 443 or consent of instructor. Williams.
- EPOB 512-3. Animal Geography.** Ecological and faunistic distribution of animals on a world basis. Prer., EPOB 341; vertebrate taxonomy and geology recommended. Staff.
- EPOB 513-3. Techniques in Geocology.** (Geog. 514.) Introduction to methods currently applied in geocological field studies (microclimatology, glaciology, hydrology, geomorphology, plant ecology). Field and laboratory analysis. Prer., consent of instructor. Barry, Andrews, Caine, Webber.
- EPOB 514-3. Population Dynamics.** Short historical survey of the development of animal population ecology, consideration of the principles of population dynamics, and survey of the present status of knowledge regarding population phenomena. Prer., EPOB 341. R. Bernstein.
- EPOB 515-2. Environmental Measurement and Control.** Theoretical and practical aspects of measuring environment surrounding biological systems and controlling environment for experimental purposes. Prer., physics, advanced biology. Pollock.
- EPOB 519-2. Techniques in Aquatic Ecology.** Fundamentals of methodology in limnology and freshwater ecology. Water chemistry, quantitative sample collection, experimental use of radiotracers, estimation of standing crop, and other techniques. Fieldwork. Prer., limnology or consent of instructor. Lewis.
- EPOB 520-3. Biology of Social Insects.** Lect. Structure and function of social insects (ants, bees, wasps, and termites) and their societies. Life histories, communication, origin and development of castes, social parasitism, and evolution of social insects are included. Prer., any course in entomology. M. Breed.
- EPOB 522-3. Tundra Ecology.** Lect. and field work. Ecological features of arctic and alpine tundra. Student field projects. Prer., basic course in ecology and consent of instructor. Marr.
- EPOB 524-3. Tropical and Insular Biology: An Ecological, Evolutionary, and Biogeographical Approach.** Ecological, biogeographical, and evolutionary concepts in tropical and insular environments. Major emphasis on community level. Comparisons made with temperate communities. Prer., EPOB 341. Cruz.
- EPOB 531-2. Peripatetic Biology.** Ideas and philosophy of biology. Discussion of laws, theories, and predictions of biology and their impact upon world thought. Prer., consent of instructor. Bushnell.
- EPOB 539-1 to 3. Independent Research in Environmental Biology.** Prer., written consent of instructor.
- EPOB 546-4. Experimental Embryology.** (MCDB 546.) Two lect. and two lab. per wk. Theoretical and practical aspects of contemporary knowledge about control processes in embryos. Evaluation of hypotheses, design of experiments, and application of procedures for study of developmental processes characteristic of embryology. Lab. devoted to original experiments with embryos. Prer., MCDB 362 or MCDB 461. Runner.
- EPOB 547-3. Ichthyology.** Lect., lab. Introduction to fishes. Emphasis on origin, diversity, taxonomy, development, morphology, physiology, behavior, migration, and populations of fishes. Prer., core curriculum in biology. Windell.
- EPOB 548-3. Ecology of Fishes.** Lect. An introduction to literature on fish biology. Emphasis on biological bases of fish production and populations. Prer., core curriculum in EPOB. Windell.
- EPOB 549-3. Immunobiology.** Basic principles of immune response; antibody formation and structure, and antibody-antigen reactions; interdisciplinary aspects of immunology. Prer., consent of instructor. Shulls.
- EPOB 550-2. Immunobiology Laboratory.** Prer., consent of instructor. Shulls.
- EPOB 551-3. Advanced Plant Physiology.** Lect., lab., and independent studies of aspects of plant growth and development. Prer., EPOB 321 or consent of instructor. Bonde.
- EPOB 552-3. Origin and Dispersal of Flowering Plants.** Lectures deal with scientific problems associated with the origin and evolution of the angiosperms. Morphological and geographical evidence will be emphasized. The lab. will entail studies of dispersal of local species plus individual research on a cosmopolitan taxon. Prer., ecology, genetics, botany. J.H. Bock.
- EPOB 553-3. Developmental Plant Anatomy.** Cells, cell complexes, and the morphological changes involved in the growth and maturation of tracheophytes. Prer., EPOB 311 and 312, or consent of instructor. Shushan.
- EPOB 554-3. Algology.** Lect., lab. Structure, physiology, and function of the algae, including both marine and freshwater forms. Emphasis on evolutionary trends and life histories. Prer., consent of instructor.
- EPOB 555-3. Lichenology.** Taxonomy, morphology, distribution, and significance of lichens. Prer., EPOB 311 or equivalent. Shushan.
- EPOB 556-2. Techniques in Endocrinology.** Introduction to modern research techniques used for investigation of endocrine systems of vertebrates. Student research project and paper required. Prer., EPOB 444/545. Jones and D. Norris.
- EPOB 558-2. Seminar: Ecophysiology of Alpine and Arctic Plants.** Lect. Discussion and reports on aspects of the title subject. Prer., plant physiology and ecology. Bonde.
- EPOB 561-3. Microbial Physiology.** Lect. Bacterial structure and function emphasizing biochemical and genetic mechanisms. Evaluation of the molecular concept of biological unity by an examination of highly diversified bacterial systems. Prer., EPOB 301; coreq., general biochemistry. Segal.
- EPOB 562-3. Advanced Ethology.** Group discussion in selected areas of comparative animal behavior. Topics changed from year to year. Prer., EPOB 324 with a grade of B or better and consent of instructor. M. Bekoff.
- EPOB 563-3. Biology of Vertebrate Reproduction.** Evolution of vertebrate gonadal function in relation to functional anatomy, hormonal controls, and environmental control of reproductive cycles. Prer., EPOB 545 and consent of instructor. Jones.
- EPOB 564-3. History of Biology.** Lect. and discussion. Growth of biological concepts from ancient times to present, based on development of factual basis, techniques, and theories. Influences by and on other sciences and relations to social, religious, and philosophical climates. Prer., several courses in biology and other sciences. Staff.
- EPOB 568-2. Microbial Physiology Laboratory.** To be taken concurrently with or subsequent to EPOB 561. Segal.
- EPOB 569-1 to 3. Independent Research in Organismic Biology.** Prer., written consent of instructor.
- EPOB 579-3. Population Genetics.** Lect. Introduction to population genetic theory and its application to problems of population biology, evolution, and applied breeding. Prer., EPOB 383. Mitton.
- EPOB 582-3. Advanced Topics in Population Genetics.** Lect. Detailed study of population genetic theory and its application to fundamental problems of population biology. Prer., EPOB 383 and 451. Crumacker.
- EPOB 584-4. Plant Population Biology.** Ecology and evolution of plant populations: Population dynamics, geographic variation, adaptive strategies and plant-animal co-evolution. Prer., genetics, plant ecology, evolution. Linhart.

EPOB 591-3. Advanced Palynology. Lect., lab. Advanced Quaternary palynological instruction in seminar and lab. sessions, with emphasis on individual student project field work, lab. work, and microscopy. Prer., consent of instructor. Nichols.

EPOB 598-3. Cenozoic Paleobotany and Palynology. Survey of Cenozoic floras used on both the megafossil and fossil pollen and spore record, geography, dispersal patterns, and climatic implications. Prer., consent of instructor. Nichols.

EPOB 962-1 to 3. Independent Research in Population Studies. Prer., written consent of instructor.

EPOB 613-3. Benthic and Aufwuchs Ecology. Lect., lab. Dynamics of communities of organisms living in or on bottom of oceans, lakes, and ponds, and of mobile and sessile organisms on submerged substrates. Includes species diversity, community structure, adaptation, physiological and behavioral ecology, and the sessile and sessile-colonial organism. Prer., EPOB 341 or consent of instructor. Busboell.

EPOB 615-2. Seminar: Recent Advances in Animal Ecology. Lectures and student participation in surveying recent literature in animal ecology. R. Bernstein.

EPOB 621-3. Ecological Plant Physiology. Lect., lab., and independent studies of ecological aspects of the physiology of native species. Prer., beginning plant physiology. Bonde.

EPOB 624-2. Quantitative Ecology. Lect., lab. Quantitative techniques in field and analytical procedures in plant ecology. Prer., EPOB 331 or 441. Webber.

EPOB 625-2. Seminar: Ecology of Fungi. The interaction of fungi with other organisms and with their environment. Prer., EPOB 311 and/or EPOB 414, or consent of instructor. Shushan.

EPOB 626-2. Seminar: Polar Ecology. General survey of ecology of polar regions, including arctic, sub-arctic, antarctic and sub-antarctic regions, followed by intensive study of one or a combination of a few ecosystem processes. Marr.

EPOB 627-2. Seminar: Advanced Insect Taxonomy. Taxonomy of selected groups (families or genera) of insects. Collection required. Identifications using special monographs. Individual project and independent field work. Prer., EPOB 431 or equivalent. M. Breed.

EPOB 628-2. Seminar: Advanced Vertebrate Ecology. Discussions on ecology of terrestrial vertebrates, with emphasis on the relationships between ecology, behavior, and evolution. Prer., consent of instructor. C. Bock.

EPOB 630-4, 631-4. The Arctic and Alpine Environments. (Geog. 630, 631, Geol. 640-641.) Lect. Concentration on multidisciplinary aspects of environmental processes and Quaternary history of the arctic-alpine region. This will involve introduction of new and recent faculty research in the Canadian Arctic and in the alpine area of the Rocky Mountains. Local field trips. (Offered alternate years.) Prer., consent of instructor. Ives.

EPOB 632-2. Analysis and Preparation of Papers in Biology. Bibliographic methods, organization and criticism of scientific papers, preparation of theses and manuscripts. Recommended for all graduate majors.

EPOB 633-2. Environmental Biology Seminar. Required of all graduate majors in environmental biology.

EPOB 635-variable credit. Advanced Environmental Biology. This course number reserved for treatment of specialized aspects of environmental biology by staff or visiting lecturers.

EPOB 641-2. Seminar: Comparative Neurophysiology. Basic functioning of nerve cells, nervous systems, and receptors of different animal groups through examination and discussion of original literature. Prer., a course in animal or cell physiology. Winston.

EPOB 642-2. Seminar: Environmental Physiology. Consideration of recent work on physiological responses to environmental changes, including temperature, humidity, light, salinity, water, and pollutants. Winston.

EPOB 643-2. Seminar: Endocrinology. Student presentations and discussions of current aspects of hormonal research. Prer., EPOB 545 or consent of instructor. D. Norris.

EPOB 646-4. Advanced Experimental Embryology. (MCDB 646.) Preparation of monographs which survey and evaluate current literature on analyses of major processes in development. Otherwise same as EPOB 546. Prer. or coreq., EPOB 546. Runner.

EPOB 651-3. Reproductive Biology of Flowering Plants. Lect., lab., field work. Current botanical research in flowering plant

reproduction, problems in plant evolution, techniques in modern gene ecology and reproductive biology. Prer., EPOB 341, 430, or consent of instructor. J. Bock.

EPOB 652-2. Seminar: Reproductive Biology. Discussion of current research on reproductive biology, (especially vertebrates) with emphasis on anatomy, endocrinology, and behavior. Prer., consent of instructor. R. Jones.

EPOB 653-2. Seminar: Development of Physiological Concepts. Written and oral reports on one or two principal ideas of physiology, as they have developed. Primary and secondary historical sources used. Prer., consent of instructor. C. Norris.

EPOB 654-2. Seminar: Vistas in Botany. Emphasis on influence of past contributions to contemporary botanical philosophy. Research papers, bibliographies, and oral presentations required. Prer., experience in plant science. J. Bock.

EPOB 655-2. Seminar: Ecoenergetics. Basic principles of ecoenergetics with considerable emphasis on flow of energy through biological systems at all levels of biological organization. Windell and Williams.

EPOB 657-2. Seminar: Special Topics in Microbiology. Designed to review current research literature in various specialized areas of microbiology. Topics vary. Prer., consent of instructor. Segal and Shulls.

EPOB 662-2 to 6. Applied Microbiology. Advanced discussion in the field of microbiology and immunology. Prer., EPOB 301 or equivalent. Segal and Shulls.

EPOB 663-2. Seminar: Organismic Biology. Required of all graduate majors in organismic biology.

EPOB 665-variable credit. Advanced Organismic Biology. This course number reserved for treatment of specialized aspects of biology by staff or visiting lecturers. Specific course content will be indicated in *Schedule of Courses* and on transcripts of those taking the course.

EPOB 692-3. Evolution and Speciation. Review of current theories, hypotheses, and controversies concerned with the organic evolution of plants and animals. Prer., consent of instructor.

EPOB 693-2. Seminar: Population Studies. Required of all graduate majors in population studies.

EPOB 695-variable credit. Advanced Population Studies. This course number reserved for treatment of specialized aspects of population studies by staff or visiting lecturers. Specific course content will be indicated in *Schedule of Courses* and on transcripts of those taking the course.

EPOB 700-1 to 6. Master's Thesis.

EPOB 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Biology—Molecular, Cellular, and Developmental

MCDB 105-4, 106-4. Introduction to Molecular, Cellular, and Developmental Biology. Fall, Spring. Three lect., one 2-hr. lab. per wk. Designed to prepare MCDB majors and other science majors for upper division MCDB courses. Nonscience majors who seek to understand modern biology and its implications for the future of mankind are encouraged to enroll. Origin and evolution of life; structure of biological macromolecules and molecular associations; structure and function of cells; sources of energy and materials for life; reproduction; molecular and Mendelian genetics; growth, development and death; multicellularity; organismal physiology; communities of organisms; man's place in nature. Lab. sections stress carrying out actual experiments, and provide time for questions and discussion of lect. material. Prer., high school chemistry and algebra. MCDB 105 prer. for 106. Students may not receive credit for both MCDB 105 and EPOB 101-110, 202, or Biol. Sci. 103. Dubin, Prescott.

MCDB 282-3. Human Heredity and Genetic Counseling. Spring 1979. For nonbiology majors. Fundamental aspects of human genetics, the cellular and chemical bases of inheritance, mutations, genes in populations, genetic diseases, polygenic inheritance, racial traits, intelligence, etc. Genetic counseling and the relevance to societal issues. Prer., one year of introductory college biology. Goldstein.

MCDB 310-1. Cell and Tissue Biology Laboratory. One three and one-half hour laboratory which must be taken concurrently with

MCDB 312 for MCDB majors and distributed studies majors desiring MCDB as the primary area. Bonneville.

MCDB 312-3. Cell and Tissue Biology. *Fall.* Three lect., one lab. per wk. Major emphasis on correlation of cell and tissue fine structure and function. Laboratory (MCDB 310) provides opportunity for first-hand experience with modern techniques. Required for majors in molecular, cellular, and developmental biology and especially valuable for students planning careers in medical science. Prer., MCDB 106 or EPOB 202; coreq., Chem. 331 or 335. MCDB 310 must be taken concurrently by MCDB majors and distributed studies majors desiring MCDB as the primary area. Bonneville, Porter.

MCDB 313-4. Histophysiology; Structure and Function of Vertebrate Organ Systems. *Spring.* Three lect., one discussion and one lab. per wk. Function and microscopic anatomy of major vertebrate organ systems. Emphasis on correlations between structure and function, particularly at cellular and tissue levels. Topics presented include integumentary, digestive, urinary, respiratory, circulatory, endocrine, reproductive, and immune systems. Prer., MCDB 312 or consent of instructor. Bonneville, Porter.

MCDB 315-2. Biology of the Cancer Cell. *Spring.* Cellular basis of cancer. Includes kinds of cancer and range of occurrence among animals; cell reproduction; loss of control of cell reproduction in cancer; chemicals, viruses, and radiation as causes of cancer; environmental causes of cancer; genetic basis of cancer. Prer., MCDB 105. Prescott.

MCDB 372-3. Elements of Biophysics. *Spring, odd-numbered years.* An introduction to the application of physical methods to biological problems and to descriptions of biological phenomena in terms of the properties of individual molecules. Two lect. and one discussion or demonstration period per wk. Prer., MCDB 106 or EPOB 102; coreq., Phys. 112, Math. 230, or consent of instructor. Berg.

MCDB 384-4. Molecular Genetics. *Spring.* Concepts of phage genetics, bacterial conjugation, transduction, transformation, recombination, mutation, and chromosome structure presented at molecular level. Gene expression through transcription and translation with emphasis on genetic approaches used to study these processes. Brief review of diploid cell genetics, population genetics, *in vitro* somatic cell genetics, and application to eukaryotic cells of concepts derived from bacterial molecular genetics. Prer., general chemistry and MCDB 105-106. Kuempel, Yarus.

MCDB 412/512-3. Biological Membranes. *Spring.* Introduction to chemical, physical-chemical, and structural aspects of membrane molecules and membrane models; examines selected bacterial, animal, and plant membrane systems to gain insights into the principles governing structure, function, and biosynthesis of biological membranes. Prer., MCDB 312. Staehelin.

MCDB 418/518-3. Principles of Neurobiology. *Spring.* Cellular and integrative neurophysiology stressing physical and chemical basis. Covers membrane biophysics, axon cable properties, excitable membranes and action potential, synaptic transmission and integration, organization of CNS, visual system, and developmental topics. Prer., two sem. each of chemistry and physics, one of calculus, MCDB 312, and consent of instructor. Dubin.

MCDB 420/520-2. Topics in Plant Cell Biology, Ultrastructure, and Morphogenesis. *Spring.* Instructor and possibly students present lectures, seminars, and papers on selected contemporary problems in morphogenesis, sexuality, physiology, and cell division among higher and lower plants. Instructor consent for nonbiology majors. Pickett-Heaps.

MCDB 422/522-3. The Plant Cell—Diversity of Form and Function. *Fall.* Three lect., occasional lab. dem. per wk. Structure and ultrastructure of a wide variety of plant cells including algae and lower plants examined and compared. The correlation of structure with possible function always emphasized; the variation and diversity in both form and role of cell organelles and the cells themselves demonstrated. Instructor consent for nonbiology majors. Pickett-Heaps.

MCDB 429/529-3. The Biology of Sex. *Spring.* A brief treatment of the evolution, genetics, biochemistry and physiology of sex determination, and of the differentiation of sexual characteristics, particularly in higher organisms. The following are highly recommended, but not required: Chem. 481, EPOB 383, MCDB 312. Yarus.

MCDB 444-3. Genetic Basis of Cellular Function. *Fall, odd-numbered years.* Organization of the cell for growth and reproduction with emphasis on genetic mechanisms, chromosome structure, and replication, transcription, translation, cell cycles, cell growth, reproduction of organelles, mitosis, cytokinesis, and evolution of eukaryotic cells. Prer., MCDB 312 and genetics. Goldstein.

MCDB 461-4. Vertebrate Embryology. (EPOB 461.) *Spring.* Two lect. and two lab. per wk. Development stressing vertebrate animals from germ cells through organ systems. Laboratory includes embryo anatomy and experimental analyses. Prer., one year of college biology. Runner.

MCDB 462-4. Developmental Mechanisms. *Fall.* Three lect., one rec. per wk. Analysis of basic molecular and cellular phenomena involved in development, with emphasis on regulation of gene expression and mechanisms of cellular differentiation and morphogenesis. Prer., MCDB 312, 384 or consent of instructor. Ham.

MCDB 468/568-3. Mechanisms of Aging. *Spring.* Aging studied as a developmental process with emphasis on the cellular and molecular mechanisms involved. Prer., MCDB 312, 384, and 362 or 461. Ham.

MCDB 471/571-3. Biomolecular Organization. *Fall, even-numbered years.* Investigates laws which govern supramolecular organization and examines a few cellular processes, such as muscle contraction and membrane function, from a molecular point of view. Prer., organic chemistry or consent of instructor. McIntosh.

MCDB 474/574-3. Interactions of Biological Molecules. *Spring.* Specific mechanisms by which classes of biological molecules are synthesized and degraded metabolically will be discussed. Examples of simple organic chemistry reactions will be compared to the biological cases. Ramifications for cellular homeostasis and organization related to the mechanisms. Prer., Chem. 332 or 336 and 481. Hirsh.

MCDB 481-2/581-3. Developmental Genetics. *Spring.* Genetic investigations of mechanisms that control gene expression in developing organisms. Results from genetic studies correlated with current knowledge of control processes at the level of DNA replication, RNA synthesis, and protein synthesis. Prer., MCDB 384, 362. McConkey.

MCDB 483-4. Laboratory Genetics. (EPOB 483.) *Spring.* Part I involves laboratory experiments with animal, plant, and fungal species to elucidate principles of Mendelian genetics, cytogenetics, behavior genetics, and population genetics. Part II involves laboratory experiments with bacteria and viruses to elucidate principles of molecular and microbial genetics. Prer., EPOB 383 or MCDB 384, and/or consent of instructor. Mitton, Soll.

MCDB 489-2. Human Biochemical Genetics. *Fall.* The human organism as a genetic system. Effect of mutation on protein structure and function; biochemical basis of human genetic disease; immunogenetics; polymorphic gene loci; gene mapping; impact of human genetics on medicine and society. Prer., MCDB 384 or EPOB 383; organic chemistry. McConkey, Kuempel.

MCDB 490/590-3. Workshop in Electron Microscopy. *Spring.* Lab. experience in operation of electron microscope and techniques for preparation of specimens including fixation, thin sectioning, freeze-etch, positive and negative staining; and limited experience with histochemical procedures and electron opaque tracer techniques. Prer., MCDB 312 and consent of instructor. MCDB 501 must be taken concurrently. Bonneville.

MCDB 495-4. Pathobiology. *Fall.* Broad view of the general principles of disease (pathobiology). Designed for science majors at the junior-senior or graduate level (not intended for premedical students). Emphasizes phenomenological and scientific aspects of abnormal biological processes including cancer, inflammation, metabolic disease, and circulatory disease. Prer., general biology and at least one of the following: cell biology, developmental biology, cell physiology, or biochemistry. Lehman and staff.

MCDB 499-variable credit. Independent Study. Opportunity for well-qualified undergraduates to undertake an independent laboratory or library research project. Consent of a prospective faculty sponsor should be obtained during the semester prior to registration for this course. Prer., consent of instructor.

MCDB 501-1. Techniques of Electron Microscopy. *Spring.* Two lect., two dem. per wk. for first five weeks of semester. Introduction to the electron microscope and techniques for preparation of specimens including fixation, thin sectioning, freeze-etch, positive and negative staining, histochemical procedures, and electron

opaque tracer techniques. Prer., MCDB 312 and consent of instructor. Bonneville.

MCDB 513-2. Advanced Topics in Electron Microscopy. *Spring, even-numbered years.* Two lect. per wk. with occasional demonstrations or lab. sessions. Topics beyond introductory stage and recent developments of current interest in advanced biological research. Elements of electron optics, image optimization, image formation and recording, resolution, radiation damage, various modes of ultramicroscopy (including CTEM, SEM, STEM, HVEM), stereoscopy of cells and tissues, image processing, specimen quantitation, visibility of atoms, autoradiography, applications to molecular biology, elements of electron diffraction. Specimen preparation treated only incidentally. Some familiarity with electron microscopy desirable. Prer., MCDB 105, 106, or EPOB 101, 110, 102, 111 or MCDB 501-590 or Phys. 112, 201, 202 or instructor consent. Fotino.

MCDB 525-2. Biology of Sensory Phenomena. *Spring, even-numbered years.* Sensory transduction in bacteria and other simple organisms; chemotaxis, phototaxis, motility, and structure and function of flagella. Emphasis, insofar as possible, on the molecular basis for sensory response. Prer., college courses in physics, chemistry, and biology or biochemistry. Berg.

MCDB 531-V, MCDB 532-V. Minicourses on Advanced Topics in MCD Biology. *Fall, Spring.* A series of short expositions on topics of intense interest to MCD faculty. Material presented will include topics at the forefront of current research, specialized topics not readily integrated into more conventional courses, and sophisticated research techniques of interest to advanced students. Prer., MCDB 384, Chem. 481, 482. Credit: 7 lectures = 1 hr.; 8-13 lectures = 2 hrs.; 14-24 lectures = 3 hrs. One paper will be required for each hour of credit. Staff.

MCDB 544-3. Selected Topics in Cell Biology. Class meets six hrs. per wk., first seven weeks of spring semester. Formal lect. and some student reports on selected topics. Laboratory demonstrations and techniques practice on occasional afternoons. Outside lecturers will enrich the offerings in their areas of special expertise. Prer., consent of instructor. McIntosh, Goldstein.

MCDB 546-4. Experimental Embryology. (EPOB 546.) *Fall.* Two lect., two labs. per wk. Theoretical and practical aspects of contemporary knowledge about control processes in embryos. Evaluation of hypotheses, design of experiments, and application of procedures for study of developmental processes characteristic of embryology. Laboratory devoted to original experiments with embryos. Prer., MCDB 362 or 461. Runner.

MCDB 555-2. Advanced Topics in Cell Biology. *Fall, even-numbered years.* Seminar course dealing with areas of current research in genetic mechanisms, chromosome structure and replication, transcription, translation, cell cycles, cell growth, reproduction of organelles, mitosis, cytokinesis, and evolution of eukaryotic cells. Prer., MCDB 444 or equivalent, and for undergraduates, consent of instructor. Goldstein.

MCDB 560-3. Mechanisms of Biological Pattern Formation. *Fall.* Genesis of asymmetries and inhomogeneities in biological material will be explored. Features common to several experimental systems analyzed in terms of current understanding of the molecular basis for cellular processes. Prer., MCDB 105-106; coreq., Chem. 481. Hirsh, McIntosh.

MCDB 564-2. Cell and Tissue Interactions in Development. *Spring.* Seminar course dealing with interactions of cells, tissues, and environments during early embryogenesis and morphogenesis. Special attention given to factors which regulate normal and abnormal development. Prer., consent of instructor. Runner.

MCDB 575-2. Animal Virology. *Spring.* One two-hr. lect. per wk. Lect. and critical analysis of the literature encompasses the structure, replication, and interactions with the host for both lytic and transforming animal viruses. The diversity of naturally occurring genomic structures and the resulting strategies of infection emphasized. Prer., MCDB 384, Chem. 482, or consent of instructor. Danna.

MCDB 588-3. Advanced Topics in Molecular Genetics. Class meets six hrs. per wk., first seven weeks of fall semester. Topics include nucleic acid structure, covering nucleotides, multistranded structures, DNA and RNA structure, and transfer RNA. Genetic mapping, Genome complexities, chromatin structure, heterochromatin and euchromatin, mutation, and selection are also discussed. Prer., consent of instructor. Yarus, Sueoka.

MCDB 591-3. Special Topics In Gene Regulation. Class meets six hrs. per wk., second seven weeks of fall semester. Topics include genome diversity, transcription, posttranslational control, host dependence during virus development, viral interference, integrated systems, and evolution of patterns of gene expression. Prer., consent of instructors. Gold, Danna.

MCDB 592-3. Special Topics in Developmental Biology. Class meets six hrs. per wk., second seven weeks of spring semester. Topics include chemical genome structure, chromatin structure, modification, known structures; genetical genome structure, genes and gene groups, complex loci; genome activity; molecular pattern formation, cellular patterns, cell lineages and asymmetries; egg nucleus, cytoplasmic determinants, and maternal effects. Prer., consent of instructors. Hirsh, Wood.

MCDB 601-3. Graduate Seminar. *Fall, Spring.* Provides opportunity for graduate students to explore three research laboratories. Student attends three different one-hour laboratory group meetings per week. Staff.

MCDB 646-4. Advanced Experimental Embryology. (EPOB 646.) *Spring.* Preparation of monographs which survey and evaluate current literature on analyses of major processes in development. Prer. or coreq., MCDB 461 and consent of instructor. Runner.

MCDB 691, 692-variable credit. Independent Study. Special research projects arranged on an individual basis. Consent of a prospective faculty sponsor should be obtained during the semester prior to registration for this course. Prer., consent of instructor.

MCDB 700-variable credit. Master's Thesis. Students seeking a master's degree should consult a departmental adviser. Plan I or Plan II is offered.

MCDB 800-0 to 8 (16 to 24 maximum). Doctor's Thesis. Each candidate for the doctoral degree must submit a thesis based on original research of a quality suitable for publication in a leading journal in the candidate's area of specialty. Thesis research is performed in the laboratory of a member of the departmental faculty and is supervised by an advisory committee with the research sponsor as chairman.

BLACK STUDIES

Bl.St. 101-5. Swahili I. *Fall.* Beginning Swahili with emphasis on oral communication. Essentials of grammar, basic vocabulary, practice in reading and speaking. Language lab. and conversation session.

Bl.St. 102-5. Swahili II. *Spring.* Intermediate Swahili with review of essentials of grammar; detailed analysis of texts. Language lab. and conversation session.

Bl.St. 199-variable credit. Independent Study.

Bl.St. 200-3. Introduction to Black Studies. *Fall.* Introduces the student to the wide-ranging field of black studies, its contents, and the nature and characteristics of a black perspective.

Bl.St. 201-3. Swahili III. *Fall.* Advanced Swahili with emphasis on development of spoken fluency and on reading of contemporary Swahili materials. Prer., Swahili II.

Bl.St. 203-3. Behavior Analysis I. *Fall.* A psychology course which deals with the interrelationships between the black individual and his social environment. Social influences upon motivation, perception and behavior. Development and change of attitudes and opinions in the ghetto.

Bl.St. 204-3. Behavior Analysis II. *Spring.* Psychological analysis of small groups, social stratification, and mass phenomena, e.g., riots. Continuation of Bl.St. 203.

Bl.St. 210-3. Politics of Contemporary Africa. *Fall.* An examination of the historical and socioeconomic factors that have continued to influence the nature of politics in postindependence Africa.

Bl.St. 211-3. Politics of Contemporary Africa. *Spring.* Continuation of Bl.St. 210 but with emphasis on Africa in the context of world politics.

Bl.St. 215-3. Afro-American History I. (Hist. 215.) *Fall.* Survey of the history of Afro-Americans. Study, interpretation, and analysis of major problems, issues, and trends affecting the black man from pre-slavery to the present.

Bl.St. 216-3. Afro-American History II. (Hist. 216.) *Spring.* Continuation of Bl.St. 215.

Bl.St. 220-3. Black Social Movements. (Soc. 228.) *Fall.* Examination of selected case studies of black collective behavior in an

historical context. Emphasis on an in-depth investigation of the continuing black struggle for social/democratic rights.

Bl.St. 221-3. Black Social and Political Thought. (Soc. 229.) *Spring.* General introductory course designed to acquaint the student with the thinking, writings, and speeches of black people, historical and contemporary.

Bl.St. 226-3. The Black West. *Fall.* An introduction to the history and sociology of blacks in the Trans-Mississippi West. King.

Bl.St. 232-3. Survey of Afro-American Literature I. (Engl. 272.) *Fall.* Chronological study of Afro-American literature beginning with the 18th century. The Harlem Renaissance, the depression writers, and writers from the 1940s to the present.

Bl.St. 233-3. Survey of Afro-American Literature II. (Engl. 273.) *Spring.* Continuation of Bl.St. 232.

Bl.St. 235-1, 236-1, 237-1. Mini Courses in Black Studies. *Fall.* Three five-week courses in black studies with each bearing 1 hr. of credit. Topics will vary in accordance with student/faculty interest and availability. One, two, or three of the courses may be taken.

Bl.St. 240-2. Afro-American Dance. *Fall, Spring.* Students study traditional and conventional dance forms and how they relate to the ethnic experience of black people in Africa and the Caribbean.

Bl.St. 250-3. Capitalism and Slavery. (Econ. 250.) *Spring.* The development of slavery as an American institution from 1619 to 1870, the plantation system, the growth of the slave trade, the stimulation of the American economy by slavery, the Civil War as an economic conflict between the industrialists of the North and the agriculturalists of the South.

Bl.St. 255-3. The Black Woman in American Society. *Fall, Spring.* A historical and sociological view of the black woman in American society.

Bl.St. 260-3. Introduction to African Literature. (Engl. 270.) *Fall, Spring.* Survey of African literature from its beginnings to the present; the oral tradition, the pioneer writers, market literature, the Negritude movement, and some major contemporary writers like Achebe, Laye, Ngugi and Soyinka. Also, some theoretical questions concerning second-language literatures.

Bl.St. 264-3. Traditional African Religions. (R.St. 264.)

Bl.St. 270-3. African-American Art History I. (F.A. Hist. 270.) *Fall.* A study of black art in both Africa and the Americas; problems in depicting real life experiences of black people.

Bl.St. 271-3. African-American Art History II. (F.A. Hist. 271.) *Spring.* Continuation of Bl.St. 270.

Bl.St. 280-3. Afro-American Music History and Appreciation I. *Fall.* A study of the history of black music. The African background studied as well as the influences of Europe and the Caribbean. Afro-American folk music studied in detail.

Bl.St. 281-3. Afro-American Music History and Appreciation II. *Spring.* Music since 1900, religious and secular. The development of jazz and modern rhythm and blues today. Black musicians and their technical development also studied. Continuation of Bl.St. 280.

Bl.St. 302-3. Selected Topics in Black Studies. *Spring.* Intensive examination of a particular topic, theme, issue, or problem concerning the black presence as chosen by the instructor. Sample offerings could include the black family institution.

Bl.St. 325-3. The Ghetto. *Fall.* A study of the social and political geography of the inner city with a particular emphasis on the life-style and problems of black persons who live in that world.

Bl.St. 336-3. Guided Readings in the Black West. *Spring.* Intensive reading in the social history of the Black West. Course participants will write papers based on an analysis and interpretation of secondary materials. Prer., Bl.St. 226.

Bl.St. 350-3. Folklore, Mysticism, and Magic in the Black World. *Fall.* A historical journey through the byways of Afro-American beliefs. Includes the origins of 19th-century rituals and various 20th-century sects and cults. Prer., Bl.St. 215/216.

Bl.St. 370-3. Culture, Racism, and Alienation. *Fall, Spring.* Investigates the effects of racism on the individual personality of the recipient and the donor of practices evolving from participation in a racist culture.

Bl.St. 385-3. Development of Caribbean Literature. (Engl. 370.) *Spring.* Critical analysis of the writings of the Caribbean with attention to literary backgrounds and to the social, political, and philosophical factors which influenced the growth of this literature.

Bl.St. 415-3. Pre-Colonial History of West Africa I. (Hist. 417.) *Fall.* Survey of West African history from earliest times through the state systems up to the European beginnings and the slave trade.

Bl.St. 430-3. Race, Racism, and American Law I. *Fall.* An in-depth analysis of the role and impact of racism in the context of the American legal system. The course will place major emphasis on the black experience while considering the impact of racism on other minorities.

Bl.St. 440-3. Criminal Justice in America. *Fall.* A two-semester course which affords an opportunity to study the criminal and juvenile justice systems as methods of preventing and controlling social disorder. The course will focus on particular problems of blacks and other minorities.

Bl.St. 441-3. Criminal Justice in America. *Spring.* Continuation of Bl.St. 440.

Bl.St. 446-3. Directed Research in the Black West. *Fall, Spring.* Supervised research in the social history of the Black West. Course participants will prepare papers based on an examination of primary source materials in archives. Prer., Bl.St. 226, 336.

Bl.St. 450-3. Research Methods in Black Studies I. (Soc. 415.) *Fall.* Preparation for empirical inquiry in black studies. Emphasis on philosophy of science concerns and skill acquisition. Students submit rigorous, executable research design for the investigation of a specific problem, topic, or issue germane to black people for credit.

Bl.St. 451-3. Research Practicum in Black Studies. (Soc. 416.) *Spring.* Research apprenticeship with emphasis on skill development. Students execute in library, field, or laboratory the research design developed in Bl.St. 450. Prer., Bl.St. 450 or consent of instructor.

Bl.St. 476-3. Contemporary Afro-American Literature. (Engl. 472.) Advanced examination of the major techniques and themes employed by contemporary Afro-American writers. Students must have sufficient background in literature to enable them to engage in serious written and oral dialogue on black literature and the ethnic culture which it reflects. Billingsley.

Bl.St. 477-3. Contemporary Afro-American Literature II. (Engl. 473.) Continuation of Bl.St. 476. Billingsley.

Bl.St. 480-3. The African Novel. (Engl. 470.) *Fall.* In addition to a detailed study of works by distinguished African novelists, examines such areas as the indigenous and foreign antecedents of African fiction and possibilities of the novel as a reflector of changing moods and attitudes.

Bl.St. 490-3. Critical Approaches to African Literature. (Engl. 471.) *Spring.* Since the emergence of modern African literature in European languages, the issue of authentic critical standards has become crucial. Course explores various dimensions of the argument while trying to determine the possibility of a distinctly African critical theory.

Bl.St. 499-variable credit. Independent Study. Consent of instructor required.

CHEMISTRY

Chem. 100-2. Preparatory Chemistry. *Fall, Spring.* Lect. For students with no high school chemistry or a very poor chemistry background; designed especially to prepare students for entrance to Chem. 103. Students whose academic plans require Chem. 101-102 should not take this course. (Chem. 100 does not count toward fulfilling natural science requirement.) Prer., one year of high school algebra. Students must earn an A or B in this course to go on to Chem. 103.

Chem. 101-4. General Chemistry Survey. *Fall.* Lect. and lab. A first course in principles of chemistry, intended primarily for pre-nursing, physical education, physical therapy, and other students wanting to fulfill curriculum or natural science requirements. No previous knowledge of chemistry is required. Students whose academic plans may require Chem. 103 should not enroll in this course. Prer., one year of high school algebra. Students presenting one year of high school chemistry for admission will receive only 3 hours credit for Chem. 101 if followed by Chem. 103.

Chem. 102-4. General Chemistry Survey. *Spring.* Lect. and lab. Introduction to organic and biochemistry for pre-nursing, physical education, physical therapy, and other students wanting such a course to satisfy curriculum or natural science requirements. Does

not satisfy prerequisites for upper division chemistry courses. Prer., Chem. 101 or equivalent.

Chem. 103-5. General Chemistry. *Fall, Spring.* Lect., rec., and lab. A first college chemistry course for students with adequate high school chemistry whose academic plans require advanced work in chemistry or who wish to satisfy the natural science requirement at a more sophisticated level than Chem. 101-102. Prer., one year of high school chemistry or Chem. 100 with a grade of *A* or *B*.

Chem. 104-4. General Chemistry. *Fall, Spring.* Lect., rec., and lab. A second-semester course covering the elements of organic and biochemistry, primarily for arts and science students who expect to take no more chemistry. Prer., Chem. 103.

Chem. 106-5. General Chemistry. *Fall, Spring.* Lect., rec., and lab. Includes ionic equilibrium, types of bonding, transition metal chemistry, and quantitative analytical techniques. Prer., Chem. 103 or equivalent, with a grade of *C* or higher.

Chem. 107-5. General Chemistry. *Fall.* Lect., rec., and lab. An advanced freshman course for selected students who expect to make a career in science. Prer., one year each of high school chemistry and physics and high placement rating; four years of high school mathematics recommended.

Chem. 108-5. General Chemistry. *Spring.* Lect., rec., and lab. Includes quantitative analysis and techniques of chemical measurement. Prer., Chem. 107.

Chem. 202-4. General Chemistry. *Fall, Spring.* Lect., rec., and lab. Selected topics in chemistry of interest to engineers. Not open to chemical engineering students. Prer., one year of high school chemistry or Chem. 100, Math. 240, and Phys. 213.

Chem. 331-4. Organic Chemistry. *Fall, Spring.* Three lect., one lab. per wk. For nonchemistry majors. Topics include structure and reactions of alkanes, alkenes, alkynes, aromatic molecules, and alkyl halides; nomenclature of organic compounds; stereochemistry; reaction mechanisms; and chemical and spectroscopic methods of structure determination. Prer., Chem. 106 (or 108) with a grade of *C* or higher.

Chem. 332-4. Organic Chemistry. *Fall, Spring.* Three lects., one lab. per wk. For nonchemistry majors. Topics include structure and reactions of alcohols, ethers, carboxylic acids, aldehydes, ketones, and amines; introduction to the chemistry of heterocycles, carbohydrates, and amino acids; nomenclature of organic compounds; and reaction mechanisms. Prer., Chem. 331 with a grade of *C* or higher.

Chem. 335-5. Organic Chemistry. *Fall, Spring.* Three lect., two lab. per wk. Required course for chemistry majors. Topics include structure and reactions of alkanes, alkenes, alkynes, aromatic molecules, and alkyl halides; nomenclature of organic compounds; stereochemistry; reaction mechanisms; and chemical and spectroscopic methods of structure determination. Prer., Chem. 106 (or 108) with a grade of *C* or higher.

Chem. 336-5. Organic Chemistry. *Fall, Spring.* Three lect., two lab. per wk. Required course for chemistry majors. Topics include structure and reactions of alcohols, ethers, carboxylic acids, aldehydes, ketones, and amines; introduction to the chemistry of heterocycles, carbohydrates, and amino acids; nomenclature of organic compounds; and reaction mechanisms. Prer., Chem. 335 with a grade of *C* or higher.

Chem. 346-3. Introductory Physical Chemistry. *Spring.* Lect. Basic principles of physical chemistry in less mathematical terms than Chem. 451. Intended as a short course for teachers and premedical students, as well as for students in biology, geology, pharmacy, and engineering. Prer., physics, elementary calculus, and two courses in chemistry.

Chem. 401-3. Modern Inorganic Chemistry. *Fall.* Lect. An introduction to modern inorganic chemistry; designed to give the undergraduate student a foundation for graduate work in chemistry. Includes atomic structure and the theoretical basis of the periodic table, structure of and bonding in molecules and crystals, reaction mechanisms, and chemistry of selected transition and nontransition elements systematized by physical principles. Prer., Chem. 451 and concurrent registration in Chem. 452.

Chem. 418-4. Advanced Quantitative Analysis. *Spring.* Lect. and lab. Instrumental analysis, including separations and measurements by gas, liquid, and thin layer chromatography, potentiometry and other electrochemical methods; visible, ultraviolet, infrared, and atomic absorption spectroscopy; titrimetry and other

analytically important applications of equilibrium theory. Prer., Chem. 451.

Chem. 450-1. Scientific Glassblowing. *Fall, Spring.* Lab. An introductory course in scientific glassblowing which allows the student an opportunity to develop sufficient skills in glass manipulation to design, fabricate, and repair glass apparatus.

Chem. 451-3. Physical Chemistry. *Fall, Spring.* Lect. Applications of thermodynamics to chemistry. Includes study of the laws of thermodynamics, thermochemistry, solutions, chemical equilibria, and phase equilibria. Prer., Chem. 335, Phys. 111, and Math. 240. Coreq., Phys. 112 and 114.

Chem. 452-3. Physical Chemistry. *Fall, Spring.* Lect. Introduction to quantum chemistry with applications to molecular and electronic spectroscopy, the nature of chemical bonding, the electronic structure of conjugated hydrocarbons, and magnetic resonance spectroscopy. Prer., Chem. 335, Phys. 112, 114, and Math. 240 or equivalent courses. Chem. 451 and 452 may be taken in any order.

Chem. 453-3. Physical Chemistry. *Spring.* Lect. Electrolyte solutions, kinetic theory, chemical kinetics, statistical mechanics, molecular structure and properties (excluding spectroscopy). Prer., Chem. 451 or Engr. 301 or equivalent course.

Chem. 454-2. Physical Chemistry Laboratory. *Spring.* One lect. and one 3 hr. lab. per wk. Instruction in the experimental techniques of modern physical chemistry with emphasis on experiments illustrating the fundamental principles of chemical thermodynamics, quantum chemistry, statistical mechanics, and chemical kinetics. Prer., Chem. 451 or equivalent course in thermodynamics; coreq., Chem. 452 or 453.

Chem. 455-3. Experimental Physical Chemistry. *Fall, Spring.* One lect. and two 3-hr. labs. per wk. Instruction in the experimental techniques of modern physical chemistry with emphasis on experiments illustrating the fundamental principles of chemical thermodynamics, quantum chemistry, statistical mechanics, and chemical kinetics. For chemistry majors. Prer., Chem. 451 or equivalent course in thermodynamics; coreq., Chem. 452 or 453.

Chem. 481-3. General Biochemistry. *Fall, Spring.* Lect. Topics include structure, conformation, and properties of proteins; enzymes; mechanisms and kinetics; intermediary metabolism; Krebs cycle, carbohydrates, lipids; energetics and metabolic control; and an introduction to electron transport and photosynthesis. Prer., one year of organic chemistry.

Chem. 482-3. General Biochemistry. *Fall, Spring.* Lect. Continuation of Chem. 481. Topics include macromolecules; metabolism of nucleic acids and nitrogen-containing compounds; biosynthesis and function of macromolecules including DNA, RNA, and proteins; biochemistry of subcellular systems; and special topics. Prer., Chem. 481.

Chem. 483/583-3. Plant Biochemistry. *Fall, even-numbered years.* Lect. Consideration of aspects of biochemistry particularly relevant to plants, with emphasis on application of principles of analytical, organic, and physical chemistry, genetics, and cell biology to problems pertaining to agriculture. Prer., Chem. 481 or 581.

Chem. 484/584-3. Biochemistry of Complex Carbohydrates. *Fall, odd-numbered years.* Lect. Detailed consideration at the current research level of the chemistry, biosynthesis, and biological functions of the glycoproteins, glycolipids, and polysaccharides of micro-organisms, plants, and animals. Prer., Chem. 481 or equivalent.

Chem. 486-3. Biochemistry Laboratory. Introduction to modern biochemical techniques. Topics include: enzymology, spectrophotometry, electrophoresis, affinity chromatography, radioisotopes, membrane structure, immunochemistry, and nucleic acid chemistry. Prer., Chem. 481; prer. or coreq., Chem. 451.

Chem. 493-1 to 3. Independent Study in Chemistry. *Fall, Spring.* Consent of instructor required.

Chem. 501-3. Advanced Inorganic Chemistry I. *Fall.* Lect. Inorganic chemistry based on physical chemistry principles. Chemistry and properties of nonmetal and coordination compounds. Prer., Chem. 452 and graduate standing or Chem. 401.

Chem. 506-3. Advanced Inorganic Chemistry II. *Spring.* Lect. A study of modern coordination chemistry. Includes a description of the bonding and properties of coordination compounds in terms of the ligand field and molecular orbital theories with emphasis on the

use of symmetry theory. A description of the chemistry, structure, and bonding of organometallic compounds is also included.

Chem. 516-2. Survey of Methods of Analysis. *Fall*. Lect. Special topics in chemical analysis, such as electron spectroscopy, thermal methods, fluorescence spectroscopy, atomic absorption spectroscopy, bio-analytical chemistry, environmental analytical chemistry. Emphasis on analytical applications. Prer., undergraduate physical chemistry or consent of the instructor.

Chem. 517-3. Advanced Analytical Chemistry. *Fall*. Lect. Electrochemical methods of analysis, analytical instrumentation. Other subjects of current research in analytical chemistry may be included. Prer., undergraduate physical chemistry or consent of the instructor.

Chem. 518-2. Chromatography and Analytical Separations. *Spring*. Lect. Analytical separation processes, with special reference to theory and practice of liquid and gas chromatography. Prer., undergraduate physical chemistry or consent of instructor.

Chem. 531-3. Advanced Organic Chemistry I. *Fall*. Lect. Survey of organic chemistry including mechanistic and synthetic organic chemistry. Prer., Chem. 451 and one year of organic chemistry.

Chem. 532-3. Advanced Organic Chemistry II. *Spring*. Lect. Modern concepts of physical-organic chemistry and their use in interpreting data in terms of mechanisms of organic reactions and reactivities of organic compounds. Prer., one year of organic chemistry and one year of physical chemistry.

Chem. 533-3. Advanced Organic Chemistry III. *Fall, alternate years*. Lect. Advanced spectroscopic techniques and applications of quantum mechanics to organic chemistry are among the topics covered. Prer., Chem. 451 and 452, and 1½ years of organic chemistry.

Chem. 538-3. Conformational Analysis and Steroids. *Fall, odd-numbered years*. Conformation and stereochemistry of ring compounds, applications of spectroscopy, structure determination and syntheses of steroids and other natural products, with emphasis on basic organic reactions. Prer., Chem. 451 and one year of organic chemistry.

Chem. 550-3. Chemical Dynamics. *Fall*. Lect. Discussion of mechanism and rate of chemical range from a fundamental point of view. The nature of collision is discussed and the concepts of cross section and rate constant developed. Theories of elementary bimolecular and decay processes are critically examined.

Chem. 551-3. Advanced Chemical Thermodynamics. *Fall*. Lect. Basic laws of equilibrium and nonequilibrium thermodynamics and applications to problems in chemistry. Emphasis on liquids; gases, chemical equilibria and rate processes; and transport phenomena. Prer., Chem. 451 or equivalent undergraduate course in thermodynamics.

Chem. 552-3. Quantum Chemistry and Kinetics. *Fall*. Lect. Introduction to quantum mechanics of atomic and molecular systems from a fundamental point of view. Prer., Chem. 452 or equivalent undergraduate knowledge of quantum mechanics.

Chem. 553-3. Statistical Mechanics. *Spring*. Lect. Fundamental concepts of quantum and classical statistical mechanics. Applications to properties of gases, liquids, solids, spin and polymer systems. Fluctuation, nucleation, and relaxation phenomena. Prer., Chem. 451, 452, or equivalent.

Chem. 554-3. X-Ray Analysis and Molecular Structure. *Fall*. Lect. Symmetry of crystals as demonstrated by X-ray diffraction; determination of molecular structure from results of X-ray diffraction by crystalline materials, including proteins. Prer., advanced calculus or consent of instructor.

Chem. 556-3. Physical Chemistry of Macromolecules. *Spring*. Lect. Structure and conformation of macromolecules; interaction between macromolecules; binding and cooperative phenomena; transport in solution; light scattering; spectroscopic probes of structure and motion.

Chem. 558-3. Introductory Quantum Chemistry. *Spring*. Lect. Basic principles and techniques of quantum mechanics with applications to questions of chemical interest. Quantum dynamics of atoms, molecules, and spin; electronic structure of atoms and molecules. Prer., Chem. 452.

Chem. 559-3. Advanced Molecular Spectroscopy. *Spring, alternate years*. Rotational, vibrational, and electronic spectra of molecules, and their interpretation in terms of the quantum theory of molecular structure. Prer., Chem. 552.

Chem. 581-3. Advanced General Biochemistry. *Fall*. Lect. In-depth analysis of structure and function of proteins, enzymes and metabolic regulation, bioenergetics and the strategies of metabolism. Prer., one year of organic chemistry.

Chem. 582-3. Advanced General Biochemistry. *Spring*. Lect. Continuation of Chem. 581, including in-depth study of photosynthesis, lipid metabolism, nucleotide chemistry and metabolism, nucleic acid chemistry, DNA synthesis, DNA directed RNA transcription, protein synthesis, nitrogen fixation, and a survey of amino acid metabolism. Prer., Chem. 481 or 581.

Chem. 600-0. Departmental Research Seminar. *Fall, Spring*. Lectures by visiting scientists and occasionally by staff members and graduate students on topics of current research. Meets once a week and is required for all graduate students in chemistry.

Chem. 601-3. Reactions in Solution, Equilibrium, and Kinetics. Prer., consent of instructor.

Chem. 625-1. Seminar: Analytical Chemistry. *Fall, Spring*. Student, faculty, and guest presentations and discussions of current research in analytical chemistry. Required of all analytical chemistry graduate students. Credit is deferred until presentation of satisfactory seminar.

Chem. 635-1. Seminar: Organic Chemistry. *Fall, Spring*. Discussions principally concerned with recent literature in organic chemistry.

Chem. 641-3. Special Topics in Organic Chemistry. *Spring*. A course devoted to various topics of current interest in organic chemistry. Among the subjects covered in recent years are photochemistry, modern synthetic methods, carbene chemistry, and organometallic chemistry.

Chem. 650-0. Seminar: Physical Chemistry. *Fall, Spring*. Discussions principally concerned with research in physical chemistry.

Chem. 652-1 to 3. Advanced Topics in Physical Chemistry. Prer., consent of instructor.

Chem. 653-3. Nuclear and Electron Magnetic Resonance Spectroscopy. *Spring, alternate years*. Theory and application of magnetic resonance techniques to modern chemical problems. Includes a study of fourier transform NMR, spin labeling and its biochemical applications, spectral analysis, relaxation times and their applications, magnetic resonance and kinetics and other topics, according to the interest of the class. Combines the classical lecture format with a student tutorial approach that allows the individual student wide choice in the selection of study topics. Prer., Chem. 552 or consent of the instructor.

Chem. 681-3 to 6, 682-3 to 6. Advanced Topics in Biochemistry. *Fall, Spring*. A detailed study of the current literature relative to one main topic is undertaken each semester. Topics covered on a rotating basis include enzyme kinetics and mechanism; lipids and lipoproteins; chemistry and enzymology of nucleic acids; biochemistry of nucleic acids in eukaryotic cells; and protein chemistry. Presentations include faculty lectures and student reports. Credit for one semester is 3 hours. The course(s) may be taken for a maximum of 12 hours credit. Prer., one year of biochemistry courses and consent of instructor.

Chem. 685-1. Biochemistry Seminar. *Fall, Spring*. Required of all biochemistry graduate students. Credit is deferred until presentation of satisfactory seminar. Prer., consent of instructor.

Chem. 693-1 to 3. Special Topics in Chemistry. *Fall, Spring*. Prer., consent of instructor.

Chem. 700-4 to 6. Master's Thesis.

Chem. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Denver Campus Offering

For details regarding the graduate program offerings on the Denver Campus, please consult the bulletin for the University of Colorado at Denver or contact the associate dean of the Graduate School on the Denver Campus.

CHICANO STUDIES

Ch.St. 101-3. Introduction to Chicano Studies. Introduction to the culture and sociology of the Mexican American.

Ch.St. 103-5. History of Mexico Through the Mexican American War. Background and development of Mexico from Pre-Columbian times to 1910.

Ch.St. 104-3. The Mexican Revolution. An in-depth study of the causes of the Mexican Civil War, the years of the war, and its resultant influence on Mexico.

Ch.St. 112-3. Bilingual Skills—Usage. Designed for Spanish-speaking students who wish to increase their proficiency in speaking Spanish and English.

Ch.St. 127-3. The Contemporary Mexican American. (Soc. 127.) The heritage of the Mexican American: political, social, economic, and cultural; prejudice and discrimination in the United States; race, racism, and minorities, the hyphenated Americans; a study of rural, urban, suburban, and migrant Mexican Americans in the United States.

Ch.St. 199-3. Independent Study.

Ch.St. 202-3. Culture of Mexican Americans in Aztlan. A survey and examination of the cultural contributions of the Mexican Americans in the Southwest up to the present.

Ch.St. 214-3. Mexican Literature in Translation: Survey. Study of the first chroniclers of Mexico up to the writers of the Mexican Revolution.

Ch.St. 215-3. Mexican Literature in Translation: Contemporary. A contemporary study of Mexico through the works of its authors, from the Mexican Revolution to the present.

Ch.St. 216-3. Mexican American Literature: Literature of Protest. A survey of contemporary Mexican American literature, literature of protest, from "Corky" Gonzales to Ramon Barrio.

Ch.St. 220. La Familia. Traditional and changing relationships within the Chicano family structure; nuclear and extended families and the interaction of the family with the institutional social system. Special focus on child development, family, sociological and psychological variables.

Ch.St. 221-3. Barrios Issues and Problems. A survey course on the social, economic, and political problems of the barrios and colonias of the southwest. Problems surveyed include employment, politics, police, drugs, welfare, health, education, religion, housing. The course will focus on a problem and discuss alternative solutions.

Ch.St. 256. Chicanos and the Law. A lower-division survey course which introduces the student to principles of justice, community-police conflicts, and the constitutional rights of the accused.

Ch.St. 262. Introduction to Chicano Teatro. An introductory study of Chicano drama encompassing its history, philosophy, mechanics, social needs, and past and present significance. Participation, community interaction, speakers, audio-visual aids, production, application, and group study in methods of Teatro.

Ch.St. 281-3. History of Latin America. (Hist. 281.) *Fall.*

Ch.St. 302. Field Experience. Observation, orientation, and participation in the operations of public and private agencies affecting the Chicano community. Candidates will be placed in one setting, such as a radio station, school, or community or community organization.

Ch.St. 320-4. Research Methods for Barrio Studies. (Soc. 320.) Methodology for barrio studies, including methodological techniques (sampling, questionnaire construction, interviewing procedures, coding, etc.) and elementary statistics. How to conduct a survey in a Chicano population.

Ch.St. 325-3. The Ghetto. (Bl.St. 325.) *Fall.* A study of the social and political geography of the inner city with a particular emphasis on the life style and problems of Black persons who live in that world.

Ch.St. 340-3. Social Psychology of the Mexican American. (Psych. 340.) Focuses on the relationship between socio-cultural factors and the perceptual, cognitive, and motivational development of the Mexican American.

Ch.St. 362-3. Chicano Teatro, Advanced. Student participation in teatro productions, written by class members and others, as a means of learning the varieties of teatro in everyday life. Communication skills will be emphasized and encouraged.

Ch.St. 380-3. Chicanos and the Mass Media. An examination of the social, psychological, and organizational dynamics of the media

industry, including TV, radio, movies, public broadcasting, and news programming. Special emphasis on a theoretical assessment of the relationship between La Raza and the media.

Ch.St. 381-3. Chicano Poetry. An examination of Chicano poetry including Pre-Columbian, colonial, Mexican, and American Southwest. Students will criticize, analyze, and compare poetry.

Ch.St. 383-3. Problems in Latin American History. (Hist. 383.)

Ch.St. 400-3. Mexican American Culture of the Southwest. (Span. 400.) Lecture course on Mexican American culture conducted by experts in the various disciplines: geography, anthropology, fine arts, comparative literature, history, political science, sociology, etc. Each lecture will be followed by small discussion groups conducted by specialists in the field.

Ch.St. 405-3. Intergroup Relations. (Soc. 405.) A study of intergroup (race) relations at the small-group level. Includes analysis of a group that has been stratified into a majority number of white students and a fixed number of minority students.

Ch.St. 411-3. Mexican-American Folklore of the Southwest. To afford students an opportunity to broaden their horizons by studying and analyzing the tradition and the folklore of the Mexican American. Special effort will also be made to demonstrate why folklore has been so important in the forming of the Mexican-American character. The course will attempt to impress on the students the importance of their own folklore and why it is so essential that it be understood.

Ch.St. 413-3. La Chicana. (Soc. 313.) Background and traditional roles of La Chicana within a bilingual, bicultural life style. Analysis of the sociopsychological development of La Chicana within culturally ascribed roles and the impositions of a foreign dominant society. The role characteristics and behavior patterns related to the different roles will be studied in their individual context and in comparison to female role assignments in other cultural groups.

Ch.St. 420-3. Hispanic Culture. (Span. 420.)

Ch.St. 423-3. Chicano Talk. (Soc. 423.) *Spring.* An analysis of the social artistic, expressive, and linguistic characteristics of the several varieties of Spanish found in the repertoire of Chicano communities; Pachuco, Calo, Tex-Mex, Manito, Pinto, etc., as well as phenomena such as code-switching.

Ch.St. 430-3, 431-3. The Chicano and U.S. Social Systems. An inventory and analysis of social and educational institutions relative to the Chicano and their present and potential effect on the Chicano.

Ch.St. 432-3. Education in Multilingual Communities. (Soc. 432/539.) A combined social-problem and sociolinguistic approach to education in multilingual communities in the United States' Southwest. Topics considered will include historical and contemporary trends in schools' language policies and practices; intra-school social and academic stratification; and consequences for student achievements, aspirations, and vocational choice and channeling. Both student descriptive accounts and empirical research findings will be emphasized. Kjolseth.

Ch.St. 455-3. The Mexican American in Politics. (P.Sc. 455.) Analysis of the social, cultural, and economic factors which affect political behavior of Mexican Americans. Special attention will be paid to the Mexican American cultural heritage and to relations between Mexican Americans and Anglo Americans.

Ch.St. 460-3. The Chicano Community and Community Organization. (Soc. 460.) Examination of the origin of the terms "community" and "barrio." A comparative analysis of the internal barrio structure and the large society community organization and community development—positive and negative role models/leaders—methods and techniques of community organization as related to La Raza. The emphasis will be placed on decentralizing of services, institutional change, innovative approaches, etc.

Ch.St. 462-3. The New Chicano Movement. (Soc. 462.) The conservative and liberal attitudes and developments, both social and political, of the Mexican American.

Ch.St. 482-3. Mexico and Central America Since Independence II. (Hist. 482.)

Ch.St. 499-1 to 3. Independent Study.

CLASSICS

I. General Classics

No Language Required

Clas. 101-3. The Study of Words. An etymological study of the vocabulary of the English language.

Clas. 110-3. Greek Mythology.

Clas. 111-3. Masterpieces of Greek Literature in Translation.

Clas. 112-3. Masterpieces of Roman Literature in Translation.

Clas. 201-3. The World of Ancient Greeks. (Hist. 201.)

Clas. 202-3. The Rise and Fall of Ancient Rome. (Hist. 202.)

Clas. 203-3. Topics in Ancient History. (Hist. 203.)

Clas. 204-3. Topics in Ancient History. (Hist. 204.)

Clas. 210-3. Women in Antiquity. (Hist. 210.) The status of women in antiquity is examined in light of modern thinking on the subject of women's roles in society.

Clas. 333-3. Ancient Athletics.

Clas. 361-3. The Religions of Greece. (Phil. 361.) Recommended prer., Clas. 110.

Clas. 400/500-3. Greece in the Periclean Age.

Clas. 401/501-3. Prehistoric and Archaic Greece (3000-600 B.C.). (Hist. 401/501.)

Clas. 402/502-3. The Athenian Empire and Greek Democracy. (Hist. 402/502.)

Clas. 403/503-3. Alexander and the Hellenistic World. (Hist. 403/503.)

Clas. 405/505-3. Greek Constitutional History.

Clas. 407/507-3. History of the Byzantine Empire. (Hist. 407/507.)

Clas. 408/508-3. The Roman Republic. (Hist. 408/508.)

Clas. 409/509-3. The Roman Empire. (Hist. 409/509.)

Clas. 410/510-3. Leaders of Greece and Rome. (Hist. 410/510.)

Clas. 411/511-3. Greek and Roman Epic.

Clas. 412/512-3. Greek and Roman Tragedy.

Clas. 413/513-3. Greek and Roman Comedy and Satire.

Clas. 416/516-3. Myth in the Arts. Prer., Hum 101-102, 6 hours classics, or instructor's consent. (Hum. 416; C.Lit. 482/582.)

Clas. 418/518-3. Classical Thought and the Origins of Christianity. (C.Lit. 441/541.) Study of first four centuries of Christian thought. Recommended prer., Clas. 110 and 361 (Phil. 361.)

Clas. 419/519-3. History of Biblical Exegesis.

Clas. 420/520-3. Byzantine Art. (F.A. Hist. 407/507.)

Clas. 422/522-3. Early Christian Literature.

Clas. 425/525-3. Archaeology of Ancient Egypt. (Anth. 432/532.)

Clas. 426/526-3. Biblical Archaeology. (Anth. 426/526.)

Clas. 427/527-3. Pre-Classical Art and Archaeology. (Anth. 427/527; F.A. Hist. 427/527.) Greece and Crete from the Neolithic period to the end of the Mycenaean world.

Clas. 428/528-3. Classical Art and Archaeology. (Anth. 428/528; F.A. Hist. 428/528.) Greek art and archaeology from the end of the Mycenaean world through the Hellenistic era.

Clas. 430/530-3. Ancient Criticism. Study of critical essays on the arts by Greek and Roman writers.

Clas. 431/531-3. Etruscan Art and Archaeology. (Anth. 488/588.)

Clas. 432/532-3. Roman Art and Archaeology. (Anth. 489/589; F.A. Hist. 432/532.)

Clas. 467/567-3. Problems in Greek Philosophy. (Phil. 467.) Discussion of philosophers outside the Platonic and Aristotelian schools. Prer., 9 hrs. philosophy or classics.

Clas. 476/576-3. Rome, the Law-Giver.

Clas. 483/583-3. Egyptian Hieroglyphics I. (Anth. 483/583; O.L.L. 468.)

Clas. 484/584-2. Egyptian Hieroglyphics II. (Anth. 484/584; O.L.L. 469.)

Clas. 485/585-2. Hieratic, Demotic, and Coptic. (Anth. 485/585.)

Clas. 499-1 to 3. Independent Study.

Clas. 515-3. Hellenistic Art and Archaeology. (Anth. 592; F.A. Hist. 515.) Prer., Clas. 428/528, Anth. 428/528, F.A. Hist. 428/528, or consent of instructor.

Clas. 521-3. Classical Greek Art. (Anth. 593; F.A. Hist. 508.) Topics selected from architecture, vase painting, sculpture. Prer., Clas. 428/528, or instructor's consent.

Clas. 523-3. Archaic Greek Art. (Anth. 594; F.A. Hist. 509.) Prer., Clas. 428/528 or instructor's consent.

Clas. 524-3. Prehistoric Greek Art and Archaeology. (Anth. 595; F.A. Hist. 510.) Prer., Clas. 427/527 or instructor's consent.

Clas. 548-3. Topics in Roman and Etruscan Art and Archaeology. (Anth. 537; F.A. Hist. 548.)

Clas. 580-3. Philosophy of Plato. (Phil. 580.)

Clas. 581-3. Philosophy of Aristotle. (Phil. 581.)

Clas. 599-1 to 3. Graduate Independent Study.

Clas. 603-3. Readings in Greek History. (Hist. 603.)

Clas. 604-3. Readings in Roman History. (Hist. 604.)

Clas. 614-3. Seminar in Archaeology of Selected Areas. (Anth. 614.) Areas to be selected in terms of current research interests.

Clas. 712-3. Seminar in Ancient History. (Hist. 712.)

Clas. 723-3. Latin Paleography. (Hist. 723.)

Clas. 724-3. Latin Paleography. (Hist. 724.)

Clas. 999-0. Candidate for Degree.

II. Classical Philology

Cl.P. 503-3. Classical Linguistics.

Cl.P. 601-1. Proseminar: Introduction to Research Methods in Classical Studies.

Cl.P. 602-3. Greek Dialects.

Cl.P. 603-3. Italic Dialects.

Cl.P. 604-3. Greek Paleography.

Cl.P. 609-3. Seminar. Subject to be announced.

Cl.P. 610-3. Seminar. Subject to be announced.

Cl.P. 650-3. Ancient Historiography. Topics to be selected from Greek and/or Roman historians.

Cl.P. 660-3. Ancient Philosophy. Topics to be selected from Greek and/or Roman philosophers.

Cl.P. 700-4 to 6. Master's Thesis.

Cl.P. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

III. Greek

Students who start the study of Greek in college to satisfy the language requirement must take Greek 101, 102, and 311.

Gr. 101-5. Beginning Greek.

Gr. 102-5. Beginning Greek. Continued.

Gr. 103-3. Beginning Modern Greek.

Gr. 104-3. Beginning Modern Greek. Continued.

Gr. 203-3. Intermediate Modern Greek.

Gr. 204-3. Intermediate Modern Greek. Continued.

Gr. 311-3. Intermediate Greek. Readings in Plato.

Gr. 312-3. Intermediate Greek. Continued. Selections from Greek tragedy.

Prerequisites for the following 400-level courses are Greek 311 and 312, or the equivalent.

Gr. 402/502-3. Greek Prose Composition.

Gr. 410/510-3. Homer.

Gr. 411/511/611-3. Greek Tragedy. Selected plays from Aeschylus, Sophocles, and Euripides.

Gr. 415/515/615-3. Greek Comedy.

Gr. 421/521-3. Lyric Poetry.

Gr. 440/540-3. Attic Orators.

Gr. 450/550-3. Herodotus.

Gr. 451/551-3. Thucydides.

Gr. 465/565-3. Koine and New Testament. (R. St. 465.)

Gr. 493/593-3. Accelerated Beginning Greek for Graduate Students. Grammar survey, intensive reading. Both semesters required for credit.

Gr. 494/594-3. Accelerated Beginning Greek for Graduate Students. Continuation of Gr. 493/593.

Gr. 499-1 to 3. Independent Study.

Gr. 500/600-1 to 3. **Advanced Graduate Reading.** Author or topic to be specified in *Schedule of Courses*. Materials to be taken from graduate reading list. May be repeated.

Gr. 501-3. **Advanced Survey of Greek Literature.**

Gr. 570-3. **Greek Inscriptions.** (Hist. 517.)

Gr. 599-1 to 3. **Graduate Independent Study.**

Gr. 622-3. **Greek Lyric and Pastoral Poetry.**

Gr. 631-3. **Greek Epic.**

Gr. 641-3. **Attic Orators and Athenian Law.**

IV. Latin

Lat. 101-5. **Beginning Latin.**

Lat. 102-5. **Beginning Latin.** Continued.

Lat. 103-5. **Latin Review.** For students who have had two years of high school Latin.

Lat. 211-3. **Intermediate Latin.** Prer., Lat. 101 and 102, or two years of high school Latin. Students with three years of high school Latin will be placed in accordance with their level of proficiency.

Lat. 212-3. **Intermediate Latin.** Continued.

The following two courses are intended for persons with four years of high school Latin or two years of college Latin.

Lat. 311-3. **Selections from Latin Prose.**

Lat. 312-3. **Selections from Latin Poetry.**

All 400 courses are intended for those who have completed one 300-level sequence.

Lat. 402/502-3. **Latin Prose Composition.**

Lat. 413/513-3. **Seneca's Tragedies.**

Lat. 421/521-3. **Minor Works of Vergil.**

Lat. 422/522-3. **Lyric Poetry.**

Lat. 423/523-3. **Satire, Horace.**

Lat. 424/524-3. **Roman Elegy.**

Lat. 425/525-3. **Horace's Odes and Epodes.**

Lat. 432/532/632-3. **Lucretius.**

Lat. 442/542-3. **Cicero's Forensic Oratory.**

Lat. 450/550-3. **Sallust.**

Lat. 451/551/651-3. **Caesar.**

Lat. 453/553-3. **Biography.**

Lat. 455/555-3. **Tacitus.**

Lat. 461/561-3. **Cicero's Philosophical Essays.**

Lat. 461/561-3. **Novel, Petronius.**

Lat. 490-3. **Teacher Training.** Offered in alternate years.

Lat. 493/593-3. **Accelerated Beginning Latin for Graduate Students.** Grammar survey, intensive reading. Both semesters required for credit.

Lat. 494/594-3. **Accelerated Beginning Latin for Graduate Students.** Continuation of Lat. 493/593.

Lat. 499-1 to 3. **Independent Study.**

Lat. 500/600-1 to 3. **Advanced Graduate Reading.** Author or topic to be specified in *Schedule of Courses*. Materials to be taken from graduate reading list. May be repeated.

Lat. 501-3. **Advanced Survey of Latin Literature.**

Lat. 592-3. **Roman Law.**

Lat. 599-1 to 3. **Graduate Independent Study.**

Lat. 611-3. **Comedy.**

Lat. 631-3. **Vergil.**

Lat. 652-3. **Tacitus.**

COMMUNICATION

Comm. 102-3. Principles of Communication I. A lecture-discussion-recitation approach to communication theory and its applications in everyday communication. This course is intended to give students a point of view and certain basic knowledge that will help them become better communicators.

Comm. 103-3. Principles of Communication II. Special emphasis is given to the more personal aspects of communication. Personal choice making, risk taking, transactionism, argumentation, a

process view of interpersonal understanding, and self-determination capacity are the dominant goals. Prer., Comm. 102 or consent of instructor.

Comm. 210-3. Communication and Social Change. The application of communication principles to the analysis of the decisions and strategies involved in social change. Consideration is given to the individual as both agent and pawn in evolutionary and revolutionary change.

Comm. 230-2. Communication Principles in Instruction. The application of basic communication concepts to the education process. Designed for students entering the teaching profession. (Course fulfills the School of Education's communication proficiency requirements.) Open to prospective teachers only; not open to freshmen.

Comm. 260-3. Introduction to Broadcasting and Film. An overview of the history and economics of broadcasting, a consideration of major issues in broadcasting and broadcast regulation, and an introduction to the components of film and contemporary film makers.

Comm. 315-3. Discussion. Theory and practice in group discussion processes, decision making, and participant and leader behavior combined with interpersonal laboratory.

Comm. 320-3. Argumentation. Principles of argumentation applied to the debating of contemporary issues and to such topics as attitudes, interpersonal transactions, configural and aesthetic form, and research and science.

Comm. 361-3. Radio Programming and Production. Introduction to audio console, microphones, turntables, tape recorders, tape editing, timing, and combo operation. Emphasis on applying the basic principles to professional production of radio programs: news, weather, sports, documentaries, features, remotes, commercials, interviews, music programs, dramas, etc. Prer., Comm. 260. No two production courses can be taken concurrently.

Comm. 362-3. Basic Television Production. Introduction to cameras, audio equipment, lighting, films, video tape, graphics, sets, etc. Production and direction of television programs, including news-weather-sports, interviews, documentaries, demonstrations, and a final program of the student's choice. Prer., Comm. 260. No two production courses can be taken concurrently.

Comm. 363-3. Filmmaking. Basic elements of film production. Emphasis on film as communication medium in which the filmmaker must control various production aspects, including composition, editing, lighting, focus and sound, to communicate intended mood and message. Prer., consent of instructor. No two production courses can be taken concurrently.

Comm. 367-2. Television Production II. Emphasizes biweekly segments for CU Today. Student will produce material in various formats — 16mm, super 8mm, remote and studio video taping, live studio, etc., — with and without editing. Prer., Comm. 362 and instructor consent. No two production courses can be taken concurrently.

Comm. 369-variable credit. Problems in Radio, Television, and Film. Opportunity for students to explore, upon consultation with the instructor, areas in radio-TV-film which the normal sequence of offerings will not allow. Prer., consent of instructor.

Comm. 400-3. Rhetorical and Aesthetic Dimensions of Communication. The study of communication as a process which integrates perspectives in argument, poetry, painting, music, film, theatre, and other mediums. Prer., Comm. 102, senior standing in communication, or senior standing in related fields and consent of instructor.

Comm. 409-variable credit. Honors.

Comm. 415/515-3. Perspectives on Human Communication. Explores process of theory and model building in communication, focusing on underlying assumptions of each theoretical perspective and detailing applications of specific theories. Comm. 515 requires examination of research studies and major paper. Prer., Comm. 102 or instructor consent.

Comm. 419-variable credit. Problems in Communication. Study in problem areas in the field of communication. Work that is basically investigative in character. Prer., consent of supervising instructor.

Comm. 420/520-3. Persuasion. The theory of motivation and change as it operates in individuals and groups. Consideration of

attitudes, beliefs, values, credibility, message variables, ethics, and effects. Analysis of persuasive campaign. Comm. 520 involves examination of selected research studies and a major paper.

Comm. 421/521-3. Psychology of Communication. An examination of selected topics (person perception, learning, creativity, interpersonal attraction, cultural differences, language acquisition, meaning) and application to communication. Registration at the 500 level involves examination of selected research studies and a major paper. Prer., Comm. 102 for majors.

Comm. 423/523-3. Nonverbal Dimensions of Communication. Study of communication by means of spatial relationships, body motion, facial expression, eye contact, vocal quality, touch, personal adornment, and environmental cues. Comm. 523 involves advanced versions of assignments given to all students.

Comm. 426/526-3. Communication and Conflict: Interpersonal and Intergroup. A study of the influence of communication on intrapersonal, interpersonal, intra-group and inter-group situations. Includes field observations and analysis and training in intervention methods. Comm. 526 involves examination of selected research studies and a major paper.

Comm. 427/527-3. Intercultural Communication. An examination of the philosophy, process, problems, and potentials unique to communication across cultural boundaries. Implications for personal and social innovation. Comparative study of communication customs in selected cultures. Comm. 527 involves examination of selected research studies and a major paper.

Comm. 428/528-3. Communication of Directed Change. Examination of the communication process underlying the diffusion of innovations. The course provides a bridge between theory and application in the study of directed change. Prer., Comm. 102 and 210.

Comm. 429-3. Interracial Communication. Study of how societal and cultural factors influence communication among members of racial groups within the United States. Both experiential and theoretical learning receive emphasis. Taught by an interracial team with an interracial population of students. (Cross-listed with Soc. 405.)

Comm. 430-3. Teaching of Communication and Theatre. Fundamental problems of the teacher of communication and theatre—textbooks, courses of study, methods, etc. Prer., consent of instructor.

Comm. 433-3. Teaching With Group Methods. The study of group forces, the teaching-learning transaction, and the teacher's role in creating effective learning groups. Designing, experimenting with, and evaluating participative educational activities as alternatives to traditional teaching methods.

Comm. 435-3. Creative Dramatics. The experiential study of creative learning techniques and the manner in which creative drama assists in the growth and development of the human being.

Comm. 439-variable credit. Problems in Communication Education. Study in problem areas in the field of communication education. Work that is basically investigative in character. Prer., consent of supervising instructor.

Comm. 460/560-3. Radio-TV Station Organization and Operation. Concentrates on analysis of station operations, public relations, personnel, financing, labor relations, and laws and regulations affecting management, while never losing sight of the manager's ethical and social responsibilities to the public. Prer., Comm. 260, or consent of instructor.

Comm. 461-1 to 3. Advanced Radio Practices. A practical application of the theory of radio programming and production. Assignments include producing radio programming for radio stations in Colorado and weekly discussion-critique sessions. Prer., Comm. 361 or Jour. 462, and consent of instructor. No two production courses can be taken concurrently.

Comm. 462-3. Advanced Television Production. Sound and motion provides the basis for this course in detailed planning and production of complex television programs. Advanced production theory prepares students for remote multi-camera television productions, 16mm motion picture films for television, battery operated portable television production, and in-studio programs. Prer., Comm. 362 and consent of instructor. No two production courses can be taken concurrently.

Comm. 464/564-3. Mass Media and Society. A discussion course in media criticism. Trains students in the writing of criticism where

the objects to be evaluated are a wide variety of mass mediated messages. Comm. 564 will require additional work. Prer., junior standing.

Comm. 467-1 to 4. Television Production III. The student will receive in-depth experience in one facet of a complex television production, e.g., directing, producing, performing, writing, sports, commercials, etc. Prer., Comm. 362, 367, and instructor consent. No two production courses can be taken concurrently.

Comm. 469-variable credit. Problems in Radio, Television, and Film. Opportunity for students to explore, upon consultation with the instructor, areas in radio-TV-film which the normal sequence of offerings will not allow. Prer., consent of instructor.

Comm. 499-variable credit. Independent Study. Prer., written consent of supervising instructor.

Comm. 519-variable credit. Problems in Communication. Opportunity for students to explore, upon consultation with the instructor, areas in communication which the normal sequence of offerings will not allow. Prer., consent of instructor.

Comm. 522-3. Information Analysis. Study of the applications and misapplications of the mathematical theory of communication. Prer., consent of instructor.

Comm. 524-3. Seminar: Organizational Communication. Relationships between such communication factors as flow, media, density, channel-saturation, information delivery and organization functioning, morale, and productivity. Lecture, theory, case observation, and analysis. Prer., consent of instructor.

Comm. 539-variable credit. Problems in Communication Education. Opportunity for students to explore on an individual basis, upon consultation with the instructor, areas in communication education. Prer., consent of instructor.

Comm. 561-3. International Patterns of Broadcasting. Comparative analysis of philosophies, practices, and organizational structures of broadcasting throughout the world. Considerable emphasis given to determination of interrelationships between broadcasting and social, political, economic, and cultural factors which have molded and reflected the broadcast system. Prer., consent of instructor.

Comm. 565-3. Television in Education. (L.M. 507.) Utilization of television at all levels of education. Theory and practice in defining needs, identifying alternative solutions, producing materials, and evaluating results. Prer., Comm. 260 or consent of instructor.

Comm. 569-variable credit. Problems in Radio-Television-Film. Opportunity for students to explore, upon consultation with the instructor, areas in radio-TV-film which the normal sequence of offerings will not allow. Prer., consent of instructor.

Comm. 601-3. Introduction to Graduate Work in Communication. Intended to familiarize students with the philosophical, ideological, and methodological bases of study in communication. Required of all departmental graduate students.

Comm. 604-1 to 4. Departmental Research Seminar. The study, analysis, and actual instrumentation and experimentation in contemporary, on-going research projects. Students will actually participate in hypothesis formation, testing, and interpretation. The content and research problems will vary, depending upon the instructor and on-going research.

Comm. 606-3. Management Communication Systems. (P.Ad. 606.) Examination of the policies and procedures appropriate for complex public agencies and private organizations in establishing and maintaining effective communication systems, internal and external; the nature of the system, problems and potentials.

Comm. 609-1 to 4. Field Problems in Communication. Analysis, observation, and field experience involving communication problems in organizations such as service, labor, industry, military, and the like. Selected research project and reports. Prer., written consent of instructor.

Comm. 615-3. Seminar: Group Methods. Critical examination of contemporary theory and research in small group behavior. Selected topics may include structure, leadership, power, conflict, decision making, and various applications. Prer., consent of instructor.

Comm. 619-variable credit. Problems in Communication. Opportunity for students to explore, upon consultation with the instructor, areas in communication which the normal sequence of offerings will not allow. Prer., consent of instructor.

Comm. 620-3. Seminar: Persuasion. Critical analysis of the principles and methods of influencing belief and action. Examination of both descriptive and experimental studies in several disciplines. Consideration of audiences, adaptation, attention, motivation, direction, and evaluation. Prer., Comm. 420/520 or consent of instructor.

Comm. 623-3. Verbal and Nonverbal Components of Communication. Analysis of theoretical and methodological orientations toward the study of relations among linguistic, paralinguistic, kinesic, proxemic, and social context elements of communication codes. Prer., graduate standing or permission of instructor.

Comm. 625-3. Historical Perspectives on Communication. An examination of communication theory from the classical period to the 20th century with special emphasis on Aristotle, Cicero, George Campbell, and Kenneth Burke.

Comm. 626-3. Philosophical Perspectives on Communication. An examination of the relationship of leading 20th-century schools of philosophy to the study of communication. Consideration of how epistemology, ontology, and axiology generate substantive issues emerging from an investigation of the interaction of philosophy and communication.

Comm. 627-3. Seminar: Intercultural Communication. Examination of multidisciplinary contributions to theory and research in intercultural communication. Development of models, consideration of research problems, and evaluation of programs, intended to facilitate interaction across cultural boundaries within and among societies. Prer., Comm. 527 or consent of instructor.

Comm. 628-3. Seminar: Argumentation. A study of philosophical and rhetorical perspectives on argument plus various applications of argumentative strategies—e.g., legal, political, scientific, etc. The class will consist of readings, discussion, and research projects on aspects of argument.

Comm. 630-3. Educational Perspectives on Communication. A study of the history and philosophy of communication and theatre education with an emphasis on contemporary trends.

Comm. 631-3. Teaching Communication in College. The application of communication concepts and principles to the teaching-learning process at the college level. Current literature on curriculum development, course construction, tests and measurements, and nonprint media utilization will be examined.

Comm. 660-3. Seminar: Broadcasting. Exploration of current issues affecting the broadcasting industry, their sociological implications, the role and responsibility (if any) of the broadcast practitioner in coping with or explaining social issues, and consideration of some possible solutions to the problems. Prer., consent of instructor.

Comm. 699-variable credit. Independent Study. (Master's students). Prer., written consent of supervising instructor.

Comm. 700-1 to 6. Master's Thesis.

Comm. 702-3. Critical Research Methods. Defines and explores a variety of approaches to criticism, examines their suitability for particular research projects, and studies the problems encountered in doing critical research. Prer., Comm. 601 or consent of instructor.

Comm. 703-3. Empirical Research Methods. Fundamentals of scientific philosophy, research design, and statistical analysis. Required of all departmental graduate students working toward the doctorate. Prer., Comm. 601 or consent of instructor.

Comm. 721-3. Empirical Perspectives on Communication. A critical analysis of empirical research studies in communication and their contributions to a theory of communication. Prer., Comm. 702 and 703, or consent of instructor.

Comm. 730-3. Scholarship in Communication. Intensive criticism and revision of a scholarly essay or a research report with the aim of publishing the paper. Discussion of selected topics related to the publication of scholarly work. Prer., Comm. 702 and 703, or consent of instructor.

Comm. 799-variable credit. Independent Study. Prer., written consent of supervising instructor. (Doctoral students.)

Comm. 800-0 to 8. (16 to 24 maximum). Doctor's Thesis.

COMMUNICATION DISORDERS AND SPEECH SCIENCE

Speech Science

Phon. 199-1 to 3. Independent Study.

Phon. 304-3. General Phonetics. (Engl. 380.) Introduction to principles of speech production, transmission, and reception. Classification of speech sounds and development of an understanding and a limited skill in transcription using International Phonetic Alphabet.

Phon. 305-4. Physiological Phonetics. A study of structures and functions of those portions of the human body important to the reception of sound and the production of speech.

Phon. 308-2. Acoustic Phonetics. A study of the acoustic signal produced by the speech mechanism. Basic physics of speech sounds.

Phon. 407/507-2. Articulatory Phonetics. Application of principles of physiological phonetics to speech production. The main emphasis is on the study of "normal" and pathological speech in American English. Practical work in phonetic transcription is included.

Phon. 408-2. Intermediate Phonetics. This course presumes a knowledge of physiological, articulatory, and auditory phonetics. After a short review of the fundamentals in these areas, this course concentrates on fundamental aspects of combinatory phonetics up to the phonetics of syllable juncture. Prer., Phon. 304 or the 305, 308 sequence.

Phon. 409-5. Synopsis of Phonetic Sciences. Survey of physiological, articulatory, and acoustic phonetics.

Phon. 505-1 to 2. Advanced Phonetics.

Phon. 508-2. Experimental Phonetics I.

Phon. 509-2. Auditory Phonetics.

Phon. 599-1 to 4. Independent Study.

Phon. 608-2. Experimental Phonetics II.

Phon. 617-1 to 3. Practicum I: Phonetics.

Phon. 717-1 to 3. Practicum II: Phonetics.

Communication Disorders

CDSS 199-1 to 3. Independent Study.

CDSS 200-3. Voice and Diction. Elementary course for the improvement of the speaking voice. Group and individual laboratory practice.

CDSS 300-2. Introduction to Communication Disorders. Survey course of the field of speech pathology with emphasis on public school speech correction as well as therapy in clinical settings.

CDSS 301/401-4. Speech and Language Development in Children. The underlying processes in the development of speech and language, normal and atypical.

CDSS 370-2. Manual Communication I. An introduction to the various systems of manual communication used by the deaf, with emphasis upon developing receptive and expressive skills in the use of the American Sign Language.

CDSS 371-2. Manual Communication II. A continuation of Manual Communication I. This course examines more closely the academic, linguistic, and research aspects of manual communication, and extends the vocabulary and situational uses of sign.

CDSS 435-2. Introduction to Language and Learning Disabilities. Orientation to field of language and learning disorders in preschool, elementary, and secondary children. Diagnostic and remedial techniques and treatment programs will be surveyed. Films, case studies, guest speakers, and field trips will provide a comprehensive view of the field.

CDSS 450-4. Speech Disorders I. Survey of the following disorders; aphasia, articulation, stuttering, and voice. Prer., Phon. 305, 307, 308.

CDSS 451-4. Speech Disorders II. Survey of the following disorders: cleft palate, cerebral palsy, language disorders, and learning disabilities. Prer., Phon. 305, 308.

CDSS 469-1. Observation and Cotherapy. Supervised observation and cotherapy with individuals exhibiting speech and hearing problems. Prer., CDSS 450, 451.

CDSS 470-3. Audiology I. Basic principles and techniques of pure tone audiometry, including clinical masking; hearing conservation programs in the schools and industry; and psychological aspects of deafness. Required projects in pure tone and screening audiometry. Prer., Phon. 305, 308.

CDSS 471-3. Audiology II. Basic principles and techniques of speech audiometry, pathologies of the auditory mechanism, special auditory tests for site of lesion and functional hearing loss, and introduction to hearing aids. Required projects in pure tone and speech audiometry. Prer., CDSS 470.

CDSS 499-1 to 3. Independent Study.

CDSS 530-3. Language Bases of Learning Disabilities.

CDSS 531-3. Appraisal and Remediation of Language Disorders.

CDSS 550-2. Cerebral Palsy.

CDSS 551-2. Articulation Disorders.

CDSS 552-2. Cleft Palate.

CDSS 553-2. Medical Backgrounds in Speech Pathology.

CDSS 554-2. Stuttering.

CDSS 555-2 to 3. Speech and Language of the Mentally Retarded.

CDSS 556-2. Aphasia.

CDSS 557-2. Voice Disorders.

CDSS 567-2. Methods of Speech Pathology Appraisal.

CDSS 570-3. Hearing Conservation in the Public Schools and Industry.

CDSS 572-2. Residual Hearing and Amplification.

CDSS 573-2. Medical Backgrounds for Clinical Audiology.

CDSS 574-2. Seminar: Assessment of Hearing I.

CDSS 575-2. Seminar: Assessment of Hearing II.

CDSS 580-2. Speechreading and Auditory Training.

CDSS 581-2. Language and Speech Development for the Deaf.

CDSS 582-2. Seminar: Rehabilitation of the Hearing Impaired.

CDSS 584-2. Social and Vocational Adjustment of the Acoustically Impaired.

CDSS 599-1 to 4. Independent Study.

CDSS 601-2. Introduction to Graduate Study in Communication Disorders and Speech Science.

CDSS 609-1 to 2. Problems in Communication Disorders and Phonetics.

CDSS 630-2. Theories of Language Disorders.

CDSS 631-3. Clinical Appraisal of Language and Learning Disabilities.

CDSS 634-3. Clinical Remediation of Language and Learning Disabilities.

CDSS 636-1 to 3. Practicum I: Language and Learning Disabilities Appraisal and Remediation.

CDSS 637-1 to 3. Practicum I: Language and Learning Disabilities Appraisal.

CDSS 638-1 to 3. Practicum I: Language and Learning Disabilities Remediation.

CDSS 639-6 to 10. Public School Internship: Speech, Language, and Learning Disabilities.

CDSS 640-3. Theoretical Backgrounds for Learning Disabilities.

CDSS 649-4 to 8. Practicum II: Language and Learning Disabilities Internship.

CDSS 657-1 to 3. Practicum I: Speech Pathology Appraisal.

CDSS 658-1 to 3. Practicum I: Speech Pathology Remediation.

CDSS 659-4 to 8. Internship: Public School Speech Correction.

CDSS 669-4 to 8. Practicum II: Speech Pathology Internship.

CDSS 670-2. Instrumentation for Audiology.

CDSS 671-2. Bioacoustics.

CDSS 677-1 to 3. Practicum I: Audiology Appraisal.

CDSS 678-1 to 3. Practicum I: Audiology Remediation.

CDSS 680-2. Differential Diagnosis of Auditory Disorders.

CDSS 689-4 to 8. Practicum II: Audiology Internship.

CDSS 698-1 to 4. Departmental Research Seminar.

CDSS 699-1 to 4. Independent Study.

CDSS 700-4. Master's Thesis.

CDSS 795-2. Practicum III: Clinical Supervision.

CDSS 796-2. Practicum IV: Clinical Administration.

CDSS 797-2. Practicum V: Research Coordination.

CDSS 798-2. Practicum VI: Classroom Instruction.

CDSS 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

COMPARATIVE LITERATURE

C.L. 421/521-3. Literary Genres.

C.L. 435/535-3. Studies in the Novel.

C.L. 436/536-3. Studies in the Drama.

C.L. 437/537-3. Studies in Poetry.

C.L. 441/541-3. Literature of Antiquity. (Clas. 418/518.)

C.L. 442/542-3. Medieval Literature.

C.L. 443/543-3. Renaissance Literature.

C.L. 444/544-3. Baroque Literature.

C.L. 445/545-3. Literature of the Enlightenment (English, French, German).

C.L. 446/546-3. Nineteenth- and Early 20th-Century Literature.

C.L. 447/547-3. Modern Literature.

C.L. 448/548-3. Contemporary Literature.

C.L. 461/561-3. Comparative Morphology of Literary Form.

C.L. 462/562-3. Poetry and Poetics.

C.L. 463/563-3. Theory and History of Literary Criticism.

C.L. 464/564-3. International Literary Relations.

C.L. 465/565-3. Influence and Literary Fortune.

C.L. 466/566-3. Themes, Motifs, and Characters.

C.L. 482/582-3. Literature and the Arts. (Clas. 416/516; Hum. 416.)

C.L. 483/583-3. Literature and History.

C.L. 484/584-3. Philosophy and Literature.

C.L. 485/585-3. Literature and the Social Sciences.

C.L. 499/599-variable credit. Independent Study in Comparative Literature.

C.L. 500-3. Proseminar I.

C.L. 501-3. Proseminar II.

C.L. 510-3. The Classical Tradition.

C.L. 511-3. The Medieval Tradition.

C.L. 560-3. Art of Translation.

C.L. 567-3. Literary Sources of Dramatic Librettos.

C.L. 580-3. General Aesthetics I.

C.L. 581-3. General Aesthetics II.

C.L. 601-3. Seminar: Major Figures.

C.L. 602-3. Seminar: Period.

C.L. 603-3. Seminar: Genre.

C.L. 604-3. Seminar: A Selected Topic.

C.L. 700-4. Master's Thesis.

C.L. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

COMPUTER SCIENCE

C.S. 110-3. Elementary Programming for Scientists and Engineers. An elementary introduction to Fortran programming with examples drawn from science and engineering. Prer., high school algebra.

C.S. 162-1. Digital Computer Programming. An introduction to digital computer programming in FORTRAN. Offered through the Division of Continuing Education. Prer., high school algebra or equivalent.

C.S. 210-3. Fundamentals of Computing I. An elementary course in computing, covering the capabilities of a computer, the elements of a programming language, and the basic techniques for designing algorithms to solve practical problems. The programming language PASCAL is used as a vehicle for expressing these concepts. Prer., three years of high school mathematics, including trigonometry, or Math. 110 or 102, or consent of department.

C.S. 299-1 to 3. Independent Study in Computer Science. Selected topics at the elementary level for students who have had little or no previous computing experience.

C.S. 310-4. Fundamentals of Computing II. Second semester of a two-semester introductory course in computing which emphasizes design, construction, and use of computer software. Includes: FORTRAN and COBOL; use of an operating system and associated utilities; use of software libraries; non-numerical and numerical algorithms. Prer., C.S. 210.

C.S. 390-1 to 6. Topics in Computer Science. Topics to be selected by instructors. Prer., consent of instructor.

C.S. 401-3. Comparative Programming Languages. (E.E. 401.) A study of programming languages. Conceptual aspects of programming languages, translators, and data structures. Relationship among language features. Prer., C.S. 310 or E.E. 351.

C.S. 402-3. Computer Architecture. Designed to present an overview of computer hardware concepts to software-oriented people. Deals with individual hardware devices and large scale hardware systems. Prer., C.S. 210 and/or Assembly Language Programming.

C.S. 413-3. Advanced Finite Mathematics I. (Math. 413.) Basic methods and results in combinatorial theory. Enumeration methods, elementary properties of functions and relations, graph theory. Considerable emphasis is placed on applications. Prer., one semester calculus, C.S. 210.

C.S. 445-3. Data Structures. Linear lists, linked lists, arrays, trees, multilinked structures. Methods of representation in memory. Applications to symbolic mathematics, sorting, searching. Techniques for garbage collection and dynamic storage allocation. Prer., C.S. 310 or E.E. 351.

C.S. 453-3. Assembly Language Programming. (E.E. 453.) A laboratory course in programming at the machine code level. Lectures deal with the organization of the machine, its effect on the order code, techniques for programming in Assembly Language. Primary emphasis on preparing and running programs. Prer., C.S. 310, E.E. 351, or consent of the instructor.

C.S. 459-3. Computer Organization. (E.E. 459.) This course is concerned with computer arithmetic units, memory systems, control systems, and input-output systems. The emphasis is completely on logic structure rather than electronic circuitry. Prer., E.E. 257 or equivalent.

C.S. 465-3. Intermediate Numerical Analysis I. (Math. 465.) Development, computer implementation, and analysis of numerical methods for applied mathematical problems. Topics include floating point arithmetic, numerical solution of linear and nonlinear systems of equations, numerical interpolation, integration, and approximation. Prer., C.S. 210, Math. 230 and 313.

C.S. 466-3. Intermediate Numerical Analysis II. (Math. 466.) Continuation of C.S. 465. Further development of same topics and introduction of new topics, such as numerical solution of matrix eigenvalue, least squares, ordinary differential equations, and optimization problems. Prer., C.S. 465.

C.S. 499-1 to 6. Independent Study in Computer Science (Upper Division). This course provides opportunities for independent study, work on a small research problem, or tutoring of lower division computer science students. Prer., C.S. 210.

C.S. 514-3. Advanced Finite Mathematics II. (Math. 414, 509.) More advanced techniques in enumeration theory and graph theory. Finite groups, Polya's theory of counting, digraphs, finite rings and fields. Application in computer science switching theory, coding theory, etc. Prer., C.S. 413.

C.S. 531-3. Formal Languages. Phrase structure grammars and transformational grammars as descriptive tools. Relations between these grammars and machines. Properties of push-down automata and their variants with applications to compiling. Decidable properties of languages and undecidable ones. Time and space bounds for standard tasks. Prer., C.S. 546.

C.S. 540-3. Computer Decision Modeling. (Mg.Sci. 625.) Application of the methods of computer science to problems in management decision making. Emphasis is placed on simulation as a method for studying the behavior of dynamic systems and the use of optimization models for their control. Prer., course in statistics.

C.S. 545-3. Algorithms. Techniques for designing algorithms, proving correctness, computing time, and space needs. Examples from sorting, set manipulation, graphs, multiplication. NP-complete problems. Prer., C.S. 445 and 546.

C.S. 546-3. Theory of Automata. Finite-state machines, regular expressions, paths on graphs, and the relations among these. Turing machines, some equivalent machines, and the idea of computability. Machines between the preceding ones in computational power and the elements of their relation to formal languages.

C.S. 553-3. Fundamental Concepts in Programming Languages. (E.E. 553.) A study of the concepts which underlie the design of a programming language: elementary operators, operands, and formation rules. Examples are drawn from contemporary languages

such as FORTRAN, COBOL, ALGOL, LISP, SNOBOL, and PASCAL. The relationship among languages, hardware, and applications is studied in the light of the underlying concepts. Prer., C.S. 401 and C.S. 453.

C.S. 554-3. Numerical Applications of Digital Computers. (E.E. 554.) A survey of the types of digital computers useful for the execution of algorithms, for the solution of typical numerical problems encountered in science and engineering. Prer., Assembly Language and C.S. 310, 311 or C.S. 465.

C.S. 555-3. Non-Numeric Techniques for Digital Computers. (E.E. 555.) A study of the methods used in implementing processors for non-numeric problems: dynamic storage allocation, list processing, recursive programming, and string manipulation. Several special purpose languages and their implementations will be studied in detail. Prer., Assembly Languages and C.S. 401.

C.S. 556-3. Translation of Programming Languages. (E.E. 556.) A study of practical techniques for translating text generated by humans into programs understood by machines: Lexical, syntactic and semantic analysis, code generation, assembly and optimization, error reporting and recovery. Students write and run their own compilers. Prer., Assembly Language and C.S. 401 and C.S. 402.

C.S. 557-3. Operating Systems. (E.E. 557.) A study of the supervisory programs within a computer system which interact most closely with the hardware, and which allow efficient and shared access to the computer. Topics covered include processes (communication, implementation, synchronization), memory management (storage allocation, virtual memory), and processor management (multiprogramming, timesharing, scheduling). Prer., C.S. 401 or C.S. 553, C.S. 445, and C.S. 583 or E.E. 551, consent.

C.S. 558-3. Artificial Intelligence. (E.E. 558.) The design of machines and systems that have been created to perform tasks that are considered to require intelligence. Prer., C.S. 210 and 401.

C.S. 560-3. Numerical Analysis I. (Math. 560.) Solution of linear systems, least squares approximations, nonlinear algebraic equations, interpolation, and quadrature. Prer., Math. 442, 313, C.S. 210.

C.S. 561-3. Numerical Analysis II. (Math. 561.) Solution of ordinary and partial differential equations; matrix eigenvalue eigenvector problems. Prer., C.S. 560.

C.S. 562-3. Numerical Solution of Initial Value Problems. (Math. 562.) Multi-step and single step methods for ODE. Stability. Stiff equations. Difference schemes for heat and wave equations. Applications. Prer., C.S. 465 or 560.

C.S. 563-3. Numerical Solution of Boundary Value Problems. (Math. 563.) Finite difference solution of two point boundary problems and elliptic problems. Methods of SOR, ADI, conjugate gradients. Finite element method. Nonlinear problems. Applications. Prer., C.S. 465.

C.S. 564-3. Numerical Linear Algebra. (Math. 564.) Direct and iterative solution of linear systems. Eigenvalue and eigenvector calculation. Error analysis. Reduction by orthogonal transformation. Prer., C.S. 465 or 560, Math. 313.

C.S. 565-3. Numerical Methods for Optimization. (Math. 565.) Linear programming. Unconstrained minimization, one dimensional search, gradient methods. Nonlinear and quadratic programming. Prer., C.S. 465 or 560, Math. 313.

C.S. 566-3. Numerical Methods for Data Analysis. (Math. 566.) Least squares fitting. Singular value decomposition. Fourier analysis of data. Surface fitting. Applications. Prer., C.S. 565 or 560, Math. 313, 481, or 482.

C.S. 567-3. Introduction to Approximation Theory. (Math. 567.) Normed linear spaces, convexity, existence and unicity of best approximations. Tchebycheff approximation by polynomials and other related families. Least square approximation and related topics.

C.S. 569-3. Numerical Methods for Nonlinear Optimization. Modern computational methods for the solution of unconstrained and constrained optimization problems, nonlinear least squares, and systems of nonlinear equations. Techniques for building algorithms to solve problems with special structure. Prer., linear algebra, multidimensional calculus.

C.S. 580-3. Operating Systems Practicum. An advanced workshop in operating systems design and implementation. Members of the class will participate in the design, development, programming, and debugging of various modules of an operating

system for a local computer. Emphasis is placed upon good design methodologies and operating systems implementation techniques. Prer., C.S. 557 or consent of instructor.

C.S. 581-3. Data Management and File Systems. Design and evaluation of storage and retrieval systems, and generalized data management systems. Examples of systems, query languages, secondary storage devices. File organization—tree hash directories, list approaches, inverted list. Security, recovery simultaneity. Case studies of various systems. Prer., C.S. 401.

C.S. 582-3. Software Engineering. First-hand study of some of the problems connected with the development of large programs. Students either individually or in small groups will be involved in the actual design and development of modules for a large software system. Prer., C.S. 453, but languages other than assembly code will be used as required.

C.S. 583. System Programming. Input/output techniques for sequential and direct access devices on a minicomputer system. Other topics include microprogrammed control units, text editor design, subprogram linkages, coroutines, recursion, and reentrant programming. Prer., C.S. or E.E. 453 or equivalent.

C.S. 599-1 to 6. Independent Study in Computer Science (Upper Division). This course provides opportunities for independent study, work on a small research problem, or tutoring of lower division computer science students. Prer., C.S. 201.

C.S. 611-3. Topics in Computer Graphics. Computer graphics hardware: printers, incremental plotters, microfilm, storage CRTs, and refreshed CRTs. Computer graphics software: special and general purpose subroutine packages, graphics languages, and data structures. Special problems: perspective viewing, hidden lines, windowing, and man-machine engineering. Prer., advanced programming ability.

C.S. 612-3. Topics in Operating Systems. Topics to be selected by instructor. Possible topics are: system design, measurement and evaluation, simulation, mathematical modeling, and parallelism. Prer., C.S. 557.

C.S. 613-3. Topics in Programming Languages. Topics to be selected by instructor. Possible topics are: syntax, semantics, meta-compilers, compiler design, and translator writing systems. Prer., C.S. 401.

C.S. 614-3. Topics in Computer Systems. Topics to be selected by instructor. Possible topics are: on-line systems, multi-processing microprogramming, architecture, data communications, and computing networks. Prer., C.S. 402.

C.S. 615-3. Topics in Formal Systems. Topics to be selected by instructor. Possible topics are: formal languages, abstract machines, combinatorics, finite mathematics, and algorithm analysis.

C.S. 616-3. Topics in Data Processing. Topics to be selected by instructor. Possible topics are: computing center management, information retrieval, data base security, commercial systems, system evaluation and selection, economics of large scale systems.

C.S. 617-3. Topics in Numerical Mathematics. Topics to be selected by instructor. Possible topics are numerical linear algebra, solution of differential equations, nonlinear algebra and optimization, data fitting, linear and nonlinear programming, solution of large problems. Prer., none.

C.S. 665-3, 666-3. Advanced Numerical Analysis. (Math. 665, 666.) Prer. for C.S. 665, C.S. 566; for C.S. 666, C.S. 665.

C.S. 700-6. Master's Thesis.

C.S. 701-3. Master's Reading Option. An alternative to the master's thesis. Students will read selected papers and pass an examination.

C.S. 710-3. Doctoral Preliminary Seminar. A seminar course required of all doctoral students. Students will demonstrate their research ability by investigating and reporting on current and open problems in computer science. Prer., admission to the Ph.D. program.

C.S. 800-1 to 6. Doctoral Research. An investigation in some specialized field of computer science. Approved and supervised by faculty members. Courses of special interest in computer applications outside of the Department of Computer Science are: Psy. 403, 503, Soc. 523, Soc. 529, M.Sc. 445, Mg.Sc. 625, and Mg.Sc. 635.

ECONOMICS

Econ. 100-3. An Introduction to the Social System. (Soc. 100.) An elementary sociological and economic analysis of society, using social indicators, demographic data, and simulations as the principal tools of analysis.

Econ. 151-3. Economic History of Europe. Historical interplay of democratic spirit and "capitalistic" spirit of economic organization. Evolutionary view of modern political economies in Europe.

Econ. 152-3. Economic History of the U.S. Continuation of Econ. 151, with emphasis on the U.S. Course may be taken independently for credit.

Econ. 153-3. Current Economic Problems. An introduction to the major concepts of economics and how they are applied to such problems as population, poverty, urban economic and social choices that face the American people in the light of limited resources.

Econ. 199-3. Independent Study for Lower Division Students. This course is intended as a concurrent supplement to other lower division economics courses to enable the student to pursue special topics which interest him, in a tutorial-size class. Consent of instructor and department required.

Econ. 200-3. Encounters With Economics. An experimental course for students with little or no formal background in economics. This course will introduce the students to the issues of our economic system and the analytical tools of the discipline.

Econ. 201-3. Principles of Economics I. An overview of the economy by examining the flow of income and GNP, the factors determining the level of employment, income, money, credit, and prices.

Econ. 202-3. Principles of Economics II. The operation of the price system as a major organizer of the economy. Elementary theory, problems, and public policy of competition, monopoly, distribution of income, and international economic relations.

Econ. 232, 233, 234, 235, 236, 237. Mini-Courses in Selected Economic Topics. This is a series of mini-courses, each carrying 1 hr. credit. Specific topics to be given each semester will be announced in the course schedule.

Econ. 250-3. Capitalism and Slavery I. (Bl.St. 250.) The development of slavery as an American institution from 1619 to 1870, the plantation system, the growth of the slave trade, the stimulation of the American economy by slavery, the Civil War as an economic conflict between the industrialists of the North and the agriculturalists of the South.

Econ. 310-3. Introduction to Radical Political Economy. Introduction to economic thinking. Development of a framework of political economy which analyzes the historical development of society and capitalism, the position of individual persons and social relationships in the productive process, the macroeconomic functioning of the system, the role of the state, and the future of capitalism.

Econ. 311-4. Economics and the Social Sciences: Foundations of the Curriculum. A two-semester sequence designed to present structures of key concepts in anthropology, economics, law, political science, social psychology, and sociology; to afford students opportunities to apply the concepts to contemporary issues; and to treat these multidisciplinary concepts as sources for social studies curriculum in the schools.

Econ. 312-4. Economics and the Social Sciences: Foundations of the Curriculum. Continuation of Econ. 311. Prer., Econ. 311.

Econ. 320-3. Women and Economics. The course explores the historical development of economic thought about women as economic agents, examines competing theories of discrimination against and work roles of women today, presents empirical facts of women's position today. Prer., Econ. 201 and 202.

Econ. 381-3. Introduction to Economic Statistics. Introduction to statistical methods and their application in quantitative economic research. Prer., Math. 107 and 108; Econ. 201 and 202.

Econ. 405-3. Principles and Applications of Economic Theory. An introduction to micro and macro theory for M.B.A. candidates and upper division students not majoring in economics. No credit for students with credit in Econ. 201 and 202. Prer., Math. 108, upper division status.

Econ. 407-3. Intermediate Microeconomic Theory. Production, price, and distribution theory. Study of value and distribution theories under conditions of varying market structures, with special reference to the contributions of modern economic theorists. Course may be taken independently for credit.

Econ. 408-3. Intermediate Macroeconomic Theory. National income and employment theory. Primary emphasis placed on determination of the levels of employment and prices. Within the framework of a general equilibrium macroeconomic model theories of consumption, investment, and money are considered. The problems of unemployment and inflation are analyzed and appropriate monetary and fiscal policies considered.

Econ. 411/511-3. Monetary and Banking Systems. Survey of major monetary and financial institutions, such as commercial banks, Federal Reserve System, and savings institutions, and the structure of debt from the standpoint of how their operation affects the money supply and its circulation.

Econ. 412/512-3. Monetary Theory and Policy. Theories of inflation and deflation and their effects upon economic growth and prosperity. Goals of monetary policy, problems involved in trying to achieve these goals, survey of some recent monetary policies in action. Prer., Econ. 411/511.

Econ. 415/515-3. Great Books of Economics. A study of economic principles as developed in the original works of great writers, especially Adam Smith and David Ricardo.

Econ. 416-1 to 3. Major Concepts in Economics and the Social Sciences I. Course for classroom teachers focusing on major concepts and generalizations of economics and other social sciences, including highlights of current research in each discipline. The concepts and generalizations are applied to current social problems.

Econ. 417-1 to 3. Major Concepts in Economics and the Social Sciences II. Continuation of Econ. 416.

Econ. 418-1 to 3. Major Concepts in Economics. Course for classroom teachers focusing on major concepts and generalizations of economics, including highlights of current research. These concepts and generalizations are applied to current economic and social problems.

Econ. 421/521-3. Public Finance I. Taxation, public expenditures, debts, and fiscal policy. Role of public finance in times of peace and war. National, state, and local taxation, with some special attention to the State of Colorado.

Econ. 422/522-3. Public Finance II. Continuation of Public Finance I. Either course may be taken separately.

Econ. 425/525-3. Urban Economics. Analysis of the level, distribution, stability, and growth of income and employment in urban regions. The topics of urban poverty, housing, land use, transportation, and local public services are examined, with special reference to economic efficiency and social progress.

Econ. 432, 433, 434, 435, 436, 437. Mini-Courses in Selected Economic Topics. A series of mini-courses, each carrying 1 hr. credit. Specific topics to be given each semester will be announced in the course schedule.

Econ. 441/541-3. International Trade. Theories of interregional and international trade, private and public trade, world population and resources, tariffs and commercial policy, international economic organization.

Econ. 442/542-3. International Finance. Foreign exchange, theories of adjustment disequilibria in the international balance of payments, international investment, international monetary and banking organizations.

Econ. 450/550-3. Economic History of Africa, Asia, and Latin America. History of trade, commercial policies, banking and financing, throughout colonial and precolonial periods, until the present date. Special attention to the effects of colonialism and other relationships with industrialized countries on economic development. This course serves as background for other courses in area studies and economic development.

Econ. 451/551-3. Economic History of Europe. Evolution of industrial society with emphasis on its growth and development from colonial times to the present.

Econ. 452/552-3. Economic History of the United States. American economic organization and institutions and their development from colonial times to the present.

Econ. 453/553-3. Natural Resource Economics. An analysis of problems associated with socially optimal use of renewable and nonrenewable natural resources over time. Problems of common property resources, irreversible forms of development, and preservation of natural area. Prer., Econ. 202 and Econ. 480/580 or equivalents.

Econ. 454-3. Environmental Economics. Effects of economic growth on the environment; application of economic theory of external diseconomies, cost-benefit analysis; program budgeting and welfare economics to problems of the physical environment. Prer., Econ. 202, 480/580 or equivalents.

Econ. 456/556-3. Agricultural and Rural Economics. Analysis of the rural sector and related problems and policies; economics of agriculture, agribusiness, and rural-urban relations; role of agriculture in economic development.

Econ. 458/558-3. Comparative Agricultural Systems and Development. Organization of agriculture and policies relating to the rural economy in different countries. Examination of such topics as the world food problem, rural population trends, land reform programs, agricultural technology, and rural-urban development strategies.

Econ. 461/561-3. Labor Economics. Determination of wages, hours, and working conditions in the American economy. Includes economic effects of trade unionism and other social institutions that have been developed to promote equality of bargaining power between labor, management, and the public.

Econ. 469/569-3. Government and Business in the Economy. An analysis of the roles of business and government in the economy, in the light of the performance of a theoretical free-market system, departures of real economies from the free-market model, and the economic goals of society.

Econ. 471/571-3. Comparative Economic Systems. Critical study of socialism, capitalism, communism, utopianism, syndicalism, cooperatives, and other proposed economic systems.

Econ. 476/576-3. Economics of the Public Service Industries. Public policy issues in the regulated industries: transportation, communications, electricity, and gas.

Econ. 477/577-3. Economic Development: Theory and Problems. Theoretical and empirical analysis of problems of economic development in both underdeveloped and advanced countries.

Econ. 478/578-3. Policies of Economic Development. Current conditions and policies of national and international economic development with emphasis on accelerating and maintaining economic and social growth.

Econ. 480/580-3. Introduction to Mathematical Economics. Introduction to the use of mathematics in economics research. Prer., Math. 107 and 108; Econ. 201 and 202.

Econ. 481/581-3. Introduction to Econometrics. The application of statistical techniques to estimating and testing economic theories. The multiple regression model and problems encountered in its application are developed in lecture and individual applied projects.

Econ. 486/586-3. Economic Development Planning and Project Analysis. A study of the techniques of economic programming and planning in less developed countries, including an understanding of such economic data as national income and product accounts, monetary accounts, balance of payments, government budgets, and input-output tables, all with reference to the techniques of economic planning. The students will form teams to prepare a mock economic plan for some less developed country. Prer., Econ. 381.

Econ. 489/589-3. The Economics of Africa and the Middle East. Current problems of development faced by African and Middle Eastern economies. Emphasis on case studies, regionalism, planning, and the ramification of economic change.

Econ. 494/594-3. General Social Dynamics. The development of a general theory of the dynamic processes of the total social system.

Econ. 498/598-3. Senior Seminar: Research on Contemporary Economic Problems. Prer., Econ. 381, 407, 408/508, 480/580, or consent of instructor.

Econ. 499/599-variable credit. Independent Study. Consent of instructor and department required.

Econ. 507-3. Applied Economics Theory. Course develops competence in techniques of applied micro/macro theory for those going

directly into policy and problem solving jobs. Topics include estimating demand, cost, and production functions; operational models of production, processes from industry/agriculture, capital theory with resource applications, benefit-cost analysis. Prer., Econ. 407, 408, 480/580 or equivalent.

Econ. 535-2. Calculus for Economists. Partial derivatives and their applications to economics; optimization, both unconstrained and constrained; matrices and determinants. Course is normally included in Economic Institute's summer offerings. Prer., Econ. 480 or equivalent, plus consent of director of Economics Institute if taught by institute faculty.

Econ. 536-2. Econometrics. The single equation regression model with two or more variables, least squares estimators and their properties, problems in single equation regression estimation, and the simultaneous equation model. Course is normally included in Economics Institute summer offerings. Prer., Econ. 381 or equivalent, plus consent of director of Economics Institute.

Econ. 537-2. Advanced Intermediate Microeconomic Theory. Production and cost theory, theory of monopoly, monopolistic competition and oligopoly, distribution theory, and general equilibrium and welfare economics. Course is normally included in Economics Institute's summer offerings. Prer., Econ. 407 and Econ. 535 or equivalents, plus consent of director of Economics Institute.

Econ. 538-2. Advanced Intermediate Macroeconomic Theory. A brief review of intermediate theory and advanced theory of modern inflation. Course is normally included in Economics Institute's summer offerings. Prer., Econ. 408 and Econ. 535 or equivalents, plus consent of the director of the Economics Institute. Econ. 535 may be taken concurrently.

Econ. 600-3. History of Economic Thought. Advances the student's cultural appreciation of the technical apparatus of current economic concepts. Students read in the original texts of certain great economic writers from the industrial revolution to the 1920s. Secondary sources will be used in some instances.

Econ. 601-3. Microeconomic Theory I. Recent and contemporary literature on fundamentals of economic theory. Consideration of value theory with particular emphasis on methodology, theory of demand, theory of the firm, and theory of distribution.

Econ. 602-3. Macroeconomic Theory I. Considers the theory of aggregate analysis and accompanying policy implications. A general equilibrium model is constructed and applied to the problems of unemployment, inflation, and growth. Particular emphasis is given to theories of consumption, investment, and the supply of and demand for money.

Econ. 603-3. Microeconomic Theory II. Continuation of Econ. 601.

Econ. 604-3. Macroeconomic Theory II. Continuation of Econ. 602.

Econ. 607-3. Mathematical Economics—Statics. Mathematical foundations of theories of consumption, production, and general equilibrium. Topics in linear, nonlinear programming, input-output analysis, game theory, and welfare economics. Prer., consent of instructor.

Econ. 608-3. Mathematical Economics—Dynamics. Mathematical exposition of contemporary macro- and microdynamics. Neoclassical and linear models. Topics in efficient and optimal growth, growth and fluctuations, stabilization and control policies. Prer., consent of instructor.

Econ. 609-3. Social Economics. How economics have taken changing environmental circumstances into account by treating economic institutions (collective rules for individual action) as variables, rather than as constants, in the total equation of economic life. Institutional value determination, such as made under collective bargaining between labor and management and by other methods of countervailing power negotiations, will illustrate the nature and method of social economics.

Econ. 621-3. Seminar: Public Finance. Advanced study of theory and problems of public expenditures, revenues, budgets, and debt, including a detailed examination of the economic effects of taxation on resource allocation, production, and distribution.

Econ. 622-3. Seminar: Fiscal Policy. Continuation of Econ. 521. A critical analysis of fiscal policy with emphasis on problems of economic stability, growth, and employment. Either course may be taken independently for credit.

Econ. 625-3. Urban and Regional Economics: Theory and Methods. Course covers basic theories in spatial location of

economic activity and land use and surveys techniques developed to analyze, measure, and predict regional and urban structure and growth, such as economic base studies, regional social accounts, input-output analysis. Prer., Econ. 425/525 or consent of instructor.

Econ. 629-3. The Economics of National Security. National defense as an economic problem, concepts of efficiency in using resources for defense, strategy and resource allocation, institutional structures, defense spending and impacts on the American economy.

Econ. 631-4. Teaching College Economics. The seminar will explore a variety of topics applicable to the study and teaching of economics. The main emphasis will be on themes, topics, and strategies most appropriate to motivate students' interest in economics.

Econ. 635-2. Mathematics for Economists: Special Topics. Development of selected topics and applications in mathematics for economists and especially linear algebra and/or differential equations. Prer., Econ. 480/580 or equivalent, plus consent of director of the Economics Institute if taught by institute summer faculty.

Econ. 636-2. Statistics for Economists: Special Topics. Development of selected topics in statistics and their applications to economic research. Prer., Econ. 381 or equivalent, plus consent of director of Economics Institute if taught by institute summer faculty.

Econ. 637-2. Microeconomic Theory: Special Topics. Development of selected topics in microeconomic theory and their applications to economic policy. Research paper required of all participants. Prer., Econ. 407 or equivalent, plus consent of director of Economics Institute if taught by institute summer faculty.

Econ. 638-2. Macroeconomic Theory: Special Topics. Development of selected topics in macroeconomic theory and their applications to economic policy. Research paper required of all participants. Prer., Econ. 408/508 or equivalent, plus consent of director of Economics Institute if taught by institute summer faculty.

Econ. 641-3. Seminar: International Trade Theory. Contemporary and classical literature on theories of international trade.

Econ. 642-3. International Finance Seminar. Foreign exchange markets, past and current international monetary mechanisms, and the processes of adjustment. Plans for international monetary reform. International monetary and banking institutions. Prer., Econ. 441/541 and 442/542.

Econ. 643-3. Seminar: International Economic Policies. Examination of current international issues involving trade, aid, investment, factoral movement, exchange-rate, and balance-of-payments policies of various nations.

Econ. 651-3. Seminar: Economic History I. Advanced study of economic development of the North Atlantic economy and problems of historical research method.

Econ. 653-3. Seminar: Natural Resources Economics. An analysis of problems associated with socially optimal use of renewable and non-renewable natural resources over time. Problems of common property resources, irreversible forms of development, and preservation of natural areas. Prer., Econ. 407, 408, and 480/580 or consent of instructor.

Econ. 654-3. Seminar: Environmental Economics. Theory of externalities: alternative policies for environmental management, taxes, subsidies, standards, pollution rights; industry models, regional models; macro-impacts of environmental policies; trans-boundary problems; preservation/development. Prer., Econ. 480/580, 507, or consent of instructor.

Econ. 656-3. Agriculture and Agribusiness. Analysis of agricultural supply and marketing processes and their interrelations with farming enterprises in industrial and developing economies; the management of farm and farm-related enterprises; commodity markets; government and agriculture.

Econ. 658-3. World Agriculture. World food and raw material needs and production capabilities; comparative agricultural systems and policies in relation to economic development; international trade in primary products.

Econ. 666-3. Seminar: Human Resources. The economics of investment in human capital including the economics of poverty and the application of cost-benefit analysis to social welfare programs.

Econ. 667-3. Seminar: Labor Market Policies. Economic analysis of wage determination and labor market operation. Detailed study

of the supply and demand for labor under competitive and non-competitive conditions; concentration on level and structure of wage rates, bargaining theory, discrimination, unions, labor mobility and migration, unemployment, and inflation.

Econ. 668-3. Seminar: Labor Markets, Industrial Organization, and Public Policy. Microanalysis of market and institutional determinants of wage structures, inflation, and unemployment with attention to organizational theory and the interactions among labor markets, product markets, and public policies.

Econ. 670-3. Topics in Urban and Regional Economics. Investigates various theoretical topics in urban and regional economics and focuses on policy issues. Course format will involve student research and presentations throughout the terms. Prer., Econ. 625.

Econ. 672-3. Comparative Economic Systems. Comparative analysis of the economic systems of different countries and stages of development; interrelations with the production and distribution of wealth and with systems of property; contemporary approaches to economic planning and economic integration.

Econ. 674-3. Comparative Industrial Organization and Planning. A study of the ways in which economic decisions are made and implemented under various patterns of industrial organization, ranging from those relying heavily on the price system to those employing a high degree of centralized planning.

Econ. 675-3. Seminar: Industrial Organization and Control. The large firm in relation to its rivals, suppliers, and customers (theory and industry studies); social control of business through antitrust and other government regulation.

Econ. 677-3. Economic Planning and Development. Deals with role of planning in economic development with particular reference to investigation of planning problems in Southeast Asia and the Middle East.

Econ. 678-3. Economic Development: Problems. Seminar in theory and practice of economic development. Topics include international poverty and inequality, dualistic development, employment mobilizing and allocating resources, human-resource development, sectoral development, planning and policymaking. Prer., Econ. 407, 408; prer. or coreq., Econ. 478-578.

Econ. 679-3. The Economics of Energy and Development. A general survey seminar which covers the economics dominating the field of energy, investigating alternative sources with the economic ramifications of each, and the economics of the logistical and ecological problems involved, related to the role of energy in economic growth of both developed and developing countries and the issues of scarcity, conservation, and imports.

Econ. 681-3. General Economics Statistics I. Application of statistical inference to economic research. Principal topics are probability theory, statistical inference, and regression analysis.

Econ. 690-3. Seminar: Economic Problems. Special problems in economic theory and in contemporary economic affairs.

Econ. 691-3. Water Resources Development and Management. An examination of the economics and engineering principles governing water planning and development. Application of benefit-cost analysis and optimization techniques of design of water systems. Relationship to national planning and growth. Prer., Econ. 407 and facility in calculus and linear algebra.

Econ. 699-variable credit. Independent Study. To be arranged with individual faculty members.

Econ. 707-3. Seminar: Mathematical Economics. Selected topics on mathematical approaches to demand and production theory, general equilibrium theory, and theory of capital accumulation and economic growth. Emphasis on periodical literature. Prer., Econ. 607, 608 or equivalent.

Econ. 710-3. Seminar: The Social Framework of Economic Policy. A study of the processes of society by which economic policy is formulated, evaluated, and carried out. Prer., Econ. 601, 602.

Econ. 711-3. Advanced Monetary Theory. Major contribution to monetary and banking theory up to the present day.

Econ. 712-3. Contemporary Monetary Theory and Policy. Continuation of Econ. 711. Modern-day monetary thinking and policy.

Econ. 732-4. Seminar: Teaching of College Economics. Open to those students who designed Econ. 200 during fall semester in Econ. 631: appraise the quality of the past week's teaching, discuss strategies and materials to be used, design modes of evaluation, and

conduct the evaluation of the experimental course and discuss the results.

Econ. 783-3. Seminar: Econometrics. Theory, construction, and testing of generalized, linear, single-equation, and simultaneous equations models.

Econ. 784-3. Seminar: Mathematical Economics and Econometrics. Advanced topics in econometrics and mathematical economics.

ENGLISH

Engl. 100-3. Exposition I. See A.S. 100-103.

Engl. 101-3. Exposition II. See A.S. 110.

Engl. 119-3. Introduction to Creative Writing. Each student's own creative writing will receive attentive individual scrutiny. In addition, the course will include close reading of the work of other students and of professional writers.

Engl. 120-3. Introduction to Fiction. Reading and analysis of short stories and novels.

Engl. 130-3. Introduction to Drama. (Thtr. 111.) Reading and analysis of plays.

Engl. 140-3. Introduction to Poetry. Reading and analysis of poetry.

Engl. 160-3. Great Books. Close study of literary classics of Western civilization: the *Odyssey* or *Iliad*, Greek drama, and several books of the Bible. Not open to students who have credit in Hum. 101, 102.

Engl. 161-3. Great Books. Close study of literary classics of Western civilization: selected dialogues of Plato, one work of Latin literature, Dante's *Inferno*, and a few works of other writers such as Cervantes, Molière, and Goethe. Not open to students who have credit in Hum. 101, 102.

Engl. 180-3. Spoken English for Foreign Students. Oral drills with the goal of promoting fluency and listening comprehension. Prer., consent of instructor. Will not fulfill humanities or major requirements.

Engl. 181-3. Advanced Spoken English for Foreign Students. Continued practice in speaking and listening comprehension, with attention to grammar and pronunciation as well as meaning and appropriateness. Prer., consent of instructor. Will not fulfill humanities or major requirements.

Engl. 182-3. Written Composition for Foreign Students. Distinction between spoken and written English and an emphasis on the grammar and vocabulary of the latter. Prer., consent of instructor. Will not fulfill humanities or major requirements.

Engl. 183-3. Advanced Written Composition for Foreign Students. Continued work on grammar and vocabulary but with greater focus on the mechanics of writing and organization of material for longer connected discourse. Prer., consent of instructor. Will not fulfill humanities or major requirements.

Engl. 198-3. Introduction to English Studies. An introduction to the skills, theories, and values of literary study.

Engl. 199-variable credit. Independent Study.

Engl. 200-3. Critical Writing. Practical criticism of novels, poems and plays, with emphasis on written work. Introduction to and practice in using various critical approaches to works of literature. Prer., Engl. 198.

Engl. 202-3. Introductory Poetry Workshop. An introductory course in poetry writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (five-seven poems). May be taken up to three times for credit.

Engl. 205-3. Introductory Fiction Workshop. An introductory course in fiction writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (one short story). May be taken up to three times for credit.

Engl. 220-3. Modern Short Story. Close reading of selected short stories with emphasis on new tendencies.

Engl. 221-3. Science Fiction. Readings in classical and popular science fiction.

Engl. 222-3. Introduction to Folklore. A cross-cultural introduction to folklore and folklife, examining forms, values, and functions.

- Engl. 225-3. Film Narrative.** A survey of the various types of film narrative, focusing on American and international classics of the sound era. The films will be studied within a context of filmic and more general aesthetic theories and in many cases compared and contrasted with their original literary bases, in order to explore the changing values of narrative art.
- Engl. 226-3. Images of Women in Literature.** A survey of images of women in English Literature from the Middle Ages to the present.
- Engl. 230-3. Introduction to Theatre and Dance.** (Th.Dn. 270.)
- Engl. 252-3. Major British Authors.** An extensive study of a small number of major works of British literature.
- Engl. 253-3. Major British Authors.** Continuation of Engl. 252, but may be taken independently of that course.
- Engl. 261-3. Contemporary Literature.** Close study of significant modern poetry, drama, short stories, novels, and critical commentary. Most of the works will range from the Thirties to our own day and will include European and American authors.
- Engl. 265-3. Masterpieces of American Literature.** Close reading and analysis of American literary classics: novels, poems, plays, and essays of the 19th and 20th centuries.
- Engl. 266-3. Masterpieces of American Literature.** Continuation of Engl. 265, but may be taken independently of that course.
- Engl. 267-3. Contemporary American Literature.**
- Engl. 270-3. Introduction to African Literature.** (Bl.St. 260.)
- Engl. 272-3. Survey of Afro-American Literature.** (Bl.St. 232.)
- Engl. 273-3. Survey of Afro-American Literature.** (Bl.St. 233.) Continuation of Engl. 272 but may be taken independently of that course.
- Engl. 274-3. The American Writer and the Black Man.** Close reading and analysis of significant literary works by 19th and 20th century black or white American writers treating black Americans: novels, poems, plays, and essays.
- Engl. 275-3. The American Writer and the Black Man.** Continuation of Engl. 274 but may be taken independently of that course.
- Engl. 276-3. The Native American in American Literature.** This course surveys traditional and contemporary Indian literature, demonstrating its relationship to American literature; that is, its influence as source material for other American writers as well as its unique qualities of style which are consistent with the distinction of cultural perspective.
- Engl. 277-3. The Native American in American Literature.** Continuation of Engl. 276.
- Engl. 278-3. Chicano Literature.** A study of Chicano thought as expressed in literature from the era of the pre-Columbian Indians of Mexico to contemporary Chicano literature.
- Engl. 279-3. Chicano Literature.** Continuation of Engl. 278.
- Engl. 280-3. Mexican American Literature: Literature of Protest.** (M.A. 216.)
- Engl. 290 to 298-3. Studies in Literature.** A study of a special literary topic or major author.
- Engl. 302-3. Intermediate Poetry Workshop.** An intermediate course in poetry writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (five-seven poems). May be taken up to three times for credit.
- Engl. 305-3. Intermediate Fiction Workshop.** An intermediate course in fiction writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (one short story). May be taken up to three times for credit.
- Engl. 315-3. Report Writing.** Instruction and practice in various forms of reports, papers, and articles. Style and editing are emphasized.
- Engl. 322-3. Intermediate Folklore.** Studies in folklore and folk motifs, particularly in literature.
- Engl. 325-2 or 3. Summer Writers' Conference.** A ten-day summer workshop of instruction in writing fiction, poetry, and plays; staffed by well-known authors and poets.
- Engl. 326-3. Women Writers.** An introduction to British and American literature by women.
- Engl. 330-3. Backgrounds of English and American Literature.** The literary, philosophic, and religious traditions of the Greco-Roman and Judeo-Christian worlds: close analysis of major texts in translation. Comparison of ancient and modern texts will be made where feasible.
- Engl. 347-3. History of Literary Theory and Criticism I.** With a preliminary look at the relevant texts of Plato, Aristotle, and Longinus, this course will concentrate on Medieval, Renaissance, and 18th-century poetics.
- Engl. 348-3. History of Literary Theory and Criticism II.** A survey of Romantic and Victorian theories of literature and criticism, concluding with an introduction to 20th-century approaches.
- Engl. 350-3. Survey of British Literature.** Chronological study of the greater figures and forces in the mainstream of English literature from the beginnings until 1700.
- Engl. 351-3. Survey of British Literature.** Continuation of Engl. 350.
- Engl. 365-3. Survey of American Literature.** Chronological survey of the literature from Bradford to Whitman.
- Engl. 366-3. Survey of American Literature.** Chronological survey of the literature from Whitman to Faulkner. Continuation of Engl. 365.
- Engl. 368-3. Twentieth-Century American Literature.** Reading course in American novelists, poets, and dramatists of the 20th century. Primarily for nonmajors.
- Engl. 370-3. Development of Caribbean Literature.** (Bl.St. 385.) See Black Studies.
- Engl. 380-3. Introduction to General Phonetics.** (Phon. 304.) See Communication Disorders and Speech Science.
- Engl. 382-3. Studies in Language.** Intensive study of special topics in the English language.
- Engl. 390, 391, 392, 393-3. Studies in Literature.** A study of a special literary topic or major author.
- Engl. 394-3. The Bible as Literature.** Survey of literary achievements of the Hebrews, as represented by the King James Bible—The Old Testament.
- Engl. 395-3. Chaucer: The Canterbury Tales.** A study of Chaucer's major works with emphasis on *The Canterbury Tales*. Reading will be done in Middle English. A short introduction to the language will precede study of the poetry.
- Engl. 397-3. Shakespeare.** Development of Shakespeare as a dramatist to 1600.
- Engl. 398-3. Shakespeare.** Shakespeare's art at its maturity.
- Engl. 399-3. Milton.** Milton's poetry and selected prose.
- Engl. 400-3. Literature and Psychology.** Critical application of basic concepts of dynamic depth psychology (Freud, Erikson, Hartman, Kris, et al.) to masterpieces of American, English, and world literatures (latter in translation). Emphasis placed upon the dynamic interplay of conscious and unconscious motivations of fictional characters.
- Engl. 402-3. Advanced Poetry Workshop.** An advanced course in poetry writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (five-seven poems). May be taken up to three times for credit.
- Engl. 405-3. Advanced Fiction Workshop.** An advanced course in fiction writing, this is an intensive workshop with enrollment limited to 16. Admission requirements: consent of instructor based on submission of manuscript (one short story). May be taken up to three times for credit.
- Engl. 408-3. Playwriting: Short Form.** (Thtr. 475.)
- Engl. 409-3. Playwriting: Long Form.** (Thtr. 485.)
- Engl. 419-3. Advanced Shakespeare.** For advanced students only. Close readings of works spanning Shakespeare's career.
- Engl. 420-3. Development of the English Novel.** From the beginnings to 1830.
- Engl. 421-3. Development of the English Novel.** Continuation of Engl. 420.
- Engl. 422-3. Modern British and Irish Novel.** A study of major figures and trends in the 20th century.
- Engl. 423-3. American Novel.** From the beginnings to 1900.
- Engl. 424-3. American Novel.** From 1900 to the present.
- Engl. 425-3. Modern Novel.** A close study of masterpieces by such novelists as Proust, Joyce, Woolf, Lawrence, Mann, Kafka,

Faulkner, and Nabokov from a comparative perspective. Close attention to forms, themes, and ideas characteristic of the modern period.

Engl. 426-3. Contemporary Novel. A study of the major novelists and developments in the genre, with emphasis on novels written since 1945.

Engl. 430-3. Development of British Drama. From beginning to the closing of the theatres in 1642.

Engl. 431-3. Development of British Drama. From 1660 to the present.

Engl. 432-3. Elizabethan and Jacobean Drama. Representative non-Shakespearean plays of the period.

Engl. 433-3. Restoration Drama. Intensive study of British plays, 1660-1700.

Engl. 434-3. Modern British and Irish Drama. A survey of the English-Irish theatre since 1900.

Engl. 435-3. American Drama. Famous American plays from O'Neill to the present.

Engl. 436-3. Modern Drama. Continental, British, and American drama since Ibsen.

Engl. 437-3. Contemporary Drama. Continuation of Engl. 436.

Engl. 440-3. Philosophy and Literature. (Phil. 473.) See Philosophy.

Engl. 442-3. Renaissance Poetry. Nondramatic poetry of Sidney, Spenser, Marlowe, Shakespeare, and others.

Engl. 443-3. Modern British and Irish Poetry. A study of the major figures and trends to 1945.

Engl. 444-3. American Poetry. American poetry from its beginnings into the 19th century.

Engl. 445-3. Modern American Poetry. A study of major figures and trends in 20th-century American poetry up to 1945.

Engl. 446-3. Modern Poetry. A study of the major British and American modern poets, with emphasis on those who did their most significant work between 1900 and 1945: Yeats, Pound, Eliot, Stevens, Auden, Williams, Moore, Crane, and Thomas (exact list varies with instructor).

Engl. 447-3. Contemporary Poetry. A study of poetry written since 1945.

Engl. 449-3. Problems in Literary Theory and History. This course investigates a particular topic in depth. Topic varies.

Engl. 450-3. Medieval Literature I. An intensive study of the major literary works of the Middle Ages before 1066.

Engl. 451-3. Medieval Literature II. An intensive study of the major literary works of the Middle Ages after 1066.

Engl. 452-3. The Renaissance in England: 1500-1600. Selected prose and nondramatic poetry from Skelton and More through Shakespeare and his contemporaries.

Engl. 453-3. The Renaissance in England: 1600-1700. Selected prose and poetry in the period indicated.

Engl. 454-3. The Age of Satire: 1660-1740. Dryden, Defoe, Swift, Pope, Addison, and Steele and their contemporaries.

Engl. 455-3. The Age of Sense and Sensibility: 1740-1800. Gray, Johnson, Goldsmith, Boswell, Cowper, Burns, and Blake and their contemporaries.

Engl. 456-3. The Early Romantics. Major emphasis on Blake, Coleridge, and Wordsworth.

Engl. 457-3. The Later Romantics. Major emphasis on Keats, Shelley, and Byron.

Engl. 458-3. Prose of the English Romantic Period.

Engl. 460-3. The Early Victorians. Main currents of Victorian thought in prose and poetry, 1830-1860.

Engl. 461-3. The Later Victorians. Continuation of Engl. 458. 1860-1900.

Engl. 465-3. Studies in American Literature to 1900. An extensive study of particular periods and movements in American literature.

Engl. 466-3. Studies in American Literature after 1900. Continuation of Engl. 465.

Engl. 470-3. The African Novel. (Bl.St. 480.)

Engl. 471-3. Critical Approaches to African Literature. (Bl.St. 490.)

Engl. 472-3. Contemporary Afro-American Literature. (Bl.St. 476.)

Engl. 473-3. Contemporary Afro-American Literature. (Bl.St. 477.)

Engl. 474-3. The British Writer and the Black Man.

Engl. 475-3. The British Writer and the Black Man. Continuation of Engl. 474.

Engl. 480-3. (Writing.) Advanced Composition for Secondary School Teachers of English. (T.Ed. 445.)

Engl. 481-3. Literature for Adolescents. (T.Ed. 444.)

Engl. 482-3. Methods and Materials in English. (T.Ed. 452.)

Engl. 484-4. English Grammar and the History of the English Language. Study of history of the English language and of the various grammars of English.

Engl. 485-3. History of the English Language. Outline of history of the language, including a brief survey of sound changes affecting modern English, of history of grammatical forms, and of the vocabulary. Elementary knowledge of English grammar will be assumed. Not open to students who have taken Engl. 484.

Engl. 488-3. Structure of American English. Study of the sounds, grammar, vocabulary, and dialects of contemporary American English.

Engl. 489-3. Semantics. Study of meaning in English from both contemporary and historical view.

The following nine courses are open to senior English majors only.

Engl. 490-3. Seminar: Literary Topics. Study of such topics as satire, comedy, tragedy, American humor, the Mexican-American in American literature.

Engl. 491-3. Seminar: Literary Topics.

Engl. 492-3. Seminar: Literary Topics.

Engl. 493-3. Seminar: Literary Topics.

Engl. 494-3. Seminar: Literary Topics.

Engl. 495-3. Seminar: Major Authors. Intensive study of the works of one major British or American author.

Engl. 496-3. Seminar: Major Authors.

Engl. 497-3. Seminar: Major Authors.

Engl. 498-3. Seminar: Major Authors.

Engl. 499-variable credit. Independent Study.

Engl. 500-509-3. Studies in Major Authors. Individual British and American authors. (Author for a given semester to be specified in the *Schedule of Courses*.)

Engl. 510-519-3. Studies in Special Topics. Special topics in British and American literature.

Engl. 520-3. Studies in the 20th-Century Novel. In-depth analyses of novels that are significant in mainstream traditions or that display major departures. The novels are studied as art forms in specific cultural settings.

Engl. 521-525-3,6. Poetry Workshop. Designed to give students practical criticism of their poetry, and to develop a sense of critical standards. Admission by submission of manuscript and/or consent of instructor.

Engl. 522-3,6. Poetry Workshop. Continuation of Engl. 521.

Engl. 523-3,6. Fiction Workshop. Designed to give students practical criticism of their fiction and to develop a sense of critical standards. Admission by submission of manuscript and/or consent of instructor.

Engl. 524-3,6. Fiction Workshop. Continuation of Engl. 523.

Engl. 525-3,6. Summer Writers' Conference. Writing workshops in poetry, fiction, playwriting. Open to writers at all levels, beginning to experienced. Topics and instructors change each year.

Engl. 527-3. Recent Poetry. Covers poetry, mainly American, written since World War II, with emphasis on the contemporary and its roots in tradition. Focuses on problems in composition.

Engl. 529-3. Recent Fiction. Covers fiction, mainly American, written since World War II, with emphasis on the contemporary and its roots in tradition. Focuses on problems in composition.

Engl. 532-3. Elizabethan and Jacobean Drama. A study of the major dramatic writers (excluding Shakespeare) of the English Renaissance from 1580 to 1642. The course will include such playwrights as Marlowe, Jonson, Beaumont and Fletcher, Massinger, Middleton, Ford, and Shirley.

Engl. 537-3. Dramatic Structure: Comedy. Representative comedy from Aristophanes to the present. Structure and principles of comedy.

Engl. 538-3. Dramatic Structure: Tragedy. Representative tragedy from Classical Greece to the present. Structure and principles of tragedy.

Engl. 545-3. The Later Victorians. Covers the principal movements and developments of English literature in the latter half of the 19th century. Topics include the Pre-Raphaelite Brotherhood, the literary reaction to changing values in Victorian religion, the search for a new aesthetic, and the emergence of naturalism and realism in literary form.

Engl. 550-3. Medieval Literature. Selections representative of the life and thought of the Middle Ages up to 1500.

Engl. 552-3. Continental Renaissance and 17th-Century Literature.

Engl. 554-3. Restoration and 18th-Century Literature. Explores the poetry, novel, and nonfiction prose of the period, with rotating emphases on genres and topics.

Engl. 565-3. Readings in American Literature. Extensive reading in the history of American literature as the basis for a graduate major or minor in the field. Emphasis on bibliographies and critical works. Independent study and research paper or papers required.

Engl. 566-3. Readings in American Literature. Continuation of Engl. 565.

Engl. 570-3. Anglo-Saxon.

Engl. 571-3. Beowulf: Advanced Anglo-Saxon.

Engl. 572-3. Modern African Literature.

Engl. 573-3. Chaucer.

Engl. 582-3. Law and Literature. (Hum. 482.) Explores the relations between law and literature by studying key works of literature in context—*Antigone*, Shakespeare's *Measure for Measure*, Racine's *Les Plaideurs* (in translation), Dickens' *Bleak House*, Kafka's *The Trial*, and others, together with selected readings from law reports, cases, and the like. Individual work will be expected.

Engl. 583-3. Rhetoric and the Teaching of Composition. Analysis of rhetorical theory with emphasis on practical applications in the classroom. Pedagogical alternatives and evaluation of teaching.

Engl. 591-3. Computer Applications in the Humanities. Use of the computer as a tool in research and instruction: style and content analysis, authorship and influence studies, text collation and edition; creativity; analysis of nontextual data; bibliographies and information banks. Programming not required.

Engl. 594-3. Poetics. An advanced poetics course for creative writing students. Instruction in the use of a variety of forms from different eras and traditions in fiction and poetry.

Engl. 595-3. Poetics. A continuation of Engl. 594.

Engl. 596-3. The Literary Magazine. Covers the history and tradition of the literary magazine movement.

Engl. 597-3. Directed Reading. Gives the graduate student in the M.A. program, with emphasis in creative writing, intensive instruction on an individual basis.

Engl. 599-variable credit. Independent Study. Independent investigation of topics of specific interest to individual students. Students wishing to enroll in Independent Study must petition the director of graduate studies prior to the beginning of the semester.

Engl. 600 to 609-3. Studies in Major Authors. Intensive study of works of one major British or American author for a given semester to be specified in the *Schedule of Courses*.

Engl. 610 to 619-3. Special Topics. Intensive study of specialized topics in English and American literature to be specified in the *Schedule of Courses*.

Engl. 620-3. Studies in the Novel.

Engl. 622-3. Studies in the Novel.

Engl. 623-3. Studies in the American Novel.

Engl. 624-3. Studies in the 20th-Century American Novel.

Engl. 632-3. Elizabethan and Jacobean Drama. Representative non-Shakespearean plays of the period.

Engl. 642-3. Studies in American Poetry.

Engl. 644-3. Studies in 20th-Century Poetry. English and American poetry.

Engl. 647-3. History of Literary Criticism. Literary criticism in Western civilization.

Engl. 648-3. History of Literary Criticism. Problems in modern literary criticism.

Engl. 650-3. English Literature of the 14th and 15th Centuries, Excluding Chaucer.

Engl. 651-3. Studies in Medieval Literature.

Engl. 652-3. The 16th Century. Selected prose and non-dramatic poetry from Skelton and More through Shakespeare and his contemporaries.

Engl. 653-3. The 17th Century. Poetry and prose of Bacon, Donne, Jonson, their contemporaries and followers.

Engl. 654-3. The Restoration and 18th-Century Literature.

Engl. 656-3. Romantic Prose.

Engl. 657-3. Romantic Poetry.

Engl. 658-3. The Victorians. Main currents of Victorian thought in prose and poetry, 1830-1860.

Engl. 659-3. The Later Victorians. Continuation of Engl. 658. 1860-1900.

Engl. 660-3. Studies in British and Irish Literature of the Early 20th Century. Chronological survey, 1900-1925, and an intensive study of a few representative authors.

Engl. 661-3. Studies in British and Irish Literature of the Later 20th Century. Chronological survey, 1925 to present, and an intensive study of a few representative authors.

Engl. 666-3. Twentieth-Century American Literature.

Engl. 680-3. Anglo-Saxon.

Engl. 681-3. Advanced Anglo-Saxon.

Engl. 682-3. Middle English. Reading of literary selections from Middle English with much detail of English words and sounds to account for present usages.

Engl. 684-3. English Dialectology.

Engl. 699-variable credit. Independent Study. See Engl. 599.

Engl. 700-4. Master's Thesis.

Engl. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

FILM STUDIES

Hum./F.S. 305-3. Film History I. An intensive introduction to film history and theory, from 1895 to 1935. Topics to be covered include the beginnings of still and motion picture photography, the growth of narrative and structural complexity from Lumiere to Gance, the influence of Griffith, American silent comedy, Soviet theories of montage, German expressionist and street films, an overview of experimental and animated films, the transition to sound, and the beginning of film theory. Lectures, discussions, and research papers supplement complete screenings of such films as *The Birth of a Nation*, *The Gold Rush*, *Greed*, *Bonaparte and the Revolution*, *Un Chien Andalou*, *The Man With a Movie Camera*, *Vampyr*, and *The Road to Glory*.

Hum./F.S. 306-3. Film History II. Starts with the late 1930s and early 1940s films of Renoir and Welles and follows the historical growth and the evolution of film aesthetics to the present. Italian Neo-realist, French New Wave, and recent experimental films are studied, as well as the films of major auteur figures such as Bergman, Kurosawa, Fellini, Hitchcock, Bunuel, Antonioni, and Coppola.

F.S. 307-3. Major Film Movements. Usually this course will be a historical-aesthetic survey dealing with the various national cinemas, to be taught in conjunction with the appropriate language department. Typical offerings are The French Film, The German Film, The Russian Film, and so on. Occasionally the course may offer a more detailed approach to a more restricted subject, i.e., French New Wave, German Expressionist Cinema, Italian Neo-realism.

F.S. 308-3. Major Film Directors. Focuses on the work of a single director or a group of related directors. Course content will vary from semester to semester. Consult the *Schedule of Courses* for specific topics.

F.S. 300-3. Beginning Filmmaking. Offered to instruct students in making Super-8 films. Instruction covers use of cameras and editing equipment, basic editing and splicing techniques, and analysis of pertinent films. The emphasis may be on making personal experimental films or on making narrative sound films, according to the instructor.

F.S. 350-3. Intermediate Filmmaking 16mm. A film production class in 16mm taught on a revolving basis in fine arts (with an emphasis on personal experimental films) and in film studies (with a documentary and/or narrative orientation). The class will cover the following: 16mm camera operation, splicing, editing, sound transfer and recording, and dealing with the lab. Each student will be expected to make a film by the end of the semester. Students should expect to spend a few hundred dollars on equipment rental, film stock, and lab costs.

See also:

Engl. 225-3. Introduction to Film Narrative.
Comm. 260-3. Introduction to Broadcasting and Film.
Hist. 270-3. Japanese History Through Cinema.
Int. Stud./Soc. Sci. 350-3. Film and Society.
Hum. 401-3. Film Topics: Film and Fiction.
Hum. 402-3. Film Theory.
F.A. 313-2. Beginning Filmmaking.
Comm. 363-3. Filmmaking.

FINE ARTS

Studio

Drawing

F.A. 100-3. Basic Drawing. Orientation course including pictorial design, life drawing, still life, and landscape, using varied drawing techniques and media. Recommended for F.A. majors instead of 2-cr. hr. Basic Drawing. May not be repeated.

F.A. 200-3. Drawing. Problems in drawing. Exploration of possibilities in pictorial design, the human figure and composition. Prer., F.A. 100 plus one more 100-level fine arts course. May be repeated once.

F.A. 300-3. Drawing and Anatomy. Problems involving the creative use of the live human figure and anatomy including studio work, slides and outside preparation. Prer., 6 hrs. F.A. 200. May be repeated once.

F.A. 400-3. Advanced Drawing. A creative approach to advanced problems in drawing. Prer., 6 hrs. F.A. 200. May be repeated.

F.A. 500-3. Graduate Drawing.

Photography

F.A. 216-3. Beginning Photography. (Formerly F.A. 319.) An introduction to techniques and concepts of photography as it relates to the fine arts. Emphasis on photography as a means to formal and expressive ends. Students must have access to an adjustable camera. Prer., soph. standing. May not be repeated.

F.A. 217-3. Beginning Photography. Exploration of possibility of relating more sophisticated technical concepts and materials (e.g., zone system and non-silver systems) to the creative process. Prer., F.A. 216. May not be repeated.

F.A. 313-3. Beginning Filmmaking. (Formerly F.A. 363.) Investigation of the techniques and aesthetics involved in making 8mm, super 8mm, and 16mm motion pictures. May be repeated.

F.A. 319-3. Intermediate Photography. Continued exploration of the possibility of individual photographic expression. Students will be encouraged to discover and develop a personal position in relation to the medium. Prer., F.A. 216, 217, or equivalent. May be repeated once. Admission by photo portfolio.

F.A. 418-3. New Directions in Photography. Investigation of the use of the photographic image in non-standard ways, such as the use of liquid emulsion on a variety of materials and the realization of the photo image in three-dimensional configurations. Prer., F.A. 216 or equivalent. May be repeated. *Note:* Course content changes each semester.

F.A. 419-3. Advanced Photography. Exploration of advanced techniques and concepts of photography as it relates to the fine arts. Emphasis on photography as a means to formal and expressive ends. Prer., F.A. 216, 217, two semesters of 319, or equivalent. May be repeated. Admission by photo portfolio.

F.A. 518-3. Graduate New Directions in Photography.

F.A. 519-3. Graduate Photography.

Painting

F.A. 120-2. Basic Painting. General introduction to painting. Problems of color and pictorial space, still life, landscape, figure, and abstract painting. Recommended for F.A. majors instead of 2-cr. hr. Basic Painting. May not be repeated.

F.A. 221-3. Color. A basic introduction to the relative effects of color as used by the artist. Emphasis is on the practice of color relations including basic characteristics, mixtures, illusions, optical mixture, color intervals and color quantity. Prer., F.A. 100 plus one more 100-level fine arts course. May not be repeated.

F.A. 320-3. Painting. Basic investigation of materials of the painter and their use in expressing the student's ideas. Prer., F.A. 120 plus one more 100-level fine arts course. May be repeated once.

F.A. 321-3. Painting. For description, see F.A. 320. Prer., F.A. 320. 6 hrs. credit. May be repeated once.

F.A. 323-3. Mural Painting. Will examine the special problems of painting murals. Students will execute at least one mural in a public place, under the direct supervision of the instructor.

F.A. 420-3. Advanced Painting. Expressive pictorial problems involving varied subject matter and painting media with an emphasis on individual development. Prer., F.A. 320, 6 hrs. credit, and 321, 6 hrs. credit. May be repeated.

F.A. 520-3. Graduate Painting.

Water Media Painting

F.A. 330-3. Water Media Painting. Introduction to transparent and opaque water color media emphasizing problems of motivation, creative expression, and techniques involving varied subject matter. Prer., F.A. 100 and 120; F.A. 221 is recommended. May not be repeated.

F.A. 331-3. Water Media Painting. Transparent and opaque water media experience emphasizing problems of motivation, expression and techniques involving varied subject matter. Prer., F.A. 330 or equivalent; F.A. 221 is recommended. May not be repeated.

F.A. 430-3. Advanced Water Media Painting. Advanced painting problems using transparent and opaque water color media, with an emphasis on individual development. Prer., F.A. 330 and 331, or equivalent. May be repeated as needed.

F.A. 530-3. Graduate Water Media Painting.

Printmaking

F.A. 240-3. Beginning Intaglio and Relief. Introduction to intaglio and relief printing and printing media. Prer., F.A. 100 and 200. May not be repeated.

F.A. 241-3. Beginning Lithography. An introduction to the techniques of black and white and color lithography, including metal plate lithography. Prer., F.A. 100 and 200. May not be repeated.

F.A. 242-3. Beginning Screen Printing. Exploration in silk screen techniques. Emphasis on creativity. Prer., F.A. 100 plus one more 100-level fine arts course. May not be repeated.

F.A. 244-3. Printmaking Survey. A practical and historical survey of printmaking. Basic introduction to intaglio, lithography, silk screen, relief, and photo processes will be explored by the student in the print studios, alternating with weekly slide lectures on the history of techniques and significant printmakers.

F.A. 340-3. Intermediate Intaglio and Relief. Continued study and experimentation in intaglio and relief processes in both black and white, color, and possible photo imagery. Prer., one other printmaking course. May be repeated once.

F.A. 341-3. Intermediate Lithography. A continuation of stone lithography and an introduction in metal plate hand litho. Depending on progress of individual student, color litho will be introduced. Prer., one other printmaking course. May be repeated once.

F.A. 342-3. Intermediate Screen Printing. Refinement of basic techniques with the emphasis on individual development. Prer., one other printmaking course. May be repeated once.

F.A. 440-3. Advanced Intaglio and Relief. Prer., F.A. 340. May be repeated.

F.A. 441-3. Advanced Lithography. Prer., F.A. 341. May be repeated.

F.A. 442-3. Advanced Screen Printing. Prer., F.A. 342. May be repeated.

F.A. 443-3. Photo Processes. An exploration into the use of photo image through the reproduction process, such as line shot, halftone, and color separation. Emphasis will be placed on the creative use rather than mechanical application. Prer., one other printmaking course and consent of instructor. May be repeated.

F.A. 540-3. Graduate Intaglio and Relief.

F.A. 541-3. Graduate Lithography.

F.A. 542-3. Graduate Screen Printing.

F.A. 543-3. Graduate Photo Processes.

Sculpture

F.A. 150-3. Basic Sculpture. (Formerly F.A. 101.) Orientation course involving three-dimensional form, expressive problems based on the human figure, and nonobjective form relationships in various sculptural materials. Recommended for F.A. majors instead of 2-cr. hr. Basic Sculpture. May not be repeated.

F.A. 250-3. Sculpture Techniques. Technical studies in bronze, aluminum, and plastic casting. Prer., F.A. 150. May not be repeated.

F.A. 251-3. Sculpture Techniques. Technical studies in sculpture media: i.e., plastic fabrication, gas and arc welding, etc. Prer., F.A. 150. May not be repeated.

F.A. 350-3. Sculpture. Original and creative studies in clay, plastic, metal, wood, and stone. Prer., F.A. 250 and 251. May not be repeated.

F.A. 351-3. Sculpture. For description, see F.A. 350. Prer., F.A. 350. May not be repeated.

F.A. 450-3. Advanced Sculpture. Individual studies in selected media. Prer., F.A. 350 and 351. May be repeated.

F.A. 550-3. Graduate Sculpture.

Art Education

Art education majors desiring teacher certification are required to take F.A. 364, 366, 367, 368, and 369, and must consult art education advisers concerning the remainder of the program. Only F.A. 369 may be repeated.

F.A. 364-2. Art in Elementary Schools. For students wishing to receive certification for teaching art in public elementary schools. Deals with the theoretical and practical problems of teaching art in the elementary school.

F.A. 365-3. Art Materials in Recreation. Designed specifically for the recreation major. Provides a workshop-type opportunity for students to become familiar with art materials that can be used effectively in a variety of recreation situations. Also includes a theoretical introduction to art and its role in recreation.

F.A. 366-2. Art Materials Workshop. Introduction to and exploration of materials available for use by the art educator and recreational director in both two- and three-dimensional materials used with various age level groups. Fine arts majors only.

F.A. 367-2. Art Materials Workshop. Introduction to and exploration of fiber and batik processes suitable for use in the public school. Fine arts majors only.

F.A. 368-2. Art in the Secondary Schools. For students wishing to receive certification for teaching art in the public secondary schools. Deals with the theoretical and practical problems of teaching art in the secondary school. Prer., F.A. 364.

F.A. 369-1. Practicum in Art Teaching. Supervised teaching of children and young people stressing the development of effective planning and presentation of art concepts and materials. Coreq., F.A. 364 and 368.

F.A. 468/568-3. Issues in Art Education. Provides students with a wide base for understanding art education purposes, trends, policies, and art education's potential as a viable discipline. Focuses on categories of general interest in art education.

F.A. 469-2. Art for the Elementary Teacher. For majors in elementary education, with emphasis on art in the elementary school.

F.A. 564/565-3. Seminar in Art Education. Subjects and instructors will vary.

Jewelry

F.A. 377-3. Jewelry Design. (Formerly F.A. 317.) Creation of jewelry with metals and non-metals. Emphasis on individual design decisions. May not be repeated.

F.A. 477-3. Advanced Jewelry Design. (Formerly F.A. 417.) For description see F.A. 377. Prer., F.A. 377. May be repeated.

F.A. 577-3. Graduate Jewelry Design. (Formerly F.A. 517.)

Ceramics

F.A. 288-3. First-Year Ceramics. (Formerly F.A. 358.) A basic introductory course in the techniques of wheel-thrown and hand-built forms, and the exploration of glazes and glazing procedures and firing of clay forms. Prer., two basic studio courses. May not be repeated.

F.A. 388-3. Wheel Throwing. A concentration in concepts and techniques dealing with wheel-thrown forms. An in-depth study of functional and semi-functional forms including glazing and firing of these forms. Prer., F.A. 288. May not be repeated.

F.A. 389-3. Clay Construction and Casting. A concentration in the concepts and techniques of mold-making, slip casting, and hand construction of clay forms as they relate to function and nonfunction. Prer., F.A. 288. May not be repeated.

F.A. 488-3. Advanced Ceramics. (Formerly F.A. 458.) Lecture, research, and experimentation in clay (wheel and hand construction techniques). Prer., F.A. 388 and 389. May be repeated.

F.A. 489-3. Ceramics Seminar. (Formerly F.A. 459.) Designed for students majoring in ceramics. Prer., F.A. 488, and instructor consent.

F.A. 588-3. Graduate Ceramics. (Formerly F.A. 558.)

F.A. 589-3. Graduate Ceramics Seminar. (Formerly F.A. 559.)

Lectures and Seminars

F.A. 104-3. Basic Art Lecture: A Survey of Art Issues. Introduction to art and visual language, stressing development of observation. Examples from major periods are studied. Illustrated lectures, discussion groups, field trips to exhibitions, etc.

F.A. 322-3. Aspects of Painting. A lecture course providing insights into the art of painting. Contemporary painting, as well as that of the past, is examined and discussed in depth.

F.A. 490/590-3. Nonstatic Art: Video. The course will utilize video as a narrative or documentary tool in relation to the various expressions of performance work, including work designated as conceptual art, body art, video performance, correspondence art, etc. Prer., consent of instructor.

F.A. 494/594-3. Photography Seminar. Reading, writing, and presentation about photography as a medium of expression. Prer., F.A.H. 401/501 or equivalent.

F.A. 495-3. Studio Seminar. For students intending to pursue graduate work and/or a professional career in art. Emphasis will be on developing a critical overview of their work and interests, and how they relate to the problems of professional activity today. Prer., B.F.A. candidate.

F.A. 496-2. Art Seminar. For fine arts honor students and advanced undergraduates. Requires a considerable amount of outside readings in the fields of aesthetics and art history. Discussion group will meet one evening each week. Admission by consent of instructor only.

F.A. 596-2. Graduate Art Seminar.

F.A. 603-3. Art of the Last Decade, Trends and Criticism. A selective study of significant works of visual art of the last decade, including major critical opinions. Prer., 20 hours of fine arts.

Visiting Artist

F.A. 497/597-3. Visiting Artist Studio. (Formerly F.A. 420.) May be repeated.

F.A. 598-2. Graduate Visiting Artist Seminar.

Art History

Double-level (400/500) courses are open to both advanced undergraduate and graduate students. An undergraduate student will normally register for the 400 level; a graduate student for the 500 level. A higher level of performance and extra work will be expected of the graduate student. Not all art history courses are offered every year. Students should check the current *Schedule of Courses*. Seniors may take 500-level courses only after consultation with the instructor.

F.A. H. 100-3. Experiencing Art—Image, Artist, and Idea. An innovative course intended to provide a broad introduction to the understanding and appreciation of art from all time periods and all parts of the world. Particularly directed to nonmajors.

F.A. H. 180-3, 181-3. History of Art (Survey). History of art of all ages, reflecting various cultures of mankind from prehistoric to the present.

F.A. H. 270-3, 271-3. African-American Art History. (Bl.St. 270, 271.) A study of black art in both Africa and the Americas; problems in depicting real life experiences of black people.

F.A. H. 280-3. Art of Antiquity. A survey of sculpture, painting, and architecture from the Paleolithic to the accession of Constantine. The geographic scope includes Mesopotamia, Anatolia, North Africa, and the lands of the eastern and western Mediterranean.

F.A. H. 281-3. Art of the Middle Ages. A survey of sculpture, painting, and architecture from 300 to 1500 A.D. — art of the Early Christian, Byzantine, Early Medieval, Romanesque, and Gothic periods.

F.A. H. 282-3. Art of the Renaissance, the Baroque, and the Rococo. A survey of sculpture, painting, and architecture from Giotto through the Rococo.

F.A. H. 283-3. Art of the 19th and 20th Centuries. Survey of sculpture, painting, and architecture from the late 18th century to the present, beginning with Neoclassicism and Romanticism. Impressionism and all the other "isms" of the 19th and 20th centuries will be covered. Prer., F.A.H. 280, 281, or 282.

F.A. H. 284-3. Introduction to Asian Art. (Formerly F.A. 190.) Designed for those having no previous experience in the study of Asian art, the course will treat the development of sculpture, painting, architecture, and the other visual arts of South Asia, the Far East, and Southeast Asia, especially as they are connected by the religious themes of Hinduism and Buddhism.

F.A. H. 401/501-3. History of Photography. (Formerly F.A. H. 386.) The history of photography from Daguerre to the present.

F.A. H. 404/504-3. Art of the Ancient Near East. A survey of the architecture, sculpture, and painting of the eastern Mediterranean from their beginnings to the end of the Sassanian Empire to include the arts of Anatolia, Mesopotamia, and Persia. Prer., F.A. H. 280 or equivalent.

F.A. H. 405/505-3. Art of India and Southeast Asia. A survey of the architecture, sculpture, and painting of India and those areas of southeast Asia influenced by India from the period of Mohenjo Daro and Harappa to recent times. The Himalayan region will be treated, as will Tantric art in general.

F.A. H. 406/506-3. Art of Islam. Art and architecture of the Islamic peoples from the death of Muhammad through the 18th century from Spain to India.

F.A. H. 407/507-3. Byzantine Art. (Clas. 420/520.) Art of the East Christian Empire from the accession of Constantine to the conquest of Constantinople with a synopsis of developments from 1453 through the 18th century.

F.A. H. 427/527-3. Pre-Classical Art and Archaeology. (Anth. 427/527, Clas. 427/527.) See Clas. 427/527.

F.A. H. 428/528-3. Classical Art and Archaeology. (Anth. 428/528, Clas. 428/528.) See Clas. 428/528.

F.A. H. 431/531-3. Etruscan Art and Archaeology. (Anth. 488/588, Clas. 431/531.)

F.A. H. 432/532-3. Roman Art and Archaeology. (Anth. 489/589, Clas. 432/532.)

F.A. H. 436/536-3. The Late Renaissance and Mannerism. Italian painting, sculpture, and architecture from about 1520 to 1580. The problems of Mannerism and the expansion of late Renaissance art in Europe will be treated. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 441/541-3. Neoclassicism and Romanticism: 1760 to 1840. A survey of painting and sculpture in England and France from the last quarter of the 18th century through the first half of the 19th century. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 442/542-3. European Art From 1830 to 1886. A survey of the major movements in painting in France and England from the Revolution of 1830 to the Impressionist crisis of 1886. Although the emphasis is on painting, major expressions in sculpture and architecture will also be discussed. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 456/556-3. Perspectives on Art and Criticism. An examination of some traditional and current ideas which have shaped, defined, or influenced the goals, practices, and evaluation of the visual arts. Lectures, readings, discussion. Open to fine arts majors or students with 9 or more hours in art.

F.A. H. 460-3. Undergraduate Seminar: Selected Topics in Art History. A seminar course dealing with selected areas or problems within the history of art. Consult current *Schedule of Courses* for seminar topic. Prer., any two of the following: F.A. H. 280, 281, 282, 283, 284, or equivalent.

F.A. H. 461/561-3. The Art of Ancient Egypt. A survey of the development of Egyptian architecture, sculpture, painting and the minor arts from their beginnings until the establishment of Christianity. Prer., F.A. H. 280 or equivalent.

F.A. H. 466/566-3. Italian Gothic Art. Developments in Italian painting, sculpture, and architecture from about 1200 to 1400 A.D., including interactions with northern Europe and the so-called Proto-Renaissance. Prer., F.A. H. 281, 282, or consent of instructor.

F.A. H. 470/570-3. Art of Oceania and Africa. Native arts of non-Western peoples of Oceania and Africa. Sculpture, architecture, and minor arts for both archaeological and ethnological cultures. Emphasis upon the function of art in society as well as aesthetic analysis.

F.A. H. 471/571-3. Pre-Columbian Art. (Anth. 497/597.) Architecture, sculpture, and painting of the high cultures of Meso-American and Andean areas before the Spanish Conquest.

F.A. H. 472/572-3. North American Indian Art. Survey of art of North American Indian cultures, including Northwest Coast, Southwest, Southeast, Northeast, and Plains, covering architecture, sculpture, and minor arts for both archaeological and ethnological cultures. Prer., consent of instructor.

F.A. H. 473/573-3. Latin American Art Since 1492. The arts of the colonies of Spain and Portugal in the western hemisphere from 1492 to the present. Prer., F.A. Hist. 282 or equivalent.

F.A. H. 474/574-3. The Arts of Japan. Appreciation and chronological development of the arts of Japan. Emphasis upon the arts of Shintoism and Buddhism as well as the particular Japanese aesthetic from prehistoric times to the present.

F.A. H. 475/575-3. The Arts of China. Survey of Chinese painting, sculpture, architecture, and other arts from Neolithic to modern times.

F.A. H. 476/576-3. Early Christian and Early Medieval Art. History of European art from Constantine to around the year 1000 with primary emphasis on western Christian, Hiberno-Saxon, Carolingian, Ottonian, and Anglo-Saxon art but including barbarian and Byzantine contributions. Prer., F.A. H. 281 or consent of instructor.

F.A. H. 478/578-3. Romanesque Art. History of European art of the 11th and 12th centuries treating architecture, sculpture, fresco painting, and manuscript illumination. Prer., F.A. H. 281 or consent of instructor.

F.A. H. 479/579-3. Gothic Art. History of European art from the mid-12th to the 16th century treating architecture, sculpture, stained glass, and manuscript illumination with special emphasis on developments in France, England, and Germany. Prer., F.A. H. 281 or consent of instructor.

F.A. H. 480/580-3. Italian Renaissance Art. *Fall.* Italian art and architecture from 1400 to the death of Donatello (1466), with emphasis on the development of Renaissance art in Florence and central Italy. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 481/581-3. Italian Renaissance Art. Spring. Italian art and architecture from about 1470 to 1520, including the diffusion of Renaissance ideas throughout Italy, and the development of the High Renaissance in central Italy and Rome. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 482/582-3. Northern Renaissance Art. Fall. History of art in Northern Europe from the late 14th through the first half of the 15th century, with emphasis on the painting of Flanders and France. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 483/583-3. Northern Renaissance Art. Spring. Continuation of F.A. H. 482/582. History of art in Northern Europe in the late 15th and 16th centuries, with emphasis on painting in Flanders, France, and Germany. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 484/584-3. Art and Architecture in Italy, 1580-1750. Fall. Traces the development of Italian art from the last gasps of Mannerism through the barocchetto style of Tiepolo. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 485/585-3. Art in the 18th Century. Spring. History of art in the 18th century up to Neoclassicism, with emphasis on painting in France, Italy, and England. Prer., F.A. H. 282 or consent of instructor.

F.A. H. 486/586-3. American Art to 1945. A survey of art of the United States from the earliest colonial period to 1945, including minor arts as well as architecture, sculpture, and painting.

F.A. H. 487/587-3. American Art: 1945 to the Present. A survey of American painting and sculpture since World War II. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 489/589-3. History of Contemporary Art. Fall. From Impressionism to the early 20th century.

F.A. H. 490/590-3. History of Contemporary Art. Spring. From Cubism through the 1960s.

F.A. H. 491/591-3. Art in the 19th Century. Fall. Study of visual arts in Europe from Goya through Post-Impressionism, with principal attention to major movements of Neo-Classicism, Romanticism, Realism, and Impressionism. Primary emphasis on art of painting, but major expressions in sculpture and architecture will also be involved.

F.A. H. 492/592-3. Modern Art. Fall. An in-depth study of the fin de siècle, stressing Post-Impressionism, Art Nouveau, and Symbolism. The course closes with Fauvism in France and the expressionist movement in Germany. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 493/593-3. Modern Art. Spring. Emphasizing the various "isms" of the 20th century, the course begins with the early Picasso and Cubism, including Analytic and Synthetic Cubism. Also studied are Italian Futurism, de Stijl and the Bauhaus, Dada, and Surrealism. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 495/595-3. Modern Architecture. A survey of world contemporary architecture from its beginnings with Richardson and Wright to the present. Prer., F.A. H. 283 or equivalent.

F.A. H. 496/596-3. Hispano-Portuguese Art. (Formerly F.A. 572.) A survey of the architecture, sculpture, and painting of Spain and Portugal from their beginnings through the 20th century.

F.A. H. 508-3. Classical Greek Art. (Anth. 593, Clas. 521.) See Clas. 521. Prer., F.A. H. 428 or consent of instructor.

F.A. H. 509-3. Archaic Greek Art. (Anth. 594, Clas. 523.) Prer., F.A. H. 428 or consent of instructor.

F.A. H. 510-3. Prehistoric Greek Art and Archaeology. (Anth. 595, Clas. 524.) See Clas. 524. Prer., F.A. H. 427 or consent of instructor.

F.A. H. 515-3. Hellenistic Art and Archaeology. (Anth. 592, Clas. 515.) See Clas. 515. Prer., F.A. H. 428 or consent of instructor.

F.A. H. 516-3. Modern Sculpture From Rodin to the Present. An intensive examination of outstanding sculptors in Europe and America from Rodin to the present; American sculpture since World War II will receive special emphasis. Prer., F.A. H. 283 or consent of instructor.

F.A. H. 548-3. Topics in Roman and Etruscan Art and Archaeology. (Anth. 537, Clas. 548.) Consideration of various aspects of Roman and/or Etruscan art and archaeology. Topics to be explored may vary and will be announced in advance. Prer., consent of instructor.

F.A. H. 560-3. Graduate Seminar: Selected Topics in Art History. Subjects and instructors will vary. Prer., consent of instructor. Undergraduates admitted with consent.

F.A. H. 649-4. Seminar: Tools of Research. (Formerly F.A. 549.) Required for Master of Arts (art history) candidates. Discussion of problems in art history and theory. Particular emphasis on defining problems for research study and systematically acquiring and presenting written evidence. Study of sources and bibliographical materials pertaining to art. Requirements in oral and written presentation in the seminar, including the preparation and use of visual aids.

Independent Studies

A student may register for independent study in studio or art history. Registration by consent of instructor only.

F.A. or F.A. H. 399-variable credit (1 to 3). Independent Study.

F.A. or F.A. H. 499-variable credit (1 to 3). Independent Study.

F.A. or F.A. H. 599-variable credit (1 to 3). Independent Study.

F.A. or F.A. H. 699-variable credit (1 to 3). Independent Study.

Thesis

F.A. 700-1 to 4. Master's Thesis (Art Education).

F.A. H. 700-1 to 4. Master's Thesis (Art History).

F.A. 750-1 to 6. Master of Fine Arts Creative Thesis.

FRENCH AND ITALIAN

French

For comparative literature and linguistics departmental courses and phonetic sciences, see those sections.

Fr. 101-5. Beginning French I. Fall, Spring. Open only to students with no previous knowledge of French or upon consultation.

Fr. 102-4. Beginning French II. Fall, Spring. Open only to students who have had Fr. 101 at the University of Colorado or upon consultation.

Fr. 105-5. Beginning French Review. Fall, Spring. Reserved for students with up to two years of high school French on basis of foreign language placement code.

Fr. 201-4. Second-Year Oral Grammar Review and Conversation. Fall. Prer., Fr. 102 or 105 or placement.

Fr. 202-3. Second-Year Oral Grammar Review and Conversation. Spring. Prer., Fr. 201 or 211 or placement (three years of high school French).

Fr. 204-3. Professional French I. Spring. Prer., Fr. 201 or 211.

Fr. 211-4. Second-Year French Reading and Conversation. Fall, Spring. Prer., Fr. 102 or 105 or placement.

Fr. 212-3. Second-Year French Reading and Conversation. Fall, Spring. Prer., Fr. 211 or placement (three years of high school French).

Fr. 220-3. Highlights of French Civilization. Spring. Prer., Fr. 201 or 211 or placement (three years of high school French).

Fr. 301-3. French Phonetics and Pronunciation. Fall, Spring. Prer., Fr. 212 or equivalent, or upon consultation. Should be taken before or concurrently with any 300-level literature course.

Fr. 302-2. Oral Practice. Fall, Spring. Prer., Fr. 301 or upon consultation. Should be taken before or concurrently with any 300-level literature course.

Fr. 303-2. Oral Professional French II. Fall. Prer., Fr. 202, 204, 212, or equivalent.

Fr. 305-3. French Composition. Fall. Prer., Fr. 202 or 212 or equivalent. Should be taken before or concurrently with any 300-level literature course.

Fr. 306-3. French Composition. Spring. Prer., Fr. 305 or upon consultation.

Fr. 311-3. Main Currents of French Literature. *Fall.* Prer., Fr. 212 or upon consultation.
Fr. 312-3. Main Currents of French Literature. *Spring.* Prer., Fr. 311 or upon consultation.
Fr. 315-3. Romance Literature In English Translation I. See Span. 315.
Fr. 316-3. Romance Literature in English Translation II. See Span. 316.
Fr. 321-2. France Today. Readings and discussion in French of 20th century French culture. Prer., Fr. 202 or 212 or equivalent, and upon consultation.
Fr. 323-3. History of France From Louis XIV to de Gaulle. *Fall or Spring.* Prer., Fr. 202 or 212 or equivalent.
Fr. 360-3. Theatre Workshop. *Spring, depending on demand.* Prer., consultation.
Fr. 381-3. Readings In French Literature in Translation. Prer., sophomore standing or consultation.
Fr. 399-1 to 3. Independent Study. Bordeaux program only.

All courses at the 400 level or above, unless otherwise indicated, are offered on a three-year cycle.

Fr. 401-2. Advanced Composition. *Fall.* Prer., Fr. 305 or upon consultation. Should be taken before or concurrently with 400-level literature courses.
Fr. 402-2. Advanced Composition. *Spring.* Prer., Fr. 401 or upon consultation. Should be taken before or concurrently with 400-level literature courses.
Fr. 403/503-3. Advanced Oral Practice and Interpreting. *Fall.* Prer., Fr. 302 or Fr. 303, or upon consultation. Frey.
Fr. 405/505-2. French for Business. *Spring.* Prer., Fr. 305 or equivalent.
Fr. 406/506-3. Structure of French. *Fall.* Some of the typical patterns of French will be analyzed, using the techniques of modern linguistics. No previous knowledge of linguistics is assumed. Prer., Fr. 301 or 501 or upon consultation. Mayer.
Fr. 407/507-3. Syntax of Modern French. *Spring.* Prer., Fr. 406/506 or consultation. Mayer.
Fr. 408-3. History of the French Language. Jensen or Mayer.
Fr. 409/509-3. Contrastive Analysis of French and English. *Spring, alternate years.* Prer., Fr. 406/506 or consultation. Mayer.
Fr. 410/510-2. Translation. *Spring.* Prer., Fr. 401. Frey.

Prer. for all following courses, French 312, graduate standing, or upon consultation.

Fr. 411/511-2 to 3, 412/512-2 to 3. French Special Topics. Different topics will be offered and, in a number of cases, cross-listed with the Department of Comparative Literature or other departments.
Fr. 413/513-3. Explication de Textes: 17th and 18th Centuries. *Summer.*
Fr. 414/514-3. Explication de Textes: 19th and 20th Centuries. *Summer.*
Fr. 415/515-3. Generative Phonology of French. *Alternate years.* Prer., Fr. 406/506 or consultation. Mayer.
Fr. 422/522-3. Topics in French Civilization. *Summer or Spring.*
Fr. 425/525-3. Old French, Medieval, and Renaissance Readings. Jensen or Kail.
Fr. 431/531-3. Seventeenth-Century French Theatre and Poetry. Barchilon.
Fr. 432/532-3. Seventeenth-Century French Prose. Barchilon.
Fr. 433/533-3. Molière and 17th-Century French Comedy. Barchilon.
Fr. 435/535-3. French Enlightenment. *Alternate years.* Stavan.
Fr. 436/536-3. Eighteenth-Century French Novel, Theatre, and Poetry. *Alternate years.* Stavan.
Fr. 442/542-3. Nineteenth-Century French Theatre and Poetry. *Fall, alternate years.* Cypres.
Fr. 443/543-3. Nineteenth-Century French Novel. *Spring, alternate years.* Cypres.
Fr. 447/547-3. Twentieth-Century French Theatre and Poetry. *Fall, alternate years.* Ketchum.

Fr. 448/548-3. Twentieth-Century French Novel. *Spring, alternate years.* Ketchum.
Fr. 449/549-3. Women Novelists of the 20th Century in France. *Alternates with French 448/548.* Ketchum.
Fr. 451/551-3. French Dramatic Theories. Prer., Fr. 311-312 or consultation. Kail.
Fr. 495-3. Methods of Teaching French and Professional Orientation. *Fall.* To be taken one semester prior to or concurrently with student teaching. Tinelli.
T.Ed. 471-8. Student Teaching. *Fall.* Prer., MLA Proficiency Test to be taken the semester prior to student teaching.
Fr. 499-1 to 3. Independent Study. Prer., senior standing and upon consultation only.
Fr. 501-2. Advanced Phonetics.
Fr. 597-2. College Foreign Language Teaching. (Ger. 597, Ital. 597, Span. 597.) *Fall.* Baker.
Fr. 599-1 to 3. Independent Study. Prer., upon consultation only.
Fr. 600-2. Bibliography and Research Methods. (Ital. 600, Span. 600.) *Fall.*
Fr. 603-3. History of the French Language to 1300: Grammar, Phonology, History. *Alternate years.* Jensen.
Fr. 604-2. History of the French Language From 1300 to the Present Day: Morphology and History. *Alternate years.* Jensen.
Fr. 605-2. Provençal. (Span. 607.) Jensen.
Fr. 610-2. Problems of French Structure. Content varies from year to year; may be taken several times for credit. Prer., Fr. 506 and 507. Mayer.
Fr. 611-2. Stylistics of French.
Fr. 612-2, 613-2, 614-2. Seminars in French Literature. For use of visiting lecturers and distinguished visiting professors.

Courses listed below are offered on a three-year cycle.

Fr. 624-3. Medieval French Literature. Kail.
Fr. 627-3. Sixteenth-Century French Poetry.
Fr. 629-2. Rabelais. Kail.
Fr. 630-3. Seventeenth-Century French Tragedy. Barchilon.
Fr. 634-3. French Classicism. Barchilon.
Fr. 637-3. Eighteenth-Century French Moralists. Stavan.
Fr. 638-2. Eighteenth-Century French Comedy. Kail, Stavan.
Fr. 644-3. French Romanticism. Cypres.
Fr. 645-3. French Realism. Cypres.
Fr. 650-3. French Dramatic Theories. Kail.
Fr. 651-3. Modern French Theatre. Ketchum.
Fr. 654-3. Modern French Novel. Ketchum.
Fr. 655-3. Modern French Poetry. Ketchum.
Fr. 656-3. French Symbolist Poetry. Cypres.
Fr. 671-2. Voltaire. Stavan.
Fr. 672-2. Racine. Barchilon.
Fr. 675-2. Montaigne. Kail.
Fr. 676-2. Rousseau. Stavan.
Fr. 677-2. Balzac. Cypres.
Fr. 678-2. Chateaubriand. Cypres.
Fr. 700-4. Master's Thesis.
Fr. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

For courses in comparative literature, linguistics, and phonetic sciences, see those sections.

Italian

Ital. 101-5. Beginning Italian. *Fall, Spring.* Four skills of listening, speaking, reading, and writing are progressively developed in a predominantly oral presentation. Language laboratory work expected.
Ital. 102-5. Beginning Italian. *Fall, Spring.* PRER., Ital. 101.
Ital. 201-3. Second-Year Italian Conversation. *Fall, Spring.* Development of oral fluency stressed. Conducted completely in Italian. Emphasis on vocabulary, grammar, listening comprehension, pronunciation and intonation. Discussion of texts read. Prer., grade of C or better in Ital. 102 or equivalent.

Ital. 202-3. Second-Year Italian Conversation. *Fall, Spring.* Prer., Ital. 201 or upon consultation.

Ital. 211-3. Second-Year Italian Reading, Grammar, and Composition. *Fall, Spring.* Conducted in Italian except for grammar explanations. Designed to provide a thorough grammar review, to improve reading abilities, and to improve writing skills. Prer., grade of C or better in Ital. 102 or equivalent.

Ital. 311-3. Introduction to the Reading of Italian Texts. *Fall, Spring.* Introduction to readings of prose and poetic works at all levels and of all periods. Concentration on literal interpretation and special emphasis on 20th-century works. Conducted in Italian. Prer., Ital. 211 or upon consultation.

Ital. 312-3. Survey of Italian Literature. Study in literary history and more classical forms of the Italian language. Special emphasis on major literary movements of the Middle Ages, Age of Humanism, and Early and High Renaissance. Conducted in Italian. Prer., Ital. 311 or upon consultation.

Ital. 313-3. Survey of Italian Literature. Literature of the 18th, 19th, and 20th centuries. Attention still devoted to comprehension of material at a literal level. Conducted in Italian. Prer., Ital. 311 or upon consultation.

Ital. 315-3. Romance Literature in English Translation I. (Port., Span., Fr. 315.) See Span. 315. May not be taken for credit towards a major in Italian.

Ital. 316-3. Romance Literature in English Translation II. (Port., Span., Fr. 316.) See Span. 316. May not be taken for credit towards a major in Italian.

Ital. 321-3. Advanced Conversation and Composition. *Fall.* Devoted to assigned translations and compositions with discussion of grammatical and stylistic problems encountered, and to conversation at an advanced level. Prer., Ital. 202 and 211 or upon consultation.

Ital. 322-3. Advanced Conversation and Composition. *Spring.* Prer., Ital. 321 or upon consultation.

Ital. 325-2. Italy and the Italians. An introduction to the people and culture of modern Italy, through an examination of the Italian way of life. Covers contemporary Italian history, politics, social organization, education, economics, film, theatre, art and literature. No knowledge of Italian is necessary.

Most 400/500-level courses are offered in alternate years.

Ital. 401/501-2. Problems in Translation, Advanced Grammar and Stylistics. Major emphasis will concern practice in translating varying types of prose from Italian into English, with emphasis on literary texts. Prer., Ital. 322 or upon consultation.

Ital. 410/510-2. Introduction to Italian Linguistics. Elements of Italian linguistics covering terminological, methodological, and bibliographical aspects as well as problems of descriptive and historical nature.

Ital. 411/511-3. Dante: *La Vita Nuova* and *Inferno*. Prer., for Italian majors, Ital. 312 or upon consultation.

Ital. 413/513-3. Medieval Italian Literature. (Fr. 512; C. Lit. 542.) Examination of medieval concept of "courtly love" as both a cultural and literary phenomenon; its theoretical and stylistic evolution from the Provençal and Old-French Romance to Italian lyric. No knowledge of Italian necessary. Prer., for Italian majors, Ital. 312 or 313 or upon consultation.

Ital. 420-3. Italian Culture and Civilization: Pre-Roman to Counter-Reformation. *Fall.* No knowledge of Italian necessary.

Ital. 421-3. Italian Culture and Civilization: Counter-Reformation to the present. *Spring.* No knowledge of Italian necessary.

Ital. 422-2. Contemporary Italian Problems. Conducted entirely in Italian, this course is intended to perfect conversational fluency in the language by means of examination and discussion of contemporary social and cultural problems in Italy. Prer., completion of either Ital. 321 or 322 or consent of instructor.

Ital. 425-3. History of Italy: 1815 to Present. A survey of the political, social, and intellectual history of Italy from 1815 to present. No knowledge of Italian necessary.

Ital. 428/528-3. The Italian Cinema. Italian cinema as an art form, in its social and historical context. Emphasis on emergence of influential new film styles with the dissolution of Fascist era.

Readings, lectures, discussion, and viewing of major films in original versions with English subtitles. Conducted in English.

Ital. 440/540-3. Dante, Petrarch, Boccaccio, and the Humanists. The three principal figures of the Italian Trecento are studied both as artists and thinkers as seen in their prose and poetic works. Concomitantly they are considered as precursors of the Renaissance and of the humanism of the Quattrocento.

Ital. 441/541-3. Italian Literature of the High Renaissance. A consideration of the principal literary figures of the Italian Renaissance; lyric poets, the epics, the novella, the essay, the other literary forms that blossomed in 15th- and 16th-century Italy.

Ital. 445/545-3. Boccaccio. A reading of samplings of the complete corpus of Boccaccio's works, evaluating his development as a humanist and with particular emphasis on his works of fiction in prose and in poetry. Readings may be done in either English or Italian.

Ital. 451/551-3. Culture of the Italian Renaissance. An interdisciplinary course emphasizing the relationship between the fine arts, the civil history, and the literature of the Italian Renaissance and its influence and repercussions in Western Europe. Knowledge of Italian is not necessary.

Ital. 465/565-3. Manzoni and Italian Romanticism. No knowledge of Italian necessary.

Ital. 470/570-3. Dante: *Purgatorio* and *Paradiso*.

Ital. 480/580-3. History of Italian Theatre.

Ital. 490/590-3. Italian Poetry of the 19th Century.

Ital. 491/591-3. Italian Poetry of the 20th Century.

Ital. 492/592-3. Italian Narrative Literature of the 19th Century.

Ital. 493/593-3. Italian Narrative Literature of the 20th Century. A study of the Italian novel and short story in the period from World War I to the present. No knowledge of Italian necessary.

Ital. 494/594-3. Pirandello and the Modern Theatre. A study of Pirandello's works against the background of 19th- and 20th-century developments in the drama.

Ital. 499-1 to 3. Independent Study.

Ital. 503-3. Structure of Modern Italian.

Ital. 505-3. Italian Historical Grammar.

Ital. 506-3. Medieval Italian Texts.

Ital. 597-2. Methods of College Foreign Language Teaching. *Fall.* Required of all new teaching associates or teaching assistants. One week of orientation prior to the beginning of fall classes is considered part of the course. Those not concurrently teaching in the fall must consult with the instructor before taking the course.

Ital. 599-1 to 3. Independent Study.

Ital. 600-2. Bibliography and Research Methods in Italian.

Ital. 700-4. Master's Thesis.

GEOGRAPHY

Geog. 100-3 or 4. Environmental Systems — Climate and Vegetation. A general introduction to the atmospheric environment of the earth: the elements and controls of climate and their implications to hydrology, vegetation, and soils.

Geog. 101-3 or 4. Environmental Systems — Landforms and Soils. An introductory survey primarily concerned with two essential aspects of mankind's natural environment—landforms and soils. Major emphasis is directed to the genesis, distribution, and utility of surface features in a variety of learning situations, including lectures, labs, tutorials, and field trips.

Geog. 199-3. Introduction to Human Geography. A systematic introduction to the broad field of man-land relationships. Emphasis is placed on the patterns and forms of mankind's changing use of the land. Topics covered include growth and distribution of populations, origin and development of agriculture, origin and development of urban communities, and man as a modifier of the natural landscape.

Geog. 200-3. World Geographic Problems. Set in several regions, problems include resource-use decision making, locational analysis, poverty and community development, and political and economic self-determination. Small student groups in role-playing simulations leading to human decisions causing geographic change.

Geog. 301-3. Geographical Techniques. An introduction to the basic techniques, skills, and tools used in geographic analysis and research. Prer. or coreq., Geog. 100, 101, 199, 200.

Geog. 305-3. Cartography I. Two lect., one 2-hr. lab. per wk. The art and science of mapmaking with emphasis on research, design, and reproduction.

Geog. 306-3. Map Interpretation. Basic introduction to the skills and reasoning ability needed to appreciate and use maps as research tools and illustrative devices. Emphasis on map reading, geographic analysis of U.S. and foreign maps and map information.

Geog. 320-3. Topics in Meteorology. (A.G. 320.) *Fall and Spring.* Designed as a supplement to A.G. 113/114 or Geog. 100. Emphasizes developments of topical interest in meteorology. Topics vary from year to year and may include some of the following: weather map analysis and prediction, climatic change, air pollution, weather modification and severe storms. Nonmathematical, but knowledge of meteorology at the level of A.G. 114 or Geog. 100 will be assumed.

Geog. 330-3. Introduction to Arctic and Alpine Environments. (EPOB 345.) Multi-disciplinary approaches to unique problems of cold environments; climatology; geomorphology; history of glaciation, climate, and vegetation; plant ecology; remote sensing of human impact on natural landscapes. Prer., two relevant courses in EPOB, geography, geology, or astro-geophysics.

Geog. 340-3. Environmental Quality and Human Choice. *Offered infrequently.* Major alterations in the global environment examined from the standpoints of the natural systems affected, individual perceptions of them, and social decisions.

Geog. 341-3. Conservation Practice. Inventory, policy, and management of natural resources. Nature, significance, distribution, and problems associated with water, forest, wildlife, soils, and recreational resources in the United States.

Geog. 342-3. Conservation Thought. Historical survey of man's consumption of earthly materials; environmental and global considerations of population growth, cultural attitude, and technological development; the diverse goals and philosophy of conservation movements in time and place.

Geog. 370-3. Geographic Analysis of Issues in American Society. The geographic viewpoint, especially regional differentiation and systems models, applied to such socioeconomic concerns as pollution, poverty, racism, violence, and political reorganization. Topics will vary.

Geog. 381-3. South America. Regional study of South America, emphasizing the relationship of man to his environment. National and regional overview of population dynamics, economic development, and natural resource distribution.

Geog. 382-3. Mexico, Central America, and the Caribbean. Study of man's relationship to the physical environment of Mexico, the Central American countries, and the Caribbean Islands.

Geog. 383-3. Historical Geography of the United States. A study of man's adjustment to and alterations of landscapes encompassed by the United States at succeeding stages of time. Emphasis given to the role of geography during the westward movement of settlement.

Geog. 384-3. Geography of the Middle East. *Offered infrequently.* A physical, cultural, economic approach to the arid lands of the Middle East, including the Arab lands of North Africa.

Geog. 386-3. The Geography of Africa. A study of the physical and cultural regions of Africa; analytical comparison of natural and cultural regions; development of present nation-states.

Geog. 401-3. Introduction to Quantitative Methods in Human Geography. Introduction to the methods and applications of quantitative methods in human geography. Particular emphasis on applications of techniques used in the spatial analysis of human settlement and the distribution of economic activities.

Geog. 402-3. Statistics for Earth Sciences. (Geol. 477.) Prer., algebra and introductory calculus or instructor's consent.

Geog. 405-3. Cartography II. Two lect., one 2-hr. lab. per wk. Advanced cartography with emphasis on independent research and projects. Field trips to leading map publishers and printers arranged.

Geog. 406/506-3. Geographic Interpretation of Aerial Photos. Use of aerial photos in geographic research. The properties of air-photos. Systematic application of types of airborne imagery for evaluating settlement, transportation, drainage, landforms, vegetation, crops, and urban features. Prer., basic course in physical geology, or equivalent. MacPhail. Boulder and Colorado Springs.

Geog. 409/509-3. Remote Sensing of the Environment. The acquisition and interpretation of environmental and natural resource data by remote sensing. Theory and equipment systems are discussed to define the potential and limitations of various sensors. The infrared and microwave portions of the EM spectrum useful to geology, biology, and geography are stressed. Prer., basic course in physical geology, or equivalent.

Geog. 410-variable credit. Field Studies in Geography. *Summers only.* Field investigation focused on a specific aspect of the landscape in a selected area. Topic and credit varies from year to year.

Geog. 416-3. Teaching Geography. Practicum and/or tutorial, by special arrangement only, in the teaching of geography, e.g., serving as small-group leaders or tutors in introductory courses, or developing and/or testing curriculum materials. Prer., consent of instructor.

Geog. 417/517-3. Research Seminar. Development of skills for research with emphasis on primary and secondary sources, on methods of evaluating source materials, and on geographic writing.

Geog. 421-3. Physical Climatology—Principles. A course introducing the physical principles of flows of heat and moisture to and from the earth's surface, the interaction and modeling of such flows, and their distribution in space and time. Prer., Geog. 100 and 302 or equivalent.

Geog. 422-3. Physical Climatology—Applied. Applications of the principles of physical climatology are examined in areas such as water balance, agriculture and forestry, and urban climatology. Prer., Geog. 421.

Geog. 431-4. Principles of Geomorphology. (Geol. 463.) Systematic study of weathering, mass-wasting, fluvial, wind, and marine processes and the landforms resulting therefrom. Prer., elementary geology or geography or equivalent, and elementary chemistry, or consent of instructor.

Geog. 433/533-4. Mountain Climatology. Survey and analysis of the climatic characteristics of selected mountain environments, their study in the field; emphasis on Rocky Mountains. Prer., a college course in weather and climate and consent of instructor. Taught from Mountain Research Station summers only.

Geog. 435-3. Biogeography, Descriptive. Survey of systems of biotic area classification on continental and world scale; principles of environmental and biotic area correlation; descriptive biogeography.

Geog. 440-3. Land Management Systems. Seminar and field survey of natural resources management systems relating to forest, farm, range, and other land use classes. Productivity, valuation and taxation characteristics of land management types. Study of land law; tenure; land reform practices; regional and world comparisons.

Geog. 443-3. Seminar: Conservation Trends. An advanced upper division seminar to provide environmental conservation and geography majors an undergraduate format for interdisciplinary discussion and research into the current and future directions of conservation (*Senior majors only.*)

Geog. 446-3. Land Use Policy and Administration. *Offered alternate years.* An introduction to the theoretical and practical problems encountered in the establishment and administration of land use policies. Special emphasis will be given to current Colorado issues and the decision processes. Loeffler.

Geog. 450/550-3. Water Resources and Water Management of Western United States. Interpretation and analysis of hydroclimatic data, surface, and ground-water. Water use is critically evaluated with emphasis on problems associated with geographic maldistribution, appropriations, irrigation, industry, pollution, and regional development.

Geog. 461/561-3. Urban Geography: Economic. An introduction to the geography of American cities. Includes demographic and ideological context of urban development, emergence of the city system, location theory, and rent models and urban-economic problems. Palm and Schmidt.

Geog. 467/567-3. Seminar: Middle Latitude Agriculture. *Offered infrequently.* Analysis of the origins and evolution of agricultural regions, the characteristics and problems of agriculture in the middle latitudes. Some emphasis on arid regions. Helburn.

Geog. 471/571-3. Political Geography. A systematic study of the geographic influences affecting the development of political units, such as nations, states, and parties, as a background for better understanding of international affairs. Myers.

Geog. 472/572-3. Historical Geography of Europe. Offered alternate years. A study of how man has changed the landscape of Europe through time, including an analysis of the past geography of Europe at selected periods of time. Myers.

Geog. 473/573-3. Geography of Populations. National and social patterns of population distribution; organization of populations; methods of census, demographic analysis, and mapping. Quick and Albaun. Boulder and Denver campuses.

Geog. 474-3. Environments and Peoples. A study of interrelations between diverse environments and peoples—past, present, and future—particularly to view cultural tradition and change as communicated through the medium of environment.

Geog. 475/575-3. Seminar: Recreational Geography. An inquiry into the spatial distribution and environmental conditions or recreation. Emphasis will be on outdoor recreation in nonurban settings. The implications of recreational values to resource managers and land use decisions will be included. Prer., Geog. 441 and 442. Helburn.

Geog. 482/582-3. Historical Geography of Eastern North America. Offered alternate years. A study of how humans have developed settlements, utilized and changed the landscape of North America east of the Mississippi River through time, including an analysis of the past geography of certain regions of eastern North America at selected periods of time. Myers.

Geog. 483/583-3. Historical Geography of Western North America. Offered alternate years. A study of how humans have developed settlements, utilized and changed the landscape of North America west of the Mississippi River through time, including an analysis of the past geography of certain regions of western North America at selected periods of time. Myers.

Geog. 486-3. The Rocky Mountain Region. Study and analysis of the existing environmental systems as they affect man's utilization of the area and the resulting population dispersal therein.

Geog. 487-3. Geography of Colorado. Location, distribution, evaluation, and utilization of Colorado resources with emphasis on the major problems of resource development and use in the population explosion.

Geog. 488-3. Soviet Union. A systematic and regional survey of features that characterize the physical, economic, and social geography of the U.S.S.R.

Geog. 489-3. Geography of Western Europe. A regional survey of the cultural, economic, historical, physical, and political geography of Europe west of the Rhine, emphasizing the distinctive character and problems of each major area.

Geog. 490-3. Geography of Central, Northern, and Southeastern Europe. A regional survey of the cultural, economic, historical, physical, and political geography of Europe east of the Rhine, emphasizing the distinctive character and problems of each major area.

Geog. 499-1 to 3. Independent Study. Independent work for undergraduates. By special arrangement with faculty only. Only for students presenting strong geography preparation. Prer., consent of instructor and departmental approval.

Geog. 514-3. Techniques in Geocology. (EPOB 513.) Offered occasionally. Introduction to methods currently applied in geocological field studies (microclimatology, glaciology, hydrology, geomorphology, plant ecology). Field and laboratory analysis. Prer., consent of instructor. Barry, Caine, Greenland.

Geog. 521-3. Seminar: Physical Climatology. Offered occasionally. A research seminar concerned with problems of mass and energy exchange in the earth-atmosphere system. Topics to be selected from such areas as bioclimatology, hydrology, climatic change, and the climates of urban, agricultural, and natural environments. Prer., Geog. 421 or consent of instructor. Greenland.

Geog. 522-3. Synoptic and Dynamic Climatology. Offered alternate years. Microclimatology examined from the standpoints of synoptic and dynamic climatology. Prer., Geog. 421 or instructor's consent. Barry.

Geog. 523-3. Seminar: Climatic Change. (A.G. 595, Geol. 595.) Offered alternate years. A cross-disciplinary survey of the evidence for the theories of climatic change. Prer., consent of instructor. Barry.

Geog. 524-3. Topics in Physical Geography. (Precise title specified in *Schedule of Courses*.) Recent research topics which

vary from year to year. This course may be taken twice as the topics vary.

Geog. 530-3. Physical Geography of the Arctic Regions. Analysis of physical parameters defining arctic regions; climates; biogeography; land and sea ice and permafrost; regional physiographies with emphasis on Arctic Canada and Arctic Scandinavia; discussion of physical processes currently active; history of glacial and periglacial activity. Prer., a college course in physical geography and consent of instructor. INSTAAR faculty.

Geog. 532-4. Mountain Geomorphology. (Geol. 560.) Field course emphasizing study of landforms produced by weathering and soils, mass movement, erosional processes under all climatic and altitudinal conditions. Prer., a college course in physical geology and consent of instructor. Taught from Mountain Research Station summers only.

Geog. 535-3. Biogeography. Chorology and classification of biotic distribution; world scale; analysis of environmental principles of biotic distribution; methods of analyzing biotic distribution. Quick.

Geog. 537-3. Advanced Palynology. (EPOB 591, Anth. 591.) Lect., lab. Offered occasionally. Microscopic and chemical procedures for extracting paleo-environmental data from sediment; microscopic pollen analysis using modern and fossil materials. Prer., consent of instructor. Nichols.

Geog. 541-3. Natural Resource Management Systems. Public and private policy and management systems relating primarily to organic natural resources. Current emphasis upon the Public Land Law Review, land law, land productivity, valuation, taxation, and operations systems. Comparative studies of policies and operations in selected countries considered in a world-trade framework. Quick.

Geog. 543-3. Land Utilization. Seminar in the principles of land use applied to the land systems of geographic regions. Problems of rural land classification and mapping local areas. Resource use related to problems of environment, conservation, land tenure, and land evaluation. Prer., consent of instructor. Boulder.

Geog. 564-3. Problems in Urban Geography. A survey of current research topics in urban geography. Emphasis on definition of possible student thesis topics. Prer., consent of instructor.

Geog. 565-3. Location Analysis of Human Activities. The study of spatial order in human use of the earth, emphasizing theories of locational structure and methods of analysis. Denver only. Lee and Schmidt.

Geog. 601-3. Seminar: Regional Analysis and Planning. Selected regional planning and development models are investigated. Regional planning programs and issues in economically advanced and less developed countries are described and evaluated. Prer., Geog. 365 and 461. Prer., Geog. 361 and 461 or instructor's consent. Denver only; alternate years. Schmidt.

Geog. 602-3. Data Processing in the Earth Sciences. (Geol. 615.) Offered occasionally. Advanced statistical analysis, multivariate statistics, time series, classification models. Prer., Geog. 402 or Geol. 477, or equivalent, or consent of instructor. Greenland.

Geog. 615-3. History and Nature of Geography. Historical treatment of geographic philosophy and methodological issues in contemporary geography. Palm or Hill.

Geog. 616-3. Seminar: Geographic Education. A survey and critique of ideas from education, psychology, philosophy, and geography related to teaching and learning, especially for graduate students in geography who plan careers in college teaching. Hill or Helburn.

Geog. 617-3. Geography Teaching Materials. Emphasis will be upon the creation of materials for classroom use in geography. Curriculum theory and available extant materials will be reviewed. Prer., Geog. 616 or instructor consent. Helburn or Hill.

Geog. 618-3. Seminar: Geographic Problems. Emphasizes research methods and their application to selected topics. An intensive classroom and field course involving several members of the departmental faculty. Weekend field trips to be arranged.

Geog. 619-1 to 3. Experimental Teaching in Geography. Advanced graduate students in geography experimenting with new course content or structures, instructional objectives, curriculum materials, evaluation devices, communication skills, etc., in student teams or in student-professor teams in existing geography courses. Prer., Geog. 616 plus practicum such as teaching assistantship. Hill and Helburn.

Geog. 621-3. Readings in Climatology. Offered alternate years. Selected topics in current climatological literature discussed in seminars. Specific themes will vary but may include aspects of microclimatology, paleoclimatic reconstruction, climatic applications of satellite data. Prer., consent of instructor. Barry or Greenland.

Geog. 630-4, 631-4. The Arctic and Alpine Environments. (EPOB 630-631, Geol. 640-641.) Offered alternate years. Concentration on multidisciplinary aspects of environmental processes and Quaternary history of the arctic-alpine region. This will involve introduction of new and recent faculty research in the Canadian Arctic and in the alpine area of the Rocky Mountains. Local field trips. Prer., consent of instructor. Ives.

Geog. 640-3. Seminar: Comparative Environmental Studies. A critical examination of cross-cultural experience with adjustments to natural hazards and with political management of resource exploitation. Prer., consent of instructor.

Geog. 671-3. Seminar: Political Geography. Offered alternate years. Detailed consideration of the history and methodology of the field, including an analysis of a selected systematic topic such as frontiers and boundaries, international rivers, conflicting claims to territory, power analysis, etc. Myers.

Geog. 672-3. Seminar: Historical Geography. Discussion of the scope and methodology of historical geography, including consideration of past and current trends, as well as future prospects. Seminar presentations on topics selected for their substantive importance. Myers.

Geog. 674-3. Seminar: Cultural Geography. Exploration of various geographic topics emphasizing the concept of culture. Emergence of several points of view in the development of cultural geography. Erickson and Hill.

Geog. 699-2 or 3. Independent Study. Independent research for graduate students. Departmental approval required.

Geog. 700-6. Master's Thesis.

Geog. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

GEOLOGICAL SCIENCES

The following courses are not open to majors in geological sciences: 101, 102, 103, 104, 111, 112, 153, 370, and 497.

Geol. 101-4. Introduction to Geology I. Three lect. and one lab. or field trip per wk. Study of the earth: its materials, its characteristics, and its dynamic processes, and how it relates to man.

Geol. 102-4. Introduction to Geology II. Three lect. and one lab. or field trip per wk. Study of the evolutionary history of the earth and life. Prer., Geol. 101 or equivalent.

Geol. 103-3. Introduction to Geology I. (Same as Geol. 101 without lab.)

Geol. 104-3. Introduction to Geology II. (Same as Geol. 102 without lab.)

Geol. 111-3. Our Dynamic Earth I. Origin, age, and thermal state of the earth. Alternative energy resources. Earthquakes, their causes and prediction. Earth structure.

Geol. 112-3. Our Dynamic Earth II. Basic concepts of the physics of the solid earth. Earth's gravity and magnetic fields, paleomagnetism, sea floor spreading, continental drift, and plate tectonics.

Geol. 123-3. Expository Writing in Geology. Practical experience in scientific writing, from short abstracts to longer term papers. Source materials are observation and geological literature.

Geol. 153-4. Geological Development of Colorado and the West. Three lect. and one field trip or lab. per wk. An outline of the development, through time, of the geology of Colorado. Follow-up for those who have had Geol. 101.

Geol. 207-5, 208-5. General Geology I, II. Three lect. and two field trips or labs. per wk. General introduction to physical and historical geology, geophysics, and geochemistry. Intended for students desiring major work in the geological sciences. Prer., elementary algebra, trigonometry, and chemistry (high school courses acceptable).

Geol. 301-5. Introduction to Mineralogy. Three lect. and rec. and one lab. per wk. Origin, occurrence, identification, classification,

and uses of minerals. Applications of mineralogy to economic geology and petrology are emphasized. Prer., Geol. 207-208. Chem. 106, Math. 130, or consent of instructor.

Geol. 312-5. Structural Geology I. Geometrical techniques for describing and illustrating geological structures. Major topics include graphic methods and geometry of fractures, folds, and igneous bodies. Prer., Geol. 207-208, Math. 110.

Geol. 333-3. Introduction to the Physics of the Solid Earth. A survey of the structure, physical properties of the materials, the environmental conditions, and the processes in the earth's interior. Methods of interpreting geophysical data to determine the state of the interior are emphasized. Prer., Phys. 213, Math. 240.

Geol. 341-4. Introductory Paleontology. Collection, identification, classification, and uses of fossils in paleoecology, evolution, and biostratigraphy. Prer., Geol. 208, or one year of biology, or consent of instructor.

Geol. 342-4. Introductory Stratigraphy. Principles of stratigraphy and interpretation of sedimentary rocks with emphasis on field techniques. Prer., Geol. 208.

Geol. 370-3. Environmental Geology. Interaction of human affairs, earth resources, and geologic processes. Investigation of geologic hazards. Evaluation of criteria for urban planning, land utilization, waste disposal, and resource conservation. Prer., physical geology or consent of instructor.

Geol. 397-3. Geology for Engineers. Advanced-level treatment of physical geology for students with strong backgrounds in science and mathematics. Emphasizes geological hazards, human use of earth materials, and adaptation to earth processes.

Geol. 404/504-3. Geological Hydrology. Surface and ground waters are examined as a dynamic system within a geological framework. Implications for human management of watercourses, water supplies, and water quality are considered. Prer., physical geology, Math. 130 (or equivalent), introductory physics, or consent of instructor. Curtis.

Geol. 410/510-3. Crystal Chemistry. Alternate years. Chemistry, morphology, and physics of crystals as related to crystalline materials in general and minerals in particular. Prer., Chem. 106, Phys. 111-112.

Geol. 411-4. Field Geology. Methods of geologic mapping including plane table surveying and photogrammetry. Prer., Geol. 312.

Geol. 412/512-3. Structural Geology II. Introduction to processes of formation of earth structures. Results of rock mechanics experiments and principles of mechanics are applied to interpret the origin and tectonic significance of common earth structures. Prer., Geol. 312.

Geol. 425-3. Groundwater. Occurrence, movement, and problems of pollution of subsurface water and the hydrologic properties of water-bearing materials. Prer., physical geology, or Geog. 101, or consent of instructor.

Geol. 427/527-4. Thermodynamics for Petrologists. A systematic treatment of thermodynamic principles and methods currently used in igneous, metamorphic, and ore petrology. Weekly problem sets, with computer applications. Prer., Math. 230, Chem. 106, Geol. 207, or equivalent. Munoz.

Geol. 431/531-4. Sedimentation. Study of processes that influence the characteristics of sedimentary rocks. Prer., Geol. 207-208, 301, 342, introductory course in chemistry. Walker.

Geol. 436/536-4. Glacial Geology. Introduction to glaciology, glacial influence on topography, crustal rebound, and sea level, and glacial chronology for northern North America. Prer., elementary geology or equivalent and consent of instructor.

Geol. 448-variable credit. Field Study in Geology. Not offered every year. For special seminars, institutes, etc. May not count toward a degree in geology.

Geol. 447/547-4. Paleontology of the Lower Vertebrates. Evolution of the nonmammalian vertebrates with an emphasis on the evolutionary development of major vertebrate features. Prer., one year beginning biology, one year beginning geology, and Geol. 341.

Geol. 448/548-4. Paleontology of the Higher Vertebrates. Evolution of mammals and birds emphasizing the evolutionary history of modern and prominent fossil orders. Prer., one year beginning biology, one year beginning geology, Geol. 341, or consent of instructor.

Geol. 460/560-4. Mountain Geomorphology. (Geog. 532.) Field course. Includes Front Range glacial geology and glaciology. Mountain Research Station summer. Must be preceded by Geol. 436/536 and Geol. 463/563 or equivalent, to carry graduate credit in geology. INSTAAR staff.

Geol. 463/563-4. Principles of Geomorphology. (Geog. 431.) Systematic study of weathering, mass-wasting, fluvial, wind, and marine processes and the landforms resulting therefrom. Prer., elementary geology or equivalent, and elementary chemistry, or consent of instructor.

Geol. 465-2. Map-Photo Interpretation. Geomorphology on maps and photos. Prer., Geol. 463.

Geol. 477-3. Statistics for Earth Sciences. (Geog. 402.) Introduction to parametric and distribution-free statistics with emphasis on applications to earth science problems. Prer., algebra and introductory calculus.

Geol. 493/593-4. Introduction to Geophysical Prospecting. Basic principles of geophysical prospecting for oil, other minerals, and water. Seismic, magnetic, gravity, electrical, and electromagnetic methods will be discussed. Laboratory included. Basic courses in physics, mathematics, and geology recommended.

Geol. 494-4. Mineral Resources in World Affairs. A nontechnical introduction to the geology, distribution, reserves, uses, and conservation of economic mineral materials, for nongeology majors. Prer., Geol. 101.

Geol. 499-variable credit. Independent Study in Geology. Time and credit to be arranged. For advanced undergraduates and graduates who have high scholastic standing. Open only upon consultation.

Geol. 501-0. Journal Club.

Geol. 502-0. Journal Club.

Geol. 505-3. Introduction to Seismology. Causes and effects of earthquakes, earthquake prediction, seismic waves, record interpretation, parameters of seismic foci, seismo-tectonics of the world. Prer., general physics, calculus. Wyss.

Geol. 517-4. Optical Crystallography. Prer., general physics or principles of physics.

Geol. 518-4. Descriptive Petrology. Prer., Geol. 417; course in systematic mineralogy desirable.

Geol. 521-4, 522-4. Igneous and Metamorphic Petrology. Systematic analysis of the petrology of igneous and metamorphic rocks. Emphasis is placed on integrating knowledge obtained from theory, experiment, and field studies. Prer., Geol. 527, optical mineralogy.

Geol. 523-3. Introduction to Ore Deposits. A survey of processes of ore formation, with examples drawn from selected mining districts. Field mapping, problems, and laboratory examination of representative specimen suites. Prer., Geol. 301, 312, 411.

Geol. 524-1. Introduction to X-Ray Crystallography. Elements of theory and practice of X-ray diffraction by crystalline solids. Prer., consent of instructor. Larson and Munoz.

Geol. 526-5. Advanced Study of Ore Deposits. Study of selected topics in ore deposits. Underground mine mapping, problems and laboratory examination of representative specimen suites. Prer., Geol. 523.

Geol. 528-4. Geochemistry of Natural Waters. Composition and origin of natural waters. Principles relating to reactions between rock materials and water. Ionic equilibria. Computer methods. Geol. 529 offered concurrently for those desiring laboratory work. Prer., college chemistry and some background in mineralogy. Runnells.

Geol. 529-1. Geochemical Analysis of Natural Waters. Five hrs. lab. per wk. Practical experience in the analysis of natural waters. Emphasis on modern instrumental and wet techniques for water analysis. Not taught every year. See Schedule of Courses. Runnells.

Geol. 530-3. Low-Temperature Geochemistry. Discussion of geochemistry of sedimentary and near surface environments. Stability diagrams, ion exchange, weathering, geochemical prospecting, and topics in thermodynamics. Prer., college chemistry and some background in mineralogy. Geol. 527 or 528 recommended. Runnells.

Geol. 532-4. Subsurface Geology. Not offered every year. Considers derivation of geological information from borehole measurements, conversion of the data to suitable diagrams, and the

geological interpretation of diagrams. Prer. or coreq., stratigraphy and structural geology, or consent of instructor. Curtis.

Geol. 538-3. Mechanics of Underground Fluids. Not offered every year. Occurrence and motion of subsurface waters and petroleum fluids considered in relation to production and disposal of fluids in wells. Prer. or coreq., structural geology, stratigraphy, sedimentation, introductory physics, or instructor's consent.

Geol. 539-3. Rock and Paleomagnetism. Offered in alternate years. Study of the origin of magnetic properties of minerals, survey of principal means of rock magnetization and their use in geologic interpretations, and the use and reliability of paleomagnetism. Basic courses in physics, chemistry, mathematics, and geology recommended. Larson.

Geol. 540-4. Quaternary Stratigraphy. Summary of geologic and pedologic methods used to recognize, date, and correlate Quaternary deposits and interpret Quaternary history. Prer., introductory geology and Geol. 463, or consent of instructor. Birkeland.

Geol. 541-3. Ancient Sedimentary Environments. Analysis of sedimentary rock sequences, biostratigraphy, sedimentary environments, and stratigraphic synthesis. Prer., Geol. 342. Eicher.

Geol. 544-4. Morphology and Genesis of Soils. Effects of climate, vegetation, parent material, topography, and time on the development, classification, and chemistry of soils. Prer., introductory geology, chemistry, or consent of instructor; Geol. 463 recommended. Birkeland.

Geol. 545-3, 546-3. Micropaleontology. Offered in alternate years. Classification, occurrence, and interpretation of minute fossils, especially Foraminifera. Prer., Geol. 341-342 or consent of instructor. Eicher.

Geol. 549-3. Geochemistry of Hydrothermal Ore Deposits. Offered alternate years. Laboratory studies, thermodynamic data, chemical data, fluid inclusions, stable isotopes, and field occurrences are all used to explain the composition, origin, and history of hydrothermal ore deposits. Prer., Geol. 527. Munoz.

Geol. 550-3. Geology of Organic Fuels. Not offered every year. Genesis and composition of organic geological materials and the processes leading to their concentration in rocks. Modern exploration for and economic evaluation of coal, oil, and gas deposits. Prer., stratigraphy, sedimentation, structural geology, or consent of instructor. Curtis.

Geol. 551-3. Advanced Invertebrate Paleontology. Not offered every year. Morphology, classification, evolutionary trends, and statistical studies of fossil invertebrates. Prer., Geol. 341. Chronic.

Geol. 552-3. Paleocology. Not offered every year. Environmental factors, relation of fossils to their depositional environment, and paleocological interpretations and syntheses. Prer., Geol. 341-342. Chronic.

Geol. 555, 556, 557, 558, 559-variable credit. Geological Topics Seminar. Seminar studies in geological subjects of special current interest are offered primarily for graduate students, as departmental staff and facilities permit.

Geol. 561-2. Mammalian Micropaleontology. Studies of mammalian microfossils. Methods of analysis, collection, and use in stratigraphic problems such as correlation, paleocology, and earth history. Prer., consent of instructor; Geol. 448/548 recommended. Robinson.

Geol. 562-5. Field Problems in Vertebrate Paleontology. Summer. Field techniques in study of fossil vertebrates and their host rocks. Four weeks field work, one week faunal analysis. Prer., Geol. 342, 411, 447/448 recommended. Robinson.

Geol. 567-2. New Global Tectonics. The most recent and the fundamental ideas regarding the hypothesis of the New Global Tectonics with emphasis on the geophysical aspects. Prer., basic courses in physics, geology, and mathematics; graduate status or consent of instructor. Wyss.

Geol. 580-3. Rock Mechanics. Offered in alternate years. Stress-strain relationships and rheological properties of rocks. Summary of experimental deformation of rocks and minerals. Dynamic analysis of stresses producing common geologic structures. Prer., structural geology, mineralogy, or consent of instructor. Braddock.

Geol. 595-3. Seminar: Climatic Change. (A.G. 595, Geog. 523.) A cross-disciplinary survey of the evidence for and theories of climatic change. Prer., consent of instructor. Barry and faculty.

Geol. 596-3. Earth and Planetary Physics I. Gravity and seismology. Internal structure of the earth, especially density distribution and composition. Basic courses in physics, mathematics, and geology recommended. Harrison.

Geol. 597-3. Earth and Planetary Physics II. Earth's magnetic field and electrical properties of its interior. Internal temperature distribution and thermal history. Physics of the moon and planets. Theories of origin of the solar system. Basic courses in physics, mathematics, and geology recommended. Harrison.

Geol. 599-variable credit. Independent Study.

Geol. 613-3. Geotectonics. Offered alternate years. Diastrophism in type areas of the world is treated from standpoint of deformation mechanics, including gravitational gliding, dome and basin mechanics, wrench fault and block fault tectonics. Prer., structural geology, petrology, or consent of instructor. Warner.

Geol. 615-3. Data Processing in the Earth Sciences. (Geol. 602.) Advanced statistical analysis, multivariate statistics, time series, classification models. Prer., Geol./Geog. 477 or equivalent or consent of instructor. Caine.

Geol. 631-3, 632-3. Sedimentary Petrology. Interpretation of the depositional and diagenetic history of sedimentary rocks as determined from thin-section studies. Prer., Geol. 531 and 517. Walker.

Geol. 640-4, 641-4. The Arctic and Alpine Environments. (EPOB 630-631, Geog. 630-631.) Concentration on multidisciplinary aspects of environmental processes and Quaternary history of the arctic-alpine region. Local field trips. Prer., consent of instructor. Ives and staff.

Geol. 653-3. Advanced Geomorphology. Recent research topics. Precise title specified in *Schedule of Courses*. Prer., Geol. 463 or consent of instructor. Andrews, Birkeland, Bradley.

Geol. 655-variable credit. Seminar in Geophysics. Advanced seminar studies in geophysical subjects for graduate students. Prer., open on consultation. Kisslinger.

Geol. 678-3. Seismic Wave Theory. Theory of wave motion in continuous media, with emphasis on isotropic, elastic materials. Propagation, reflection, refraction, dispersion, and diffraction of body- and surface-waves in infinite and bounded systems, with applications to seismic waves. Prer., differential equations, complex functions, classical mechanics. Kisslinger.

Geol. 679-3. Advanced Seismology. Wave propagation in the earth; inversion of seismological data to obtain earth structure. Matrix formulation of seismic wave transmission. Theory of seismic wave generation illustrating use of contour integration techniques. Prer., Geol. 678. Engdahl.

Geol. 698-3. Rock Physics. Not offered every year. Magnetic, electrical, optical, thermal, and mechanical properties of rocks. Emphasizes basic concepts of solid-state physics and shows the use of these properties in helping to interpret the geologic records. Basic courses in physics, mathematics, and geology recommended. Open on consultation. Spetzler.

Geol. 699. Research. The work will be chiefly individual and will depend largely on preparation and initiative of the student. Credit will depend on time spent and results obtained. Prer., consent of instructor.

Geol. 700-4 to 6. Master's Thesis.

Geol. 800-0 to 8. Doctor's Thesis.

GERMANIC LANGUAGES AND LITERATURES

German

See *Schedule of Courses* for specific course offerings in each semester.

Ger. 101-4. Beginning German I. Fall, Spring. For students with no previous training in German.

Ger. 102-4. Beginning German II. Fall, Spring. Prer., Ger. 101 or equivalent.

Ger. 199-variable credit. Independent Study. Prer., permission of the instructor and approval by the department.

Ger. 201-4. Intermediate German. Fall, Spring. A review and continuation of the basic skills begun in the first year: reading, writing,

speaking and oral comprehension. Fulfills college language requirement. Prer., Ger. 102 or equivalent.

Ger. 202-4. Intermediate German: Reading. Fall, Spring. Prer., Ger. 201 or three levels of high school German or equivalent. Fulfills Graduate School language requirement for the Ph.D.

Ger. 205-2. Intermediate German: Conversation. Fall, Spring. For students who wish supplementary conversational practice on the third semester level. This course does not satisfy the foreign language requirement. Students may take this course concurrently with Ger. 201. Prer., Ger. 102 or equivalent.

Ger. 206-4. Intermediate German: Communication Skills. Fall, Spring. Prer., Ger. 201 or three levels of high school German. Fulfills Graduate School language requirement for the Ph.D.

Ger. 222-4. Scientific German. Fall, Spring. Prer., Ger. 201 or three levels of high school German, or upon consultation. Fulfills Graduate School language requirement for the Ph.D.

Ger. 223-2. Linguistic Introduction to Learning German. Introduction to language and to Modern German in particular for students learning German. Understanding of Modern German through its history; the ways in which languages are learned; the German language in literature. Prer., Ger. 101. Lewis.

Ger. 301-3. Advanced Conversation and Grammar. Fall, Spring. Required for German majors. Prer., Ger. 202 or 206 or 222, or four levels of high school German, or upon consultation.

Ger. 302-3. Advanced Conversation and Composition. Fall, Spring. Required for German majors. Prer., Ger. 301 or upon consultation.

Ger. 309-2. German Pronunciation and Diction. An introduction to phonetics. Prer., Ger. 202 or 206 or 222, or upon consultation.

Ger. 311-3. German Literature I. Fall, Spring. An examination of selected literary texts from 1910 to the present. Prer., Ger. 202 or 206 or 222, or upon consultation. May be taken either before or after or concurrently with Ger. 312.

Ger. 312-3. German Literature II. Fall, Spring. An examination of selected literary texts up to 1910. Prer., Ger. 202 or 206 or 222, or upon consultation. May be taken either before or after or concurrently with Ger. 311.

Ger. 325-3. Germany and the Germans. Introduction to the people and cultures of contemporary Germany as revealed through politics, history, educational systems, theater, film, art, and literature.

Ger. 381-3. German Literature in English Translation I. Fall. Reading knowledge of German not required. Prer., sophomore standing or above, or upon consultation. Blomster or Wessell.

Ger. 382-3. German Literature in English Translation II. Spring. Reading knowledge of German not required. Prer., Ger. 381 or upon consultation. Blomster or Wessell.

Ger. 383-3. The History of the German Film. Reading knowledge of German not required. Prer., sophomore standing or above, or upon consultation. Schmidt.

Ger. 400-2. Senior Seminar. Spring. Prer., Ger. 311 and Ger. 312 or upon consultation.

Ger. 401-3. Advanced Composition, Conversation, and Stylistics I. Fall. Prer., Ger. 302 or upon consultation. Required for German majors.

Ger. 402-3. Advanced Composition, Conversation, and Stylistics II. Spring. Prer., Ger. 401 or upon consultation. Required for German majors.

Ger. 410/510-3. Applied Linguistics. Fall. Introduction to the study of language and its applications to teaching of German. Analysis of phonology, grammatical structure and vocabulary of German and English for high school and college teachers of German. Firestone or Lewis.

Ger. 411-3. German Literature of the 19th Century. Fall, alternate years. Prer., Ger. 311 and 312 or upon consultation. Hall or Schmidt.

Ger. 412-3. German Literature of the 20th Century. Spring, alternate years. Prer., Ger. 311 and 312 or upon consultation. Blomster.

Ger. 423-3. German Civilization. (Soc. 407.) Reading knowledge of German not required. Prer., junior standing or above, or upon consultation. Schmidt.

Ger. 433-2. German Classicism I. Fall, alternate years. Prer., Ger. 311 and 312 or upon consultation. Wessell.

Ger. 434-2. German Classicism II. *Spring, alternate years.* Prer., Ger. 433 or upon consultation.

Ger. 435-3. German Romanticism. Prer., Ger. 311 and 312 or upon consultation. Schmidt.

Ger. 436-3. German Lyric Poetry. Prer., Ger. 311 and 312 or upon consultation. Blomster or Schmidt.

Ger. 437-3. Introduction to German Literary History I. *Fall.* Prer., Ger. 311 and 312 or upon consultation. Hall or Schmidt.

Ger. 438-3. Introduction to German Literary History II. *Spring.* Prer., Ger. 437 or upon consultation. Blomster or Schmidt.

Ger. 480-variable credit. Seminar: Literature in Cultural Context. Provides a broader framework for the work of literature, viewing it from various cultural perspectives. Specific content of course is defined by the instructor each time it is given. In English translation.

Ger. 481-2. Seminar: German Literature in Translation. Reading knowledge of German not required. Prer., junior standing or above or upon consultation.

Ger. 482-variable credit. Hermann Hesse. In English translation; reading knowledge of German not required. Prer., junior standing or above or upon consultation. Blomster.

Ger. 484/564-3. Literature and Music in Translation. *Summer only.* Taught in Aspen, Colorado. Students must be concurrently enrolled in Ger. 485/565. Blomster.

Ger. 485/565-3. Music and Humanities in Translation. *Summer only.* Taught in Aspen, Colorado. Students must be concurrently enrolled in Ger. 484/564. Blomster.

Ger. 491-3. Richard Wagner and the Middle Ages. In English translation; reading knowledge of German not required. Prer., junior standing or above or upon consultation. Firestone.

Ger. 495/595-3. Methods of Teaching German. *Fall.* Required of students who desire the recommendation of the department for secondary school teaching positions. For student teaching in German, see T.Ed. 471 under the School of Education.

Ger. 499-variable credit. Independent Study. Prer., permission of instructor and approval by the department.

Ger. 501-3. Advanced Language Skills I. *Fall.* Training in oral and written language arts: speaking to groups, reciting, and lecturing; English to German translations of difficult texts; writing expository prose. Schmidt.

Ger. 502-3. Advanced Language Skills II. *Spring.* Continuation of Ger. 501, with an emphasis on levels of style. Schmidt.

Ger. 511-3. Topics in German Linguistics. Content varies. Topics include language acquisition and error analysis, German dialects and others. Prer., Ger. 410/510 or upon consultation. Firestone or Lewis.

Ger. 512-3. German-English Language Contact. Survey of types of linguistic borrowing. Influence of English on German and German on English in different historical periods, especially post-World War II; German-English bilingualism in North America. Lewis.

Ger. 513-3. Structure of Modern German. Emphasizes morphological and syntactic patterns in German. Lewis.

Ger. 514-3. History of the German Language I. *Fall.* Stresses the cultural and political factors which helped to shape the language. The main linguistic aspects dealt with are lexical and semantic changes. Firestone or Oster.

Ger. 515-2. History of the German Language II. *Spring.* Historical grammar, stressing phonological, morphological, and syntactic changes in the language. Firestone or Oster.

Ger. 517-3. Gothic. Grammar and readings in the Gothic language. The course also provides an introduction to comparative Germanic linguistics. Firestone or Oster.

Ger. 518-3. Old Norse. Introduction to grammar and vocabulary of Old Norse. Selected readings in prose and poetry. Oster.

Ger. 519-3. Old High German. Grammar and readings of selected texts from the earliest writings in German. Review of linguistic change from the 8th century to the present. Firestone or Oster.

Ger. 520-2. Nordic Mythology. (Scand. 420.) In English translation. Prer., senior standing or upon consultation. Oster.

Ger. 521-3. Introduction to Middle High German. A study of classical medieval German, with readings from works by principal Middle High German poets. Firestone or Hall.

Ger. 524-3. Early German Literature. A survey of German literature from the earliest monuments through about 1600. Readings in Modern German translation. Hall.

Ger. 525-2. Icelandic Saga. (Scand. 425.) Readings and discussions of a representative selection from the sagas. In English translation. Oster.

Ger. 532-3. German Literature From 1600 Through Classicism. A survey of literary forms, movements, and writers from the Reformation and German Renaissance through the Baroque and the 18th century. Wessell.

Ger. 533-3. German Literature of the 19th Century. A survey of literary forms, movements and writers from Romanticism to the end of Realism. Schmidt.

Ger. 534. German Literature of the 20th Century. A survey of literary forms, movements, and writers from Naturalism up to the present. Blomster.

Ger. 537-3. Lessing and His Time.

Ger. 541-3. Goethe I: The Young Goethe. Goldsmith.

Ger. 542-3. Goethe II: After 1808. Goldsmith.

Ger. 543-3. Goethe's Early Dramas and Faust I. Goldsmith.

Ger. 544-3. Goethe's Faust II. Goldsmith.

Ger. 547-3. Schiller I. Blomster.

Ger. 548-3. Schiller II. Blomster.

Ger. 571-3. Thomas Mann. Blomster.

Ger. 572-3. Franz Kafka. Blomster or Schmidt.

Ger. 573-3. Bertolt Brecht. Goldsmith or Schmidt.

Ger. 581-3. German Civilization. A survey of cultural history with an emphasis on movements that have contributed most in shaping modern Germany in its spiritual and artistic manifestations. With slides and tapes. Knowledge of German required. Blomster or Schmidt.

Ger. 592-variable credit. Seminar: Interdisciplinary Studies. Course taught jointly by members of this department with faculty from other departments. Relationships most frequently studied in this course include those between literature and history, music, philosophy, or the fine arts.

Ger. 593-2. Literature in the Classroom.

Ger. 596-2. Educational Media in the Foreign Language Classroom. Designed to familiarize the foreign language teacher with the technique of selection, preparation, and application of multimedia in the teaching of foreign language.

Ger. 597-2. College German Teaching. *Fall.* Required of new part-time instructors who have no previous teaching experience.

Ger. 599-variable credit. Independent Study. Prer., permission of the instructor and departmental approval.

Ger. 601-3. Proseminar. An introduction to the techniques and problems of scholarly research and writing; familiarization with research tools, followed by application to a specific project in German literature.

Ger. 699-variable credit. Independent Study. Prer., permission of the instructor and departmental approval.

Ger. 700-6. Master's Thesis.

Ger. 710-3. Seminar in German Literature.

Ger. 711-3. Seminar in German Literature.

Ger. 712-3. Seminar in German Literature.

Ger. 720-3. Seminar in Germanic Linguistics.

Ger. 721-3. Seminar in Germanic Linguistics.

Ger. 730-3. Seminar in Language Instruction.

Ger. 799-variable credit. Independent Study. Prer., permission of instructor and departmental approval.

Ger. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Also recommended as supplementary courses for German majors are all courses in Scandinavian languages and literatures, and Hist. 435 and 436, History of Germany.

Scandinavian

Nor. 101-5. Beginning Norwegian I. *Fall.*

Nor. 102-5. Beginning Norwegian II. *Spring.* Prer., Nor. 101 or upon consultation.

Nor. 211-3. Second-Year Norwegian Reading and Conversation I. *Fall*. Fulfills the college language requirement for the B.A. and B.F.A. degrees. Prer., Nor. 102 or upon consultation.

Nor. 212-3. Second-Year Norwegian Reading and Conversation II. *Spring*. Prer., Nor. 211 or upon consultation.

Scand. 199-variable credit. Independent study. Prer., permission of instructor.

Scand. 420-2. Nordic Mythology. (Ger. 520.) Prer., senior standing or upon consultation. Oster.

Scand. 425-2. Icelandic Saga. (Ger. 525.) In English translation. Oster.

Scand. 480-3. The Modern Scandinavian Novel. In English translation. Oster.

Scand. 490-3. The Modern Scandinavian Drama. In English translation. Oster.

Scand. 492/592-2. Ibsen. In English translation. Oster.

Scand. 499-variable credit. Independent Study. Prer., permission of instructor.

Swed. 101-5. Beginning Swedish I. *Fall*.

Swed. 102-5. Beginning Swedish II. *Spring*. Prer., Swed. 101 or upon consultation.

Swed. 201-2. Second-Year Conversational Swedish. Prer., Swed. 102 or upon consultation. This course does not fulfill the college language requirement for the B.A. and B.F.A. degrees.

Swed. 211-3. Second-Year Swedish Reading and Conversation I. *Fall*. This course fulfills the college language requirement for the B.A. and B.F.A. degrees. Prer., Swed. 102 or upon consultation.

Swed. 212-3. Second-Year Swedish Reading and Conversation II. *Spring*. Prer., Swed. 211 or upon consultation.

Swed. 325-3. Modern Sweden. A discussion of various aspects of modern Sweden with emphasis on achievements in areas such as social welfare, civil liberties, education, environment, and the living and life standards resulting from them. Taught in English.

Swed. 487-3. Masterpieces of Swedish Literature I. In English translation. Oster.

Swed. 488-3. Masterpieces of Swedish Literature II. In English translation. Prer., Swed. 481 or upon consultation. Oster.

Swed. 491/591-2. Strindberg. In English translation. Oster.

Swed. 499-variable credit. Independent Study. Prer., permission of instructor.

HISTORY

Hist. 101-3. History of Western Civilization.¹ *Fall, Spring*.

Hist. 102-3. History of Western Civilization.¹ *Fall, Spring*.

Hist. 103-3. Introduction to Asian History: The Middle East and India.

Hist. 104-3. Introduction to Asian History: China and Japan.

Hist. 151-3. History of the United States to 1865.¹ *Fall, Spring*.

Hist. 152-3. History of the United States Since 1865.¹ *Fall, Spring*.

Hist. 201-3. The World of the Ancient Greeks. (Clas. 201.) *Fall*.

Hist. 202-3. The Rise and Fall of Ancient Rome. (Clas. 202.) *Spring*.

Hist. 203-3. Topics in Ancient History. (Clas. 203.) Hohlfelder.

Hist. 204-3. Topics in Ancient History. (Clas. 204.) Hohlfelder.

Hist. 205-3. Encounters With History. Downey.

Hist. 207-3. History of Christianity I: To the Reformation. Christensen.

Hist. 208-3. History of Christianity II: Since the Reformation. Christensen.

Hist. 211-3. Culture and Institutions of the Middle Ages. *Fall*.

Hist. 212-3. Culture and Institutions of the Middle Ages. *Spring*.

Hist. 213-3. Topics in Medieval History. Hill.

Hist. 214-3. Topics in Medieval History. Hill.

Hist. 215-3. Afro-American History I. (Bl. St. 215.)

Hist. 216-3. Afro-American History II. (Bl. St. 216.)

Hist. 219-3. Topics in European Intellectual History. Gross.

Hist. 220-3. Topics in European Intellectual History. Gross.

Hist. 223-3. Topics in Renaissance-Reformation History. Christensen.

Hist. 224-3. Topics in Renaissance-Reformation History. Christensen.

Hist. 225-3. Topics in Early Modern European History. Ruestow.

Hist. 226-3. Topics in Early Modern European History. Ruestow.

Hist. 227-3. Topics in the History of East-Central Europe. Fischer-Galati.

Hist. 228-3. Topics in the History of East-Central Europe. Fischer-Galati.

Hist. 235-3. Topics in German History. Pois.

Hist. 236-3. Topics in German History. Pois.

Hist. 237-3. Topics in Recent European History.

Hist. 238-3. Topics in Recent European History.

Hist. 241-3. History of England. *Fall*.

Hist. 242-3. History of England. *Spring*.

Hist. 244-3. Topics in English History. Simon.

Hist. 245-3. Topics in English History. Simon.

Hist. 248-3. Topics in 18th-19th-20th Century English History. Middleton.

Hist. 249-3. Topics in 18th-19th-20th Century English History. Middleton.

Hist. 253-3. Topics in the History of American Indian-White Relations. Pilcher.

Hist. 254-3. Topics in American History. Pilcher.

Hist. 255-3. Topics in History of American Capitalism, 1865-Present. Scamehorn.

Hist. 258-3. History of Colorado.¹

Hist. 259-3. Topics in American Southwest History.

Hist. 260-3. Topics in American Southwest History.

Hist. 261-3. Topics in American History to 1865. Athearn.

Hist. 262-3. Topics in American History Since 1865. Athearn.

Hist. 263-3. Topics in American Society and Thought. Mann.

Hist. 264-3. Topics in American Society and Thought. Mann.

Hist. 265-3. Topics in U.S. History, 1929-1952. Scamehorn.

Hist. 266-3. Topics in U.S. History, 1948-Present. Scamehorn.

Hist. 267-3. Topics in American Diplomatic History.

Hist. 268-3. Topics in Modern American History, 1900-1929.

Hist. 270-3. Japanese History Through Film. Lebra.

Hist. 271-3. History of the Modern Far East.¹ *Fall*.

Hist. 272-3. History of the Modern Far East.¹ *Spring*.

Hist. 273-3. Topics in Urban American History. Downey.

Hist. 274-3. Topics in Urban American History. Downey.

Hist. 277-3. Topics in the History of India. Lebra.

Hist. 279-3. Topics in American Military History.

Hist. 280-3. Topics in American Military History.

Hist. 281-3. History of Latin America. The Colonial Experience. (M.A. 281.) Taylor.

Hist. 282-3. History of Latin America. The National Experience. Slenes.

Hist. 283-3. Topics in Latin American History. Taylor and Slenes.

Hist. 284-3. Topics in Latin American History. Taylor and Slenes.

Hist. 291-3. Topics in Middle Eastern History. Jankowski.

Hist. 292-3. Topics in Middle Eastern History. Jankowski.

Hist. 295-3. Topics in African History.

Hist. 296-3. Topics in African History.

Hist. 298-3. History of Women in the United States.

Hist. 301-3. Selected Readings in Ancient History. Hohlfelder.

Hist. 302-3. Selected Readings in Medieval History. Hill.

Hist. 303-3. Selected Readings in Renaissance and Reformation. Christensen.

Hist. 304-3. Selected Readings in Early Modern Europe. Ruestow.

Hist. 305-3. Selected Readings in European Intellectual History. Gross.

Hist. 306-3. Selected Readings in Early English History. Simon.

Hist. 307-3. Selected Readings in Britain Since 1688. Middleton.

Hist. 308-3. Selected Readings in Comparative European History. Fischer-Galati.

Hist. 309-3. Selected Readings in Modern European History. Beach.

Hist. 310-3. Selected Readings in German History. Pois.

Hist. 311-3. Selected Readings in Early American History. Pilcher.

¹Also available through correspondence study.

- Hist. 312-3. **Selected Readings in the American West.** Athearn.
 Hist. 313-3. **Selected Readings in Great Plains.**
 Hist. 314-3. **Selected Readings in American Society and Thought.** Mann.
 Hist. 315-3. **Selected Readings in Urban American History.** Downey.
 Hist. 316-3. **Selected Readings in American Diplomatic History.**
 Hist. 317-3. **Selected Readings in Recent American History.** Scamehorn.
 Hist. 318-3. **Selected Readings in Japanese History.** Lebra.
 Hist. 319-3. **Selected Readings in Modern Middle East History.** Jankowski.
 Hist. 320-3. **Selected Readings in Recent Chinese History.** Miner.
 Hist. 321-3. **Selected Readings in Latin American History.** Taylor.
 Hist. 322-3. **Selected Readings in Latin American History.** Slenes.
 Hist. 323-3. **Selected Readings in Russian History.** Engel.
 Hist. 331-3. **Research Seminar: Ancient History.** Hohlfelder.
 Hist. 332-3. **Research Seminar: Medieval History.** Hill.
 Hist. 333-3. **Research Seminar: Renaissance & Reformation.** Christensen.
 Hist. 334-3. **Research Seminar: Early Modern Europe.** Ruestow.
 Hist. 335-3. **Research Seminar: European Intellectual History.** Gross.
 Hist. 336-3. **Research Seminar: Early English History.** Simon.
 Hist. 337-3. **Research Seminar: Britain Since 1688.** Middleton.
 Hist. 338-3. **Research Seminar: Comparative European History.** Fischer-Galati.
 Hist. 339-3. **Research Seminar: Modern European History.** Beach.
 Hist. 340-3. **Research Seminar: German History.** Pois.
 Hist. 341-3. **Research Seminar: Early American History.** Pilcher.
 Hist. 342-3. **Research Seminar: The American West.** Athearn.
 Hist. 343-3. **Research Seminar: Great Plains.**
 Hist. 344-3. **Research Seminar: American Society and Thought.** Mann.
 Hist. 345-3. **Research Seminar: Urban American History.** Downey.
 Hist. 346-3. **Research Seminar: American Diplomatic History.**
 Hist. 347-3. **Research Seminar: Recent American History.** Scamehorn.
 Hist. 348-3. **Research Seminar: Japanese History.** Lebra.
 Hist. 349-3. **Research Seminar: Modern Middle East.** Jankowski.
 Hist. 350-3. **Research Seminar: Recent Chinese History.** Miner.
 Hist. 351-3. **Research Seminar: Latin American History.** Taylor.
 Hist. 352-3. **Research Seminar: Latin American History.** Slenes.
 Hist. 353-3. **Research Seminar: Russian History.** Engel.
 Hist. 361-3. **The Indian in American History.** Pilcher.
 Hist. 362-3. **American Reform Movements.** Mitterling.
 Hist. 372-3. **Teaching History.** Downey.
 Hist. 378-3. **Japan at War.** Lebra.
 Hist. 383-3. **Rural Societies of Mexico, 1800-Present.** Taylor.
 Hist. 384-3. **The Cuban Revolution.** Slenes.
 Hist. 385-3. **Latin America: Dependency and Development in the 20th Century.** Slenes.
 Hist. 391-3. **History of Zionism and Israel.** Jankowski and Pois.
 Hist. 398-3. **Women in Victorian England.**
 Hist. 400/500-3. **Women in Japanese History.** Lebra.
 Hist. 401/501-3. **Prehistoric and Archaic Greece (3000-600 B.C.).** (Clas. 401.)
 Hist. 402/502-3. **The Athenian Empire and Greek Democracy.** (Clas. 402.)
 Hist. 403/503-3. **Alexander and the Hellenistic World.** (Clas. 403.)
 Hist. 404/504-3. **The Scientific Revolution, 1543-1687.** Ruestow.
 Hist. 407/507-3. **History of the Byzantine Empire.** (Clas. 409.)
 Hist. 408/508-3. **The Roman Republic.** (Clas. 408.)
 Hist. 409/509-3. **The Roman Empire.** (Clas. 409.)
 Hist. 410/510-3. **Leaders of Greece and Rome.** (Clas. 410.)
 Hist. 411/511-3. **Social Foundations of European Civilization.** *Fall.* Hill.
 Hist. 412/512-3. **Intellectual History of Medieval Europe.** *Spring.* Hill.
 Hist. 413/513-3. **Constitutional and Legal History of England to 1485.** Simon.
 Hist. 414/514-3. **Constitutional and Legal History of England to 1714.** Simon.
 Hist. 415/515-3. **History of Science from the Ancients to Sir Isaac Newton.** Hill and Ruestow.
 Hist. 416/516-3. **History of Science from Sir Isaac Newton to the Present.** Hill and Ruestow.
 Hist. 417-3. **Pre-Colonial History of West Africa.** (BLSt. 415.)
 Hist. 419/519-3. **European Intellectual History, 1750-1870.** Gross.
 Hist. 420/520-3. **European Intellectual History, 1870-Present.** Gross.
 Hist. 422/522-3. **History of World War II.**
 Hist. 423/523-3. **Europe During the Renaissance.** Christensen.
 Hist. 424/524-3. **Age of the Reformation.** Christensen.
 Hist. 425/525-3. **War and the European State, 1618-1793.** Ruestow.
 Hist. 426/526-3. **The Age of Reason, Montaigne to Voltaire.** Ruestow.
 Hist. 427/527-3. **History of East-Central Europe.** Fischer-Galati.
 Hist. 428/528-3. **History of East-Central Europe.** Fischer-Galati.
 Hist. 429/529-3. **History of France from the Earliest Beginnings to 1815.** Beach.
 Hist. 430/530-3. **History of France Since 1815.** Beach.
 Hist. 431/531-3. **Nineteenth-Century Europe.** Beach.
 Hist. 432/532-3. **Twentieth-Century Europe.** Beach.
 Hist. 433/533-3. **The French Revolution and Napoleon.** Beach.
 Hist. 434/534-3. **Colonial America, 1600-1750.** Pilcher.
 Hist. 435/535-3. **History of Germany to 1849.** Pois.
 Hist. 436/536-3. **History of Germany Since 1849.** Pois.
 Hist. 437/537-3. **Diplomatic History of Europe in the 19th Century.**
 Hist. 438/538-3. **Diplomatic History of Europe in the 20th Century.**¹
 Hist. 443/543-3. **Tudor England.** Simon.
 Hist. 444/544-3. **Stuart England.** Simon.
 Hist. 445/545-3. **Constitutional and Legal History of England, 1715-1832.** Middleton.
 Hist. 446/546-3. **Constitutional and Legal History of England, 1832-Present.** Middleton.
 Hist. 447/547-3. **England in the Age of Revolutions, 1688-1832.** Middleton.
 Hist. 448/548-3. **England in the Age of Collectivism, 1832-Present.** Middleton.
 Hist. 449/549-3. **The Gilded Age, 1870-1900.** Downey.
 Hist. 451/551-3. **The American Revolution.** Pilcher.
 Hist. 452/552-3. **Early National America.**
 Hist. 453/553-3. **Civil War and Reconstruction.** Athearn.
 Hist. 454/554-3. **Recent America, 1900-1929.**
 Hist. 455/555-3. **History of American Capitalism in the Age of Affluence.** Scamehorn.
 Hist. 456/556-3. **The Jacksonian Era.** Mitterling.
 Hist. 457/557-3. **The Early American Frontier.** Athearn.
 Hist. 458/558-3. **The Later American Frontier.** Athearn.
 Hist. 459/559-3. **Anglo-American Southwest.**
 Hist. 461/561-3. **Constitutional History of the United States to 1860.** Pilcher.
 Hist. 462/562-3. **Constitutional History of the United States Since 1860.**
 Hist. 463/563-3. **American Society and Thought to 1860.** Mann.
 Hist. 464/564-3. **American Society and Thought Since 1860.** Mann.
 Hist. 465/565-3. **U.S. History, 1929-1952.** Scamehorn.
 Hist. 466/566-3. **U.S. History, 1948-Present.** Scamehorn.
 Hist. 467/567-3. **Diplomatic History of the United States to 1900.**¹
 Hist. 468/568-3. **Diplomatic History of the United States Since 1900.**¹
 Hist. 469/569-3. **Workshop in Colorado History.** Downey.
 Hist. 470/570-3. **History of Urban America.** Downey.

¹Also available through correspondence study.

- Hist. 472/572-3. History of Modern Chinese Intellectual Thought. Miner.
- Hist. 473/573-3. History of Traditional China. Miner.
- Hist. 474/574-3. History of Modern China. Miner.
- Hist. 475/575-3. History of Japan. Lebra.
- Hist. 476/576-3. History of Japan. Lebra.
- Hist. 477/577-3. Ancient and Medieval India. Lebra.
- Hist. 478/578-3. Modern India. Lebra.
- Hist. 479/579-3. U.S. Military History to 1900.
- Hist. 480/580-3. U.S. Military History Since 1900.
- Hist. 481/581-3. History of Mexico to 1821. Taylor.
- Hist. 482/582-3. The Emergence of Modern Mexico. Taylor.
- Hist. 483/583-3. Brazil and Argentina Since Independence. Slenes.
- Hist. 484/584-3. The Andean Countries Since Independence. Slenes.
- Hist. 485/585-3. History of Spain. Taylor.
- Hist. 488/588-3. Medieval Middle East, 500-1600 A.D. Jankowski.
- Hist. 489/589-3. The Modern Middle East, 1600 to the Present. Jankowski.
- Hist. 490/590-3. History of Flight and the Exploration of Space. Scamehorn.
- Hist. 491/591-3. The Arab-Israeli Problem. Jankowski.
- Hist. 493/593-3. History of Russia Through the 17th Century.¹
- Hist. 494/594-3. Imperial Russia.¹
- Hist. 495/595-3. The Russian Revolution and the Soviet Regime.¹
- Hist. 496/596-3. The Soviet Union, 1929 to the Present.
- Hist. 497/597-3. Russian Intellectual History.
- Hist. 498-3. Senior Colloquium.
- Hist. 499-variable credit. Independent Study.
- Hist. 505-3. The New South. Hernandez.
- Hist. 506-3. History of British Empire/Commonwealth. Wolf.
- Hist. 517-3. Greek Inscriptions. (Gr. 570.)
- Hist. 521-3. History of Colorado.
- Hist. 540-3. History of Italy 1815-1945. Allen.
- Hist. 541-3. History of Africa to 1850. Wolf.
- Hist. 542-3. History of Africa From 1850. Wolf.
- Hist. 550-3. A Political History of Africa. Wolf.
- Hist. 560-3. Mexican-American Southwest.
- Hist. 586-3. Old South and National Disunion. Hernandez.
- Hist. 587-3. History of Southern Africa. Wolf.
- Hist. 598-3. Computer Applications in the Humanities. (Eng. 591.) Sawin.
- Hist. 599-variable credit. Independent Study.
- Hist. 644-3. Readings in Modern European Diplomatic History. Allen.
- Hist. 645-3. Readings in African History. Wolf.
- Hist. 646-3. Readings in African History. Wolf.
- Hist. 647-3. Readings in English History Since 1714. Middleton.
- Hist. 648-3. Readings in British Commonwealth. Wolf.
- Hist. 649-3. Readings in the American Revolution. Pilcher.
- Hist. 650-3. Readings in U.S. History to 1776. Pilcher.
- Hist. 651-3. Readings in U.S. History, 1776-1815. Mitterling.
- Hist. 652-3. Readings in U.S. History, 1815-1860.
- Hist. 653-3. Readings in U.S. History, 1860-1900. Hernandez.
- Hist. 654-3. Readings in the American Southwest.
- Hist. 655-3. Readings in History of American Capitalism. Scamehorn.
- Hist. 657-3. Readings in the Early American Frontier. Athearn.
- Hist. 658-3. Readings in the American West. Athearn.
- Hist. 661-3. Readings in the History of American Women. Chambers-Schiller.
- Hist. 663-3. Readings in U.S. Society and Thought. Mann.
- Hist. 665-3. Readings in U.S. History, 1929-1952. Scamehorn.
- Hist. 666-3. Readings in U.S. History, 1948-Present. Scamehorn.
- Hist. 667-3. Approaches to the Teaching of History. Downey.
- Hist. 668-3. Readings in American Diplomatic History.
- Hist. 669-3. Readings in the Emergence of Modern America, 1870-1900. Downey.
- Hist. 670-3. Readings in the History of Urban America. Downey.
- Hist. 671-3. Readings in Chinese History. Miner.
- Hist. 674-3. Readings in Southeast Asian History.
- Hist. 675-3. Readings in Modern Japanese History. Lebra.
- Hist. 676-3. Readings in Modern Indian History. Lebra.
- Hist. 681-3. Readings in Latin American Colonial History. Taylor.
- Hist. 682-3. Readings in Latin American National History. Slenes.
- Hist. 683-3. Readings in Mexican American Southwest. Hernandez.
- Hist. 685-3. Introduction to Historic Preservation. Scamehorn.
- Hist. 690-3. Introduction to Archival and Records Management Procedures. Scamehorn.
- Hist. 691-3. Readings in Middle Eastern History. Jankowski.
- Hist. 692-3. Readings in Near Eastern History. Jankowski.
- Hist. 693-3. Readings in Modern Russian History.
- Hist. 695-3. Readings in the History of European Women. Engel.
- Hist. 697-3. The Russian Revolutionary Movement.
- Hist. 699-3. Independent Study.
- Hist. 700-4 to 6. Master's Thesis.
- Hist. 711-3. Seminar: Teaching History in Higher Education. Downey.
- Hist. 712-3. Seminar: Ancient History. (Clas. 712.) Hohlfelder.
- Hist. 721-3. Problems in Medieval History. Hill.
- Hist. 722-3. Problems in Medieval History. Hill.
- Hist. 723-3. Latin Paleography. (Clas. 723.) Hill.
- Hist. 724-3. Latin Paleography. (Clas. 724.) Hill.
- Hist. 727-3. Seminar: Early Modern Europe, 16th-18th Centuries. Ruestow.
- Hist. 728-3. Seminar: East Central Europe. Fischer-Galati.
- Hist. 730-3. Intellectual History of Europe, 1100-1500. Gross.
- Hist. 731-3. Intellectual History of Europe, 1100-1500. Gross.
- Hist. 732-3. Studies in Renaissance Culture. Christensen.
- Hist. 733-3. Studies in the 18th Century. Christensen.
- Hist. 734-3. Seminar: Modern European History. Beach.
- Hist. 735-3. Seminar: Modern European History. Beach.
- Hist. 736-3. Seminar: History of Modern Germany. Pois.
- Hist. 737-3. Seminar: History of Modern Germany. Pois.
- Hist. 738-3. Seminar: French Revolution and Napoleon. Beach.
- Hist. 739-3. Seminar: 20th-Century France. Beach.
- Hist. 740-3. Seminar: European Intellectual History. Gross.
- Hist. 741-3. Seminar: History of the British Empire. Wolf.
- Hist. 742-3. Seminar: African History. Wolf.
- Hist. 743-3. Seminar: History of England to 1715. Simon.

Consent of instructor is required.

- Hist. 600-3. Historical Methods: Introduction to the Professional Study of History. *Fall*.
- Hist. 601-3. Historiography: introduction to the Professional Study of History. *Spring*.
- Hist. 602-3. Teaching History in Higher Education.
- Hist. 603-3. Readings in Greek History. (Clas. 603.)
- Hist. 604-3. Readings in Roman History. (Clas. 604.)
- Hist. 611-3. History of Biology. (EPOB 564.)
- Hist. 613-3. Readings in 17th-Century Europe. Ruestow.
- Hist. 614-3. Readings in 18th-Century Europe. Ruestow.
- Hist. 615-3. Readings in the History of Science. (Phil. 515.)
- Hist. 616-3. Readings in the History of Science. (Phil. 516.)
- Hist. 621-3. Readings in Medieval History. Hill.
- Hist. 628-3. Readings in History of East-Central Europe. Fischer-Galati.
- Hist. 632-3. Readings in Renaissance History. Christensen.
- Hist. 633-3. Readings in 16th-Century History. Christensen.
- Hist. 634-3. Readings in European Intellectual History. Gross.
- Hist. 635-3. Readings in Modern German History. Pois.
- Hist. 637-3. Revolution.
- Hist. 638-3. Readings in Modern French History. Beach.
- Hist. 642-3. Readings in English History to 1714. Simon.
- Hist. 643-3. Readings in Modern European History. Beach.

¹Also available through correspondence study.

Hist. 744-3. Seminar: History of England to 1715. Simon.
Hist. 746-3. Seminar: English History, 1832-Present. Middleton.
Hist. 749-3. Seminar: Early American History. Pilcher.
Hist. 750-3. Seminar: Early American History. Pilcher.
Hist. 752-3. Seminar: Middle Period of American History: 1840-1876. Hernandez.
Hist. 753-3. Seminar: Modern European Diplomatic History. Allen.
Hist. 754-3. Seminar: Modern European Diplomatic History. Allen.
Hist. 755-3. Seminar: History of American Capitalism. Scamehorn.
Hist. 757-3. Problems in the History of the American Frontier. Athearn.
Hist. 758-3. Problems in the History of the American Frontier. Athearn.
Hist. 759-3. Seminar: The Emergence of Modern America, 1870-1900. Downey.
Hist. 760-3. Problems in the History of the American Southwest.
Hist. 761-3. Seminar: American Constitutional History. Pilcher.
Hist. 762-3. Seminar: American Constitutional History. Pilcher.
Hist. 763-3. Seminar: American Society and Thought. Mann.
Hist. 764-3. Seminar: American Society and Thought. Mann.
Hist. 765-3. Seminar: U.S. History, 1929-1952. Scamehorn.
Hist. 766-3. Seminar: U.S. History, 1948-Present. Scamehorn.
Hist. 767-3. Seminar: American Diplomatic History.
Hist. 768-3. Seminar: American Diplomatic History.
Hist. 770-3. Seminar: History of Urban America. Downey.
Hist. 771-3. Seminar: Premodern Chinese History. Miner.
Hist. 772-3. Seminar: Modern Chinese History. Miner.
Hist. 776-3. Seminar: Modern Japanese History. Lebra.
Hist. 781-3. Seminar: Latin American History. Taylor.
Hist. 782-3. Seminar: Latin American History. Slenes.
Hist. 785-3. Training in Historic Preservation. Scamehorn.
Hist. 790-3. Training in Archival and Records Management Procedures. Scamehorn.
Hist. 792-3. Seminar: Islamic History. Jankowski.
Hist. 794-3. Seminar: Modern Russian History.
Hist. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

INTEGRATED STUDIES

Biological Science

Science majors should see EPOB 101-102 and MCDB 105-106. Students may not receive credit for Biol.Sci. 103-104 in addition to EPOB 101-102 or MCDB 105-106.

Biol.Sci. 103-4. Introduction to Biological Science. *Fall.* Principles of biology and their implications. For nonscience majors. Central theme is "Man and the Environment" with an emphasis on ecology, natural resource conservation, and the interrelatedness of a growing human population. Lectures, recitations, open laboratories, optional field studies.

Biol.Sci. 104-4. Introduction to Biological Science. *Spring.* A continuation of 103 with the emphasis, "Man as a Functioning Organism." Organ systems including common malfunctions are studied around the central theme of a constant internal environment.

Biol.Sci. 304-3. The Darwinian Revolution. *Spring.* An examination of the origins, development, and influence of evolutionary theory. Reading, discussion, lectures. A course paper is required. Prer., two semesters of college biology.

Biol.Sci. 499-1 to 3. Independent Study. Consent of instructor required.

Humanities

An interdisciplinary major in humanities is offered by the Department of Integrated Studies. For require-

ments, see Humanities section. The sequence Hum. 101-102 fulfills the college humanities requirement.

Hum. 101-6. Introduction to the Humanities. *Fall.* Seven meetings a week (four discussion classes, three lect.-demonstrations in art and music). Analytical and comparative study of works in literature, philosophy, music, and the visual arts. From Aegean to Baroque, emphasizing structure, content, and style in specific examples.

Hum. 102-6. Introduction to the Humanities. *Spring.* Continuation of Hum. 101. From Baroque to contemporary styles. Prer., Hum. 101. Credit cannot be received for both Hum. 101-102 and Engl. 160-161 (formerly 120-121.)

See the *Schedule of Courses* for the following topics currently offered.

Hum. 301-3. The Comic Sense.

Hum. 302-3. Narrative in the Arts. Explores the nature of narrative, its forms of presentation in literature, film, dance, art, and music-verbal and nonverbal modes of relating a story with consideration of the importance of fictional and documentary narrative. Prer., Hum. 101-102 recommended, 6 hrs. of literature; consent of instructor.

Hum. 303-3. Arts and Society. Prer., Hum. 101-102 recommended; consent of instructor.

Hum. 304-3. The Tragic Sense. Tragedy extends our awareness of man's emotional capacity. The pain and the majesty of human life are celebrated in the fiction of Dostoevsky, the art of Rembrandt, and the opera of Verdi, as well as in classic and modern dramatic literature.

Hum. 305-3. History of Film. Follows film's historical and aesthetic growth by viewing silent and early sound films (half of the films shown are silents). Genres studied include documentaries, experimental films and classic Russian, German, French, and American films made before 1940.

Hum./F.S. 306-3. Film History II. This course starts with the late 1930s and early 1940 films of Dreyer, Vigo, Welles, Cocteau, late Eisenstein, and Chaplin and follows the historical growth and evolution of film esthetics to the present. Neo-realist, French New Wave, and recent experimental films are studied.

Hum. 320-3. Computers and Folklore. Involves a rapid survey of various genres of folklore: ballads, folk song and drama, riddles, similes, limericks, puns, and jokes, as well as nonverbal folklore. Individual and class projects are carried out, making use of established computer-aided methods of analysis.

Hum. 401-3. Film and Fiction. The course explores the similarities and differences between literature and film as narrative arts. Several novels, short stories, plays and the films made from them are studied. Problems in point of view, manipulation of time, tone, structure, and setting are examined.

Hum. 402-3. Film Theory. Prer., Hum. 305 or consent of instructor.

Hum. 408-3. Period Studies. Will focus on the literature, art, and music of a particular period or movement. For example, the Baroque, Neo-Classicism, Romanticism, or Expressionism. Prer., Hum. 101-102 or consent of instructor.

Hum. 410-3. Studies in Humanities. Prer., Hum. 101-102 or consent of instructor.

Hum. 411-3. Studies in Humanities. Prer., Hum. 101-102 or consent of instructor.

Hum. 416-3. Myth in the Arts. (Clas. 416/516; C. Lit. 482/582.) Prer., Hum. 101-102 or 6 hours of general classics or consent of instructor.

Hum. 480-3. The Arts and Aesthetic Theory. (C. Lit. 580.) Readings in 20th-century aesthetics with emphasis on the direct relation between aesthetic theory and the several arts. Prer., Hum. 101-102 or 9 hrs. in any one of the arts, or consent of instructor.

Hum. 482-3. Law and Literature. (Engl. 582.) *Fall, alternate years.* Exploration of law as theme and structure from *Antigone* and Utopia to modern fiction, plus readings in legal materials. Prer., Hum. 101-102.

Hum. 483-3. Law and Literature. (Engl. 583.) *Spring, alternate years.* Continuation of Hum. 482. Seminar investigating problems of censorship, obscenity, etc. Prer., Hum. 482 or consent of instructor.

Hum. 499-1 to 3. Independent Study. Prer., Hum. 101-102. Consent of humanities instructor required.

Integrated Studies

Int.St. 211-3. Nature of Law. (Phil. 292.) *Fall.* Introduction to law for liberal arts students, focusing on underlying principles and developments. To gain insight into nature, functions, limits of law. First semester, general nature of law, relation of law to justice and power, diverse systems, legal process, legal reasoning.

Int.St. 212-3. Nature of Law. (Phil. 292.) *Spring.* Continuation of Int.St. 211. Int.St. 211 not a prer.

Int.St. 411-3. Modes of Thought. *Fall.* Readings and discussion concerning the modes of thought appropriate to the diverse problems—theoretical, practical, or creative—that men formulate or confront. Practice in the arts of analytical reading, clear speaking, and precise writing is encouraged. Registration by consent of the instructor.

Int.St. 412-3. Modes of Thought. *Spring.* Continuation of Int.St. 411.

Natural Science

Nat.Sci. 301-3. History of Science: Ancients to Copernicus. (Phil. 342.) The history of science and natural philosophy from the ancients through the Hellenistic and medieval developments of astronomy, physics, biology, and medicine to the recasting of Ptolemaic astronomy by Copernicus. Taught collaboratively by faculty in the sciences and philosophy. Prer., upper division status or permission.

Nat.Sci. 302-3. History of Science: Copernicus to Newton. (Phil. 342.) The genesis of modern science in the 16th and 17th centuries through the achievements of Bacon, Descartes, Kepler, Galileo, and Harvey, including such strands as Renaissance magic and mysticism, advances in mathematics and instrumentation, and the rise of the atomistic-mechanical philosophy. Prer., upper division status or permission.

Nat.Sci. 303-3. History of Science: Newton to Einstein. (Phil. 343.) The history of physical and biological science, including psychology, from the epoch-making achievements of Isaac Newton and the work of Stephen Hales in biology to the dawn of the 20th-century revolutions in physics, chemistry, and genetics. Prer., upper division status or permission.

Nat.Sci. 304-3. Perspectives of 20th-Century Science. (Phil. 344.) A historical study of some of the leading developments of 20th-century science, selected for their scientific or social significance, including quantum theory of atomic structure and the chemical bond, Einstein's relativity theory, nuclear fission, the genetic code, concepts of the ecosystem, and other topics. Prer., upper division status or permission.

Nat.Sci. 401-3. Environmental Studies. *Fall.* A multidisciplinary consideration of modes of learning with strong emphasis on an individual research project. To further an understanding of science and the ways science deals with environmental phenomena, class meetings will be devoted to discussions of readings, lecture-demonstrations, and student presentations. The goal of the course is to allow students to expand their understanding of science as a way of looking at the world. Prer., one year of college science and consent of instructor.

Nat.Sci. 402-3. Environmental Studies. *Spring.* Continuation of Nat.Sci. 401. Prer., one year of college science and consent of instructor.

Physical Science

Phys.Sci. 101-4. Introduction to Physical Science (an Approach by Inquiry). *Fall.* The nature of science illustrated by theories of light and of the solar system, from Stonehenge to Newton's theory of universal gravitation. Classes are small and informal, combining lecture, discussion, and laboratory.

Phys.Sci. 102-4. Introduction to Physical Science (an Approach by Inquiry). *Spring.* Format of this class is similar to Phys.Sci. 101, with a continuing exploration of selected topics in physics and astronomy (e.g., sound and light waves, Einstein's theory of relativity, modern cosmology).

Phys.Sci. 199-1 or 2. Independent Study. *Fall, Spring.* Individual projects, including the opportunity to aid in the teaching activities of the staff. Prer., Phys.Sci. 101-102 and consent of instructor.

Phys.Sci. 201-4. Foundations of Modern Physical Science. *Fall.* Twentieth-century developments in physical science presented in a nontechnical way, with emphasis on the fundamental experiments and principles; topics may include theories of relativity, structure of atoms and nuclei, nature of light, and cosmology. Prer., Phys.Sci. 101-102 or consent of instructor.

Phys.Sci. 202-4. Foundations of Modern Physical Science. *Spring.* Continuation of Phys. Sci. 201, concluded by discussion of the relations of science, technology, and public policy. Prer., Phys.Sci. 201.

Phys.Sci. 499-1 to 3. Independent Study. *Fall and Spring.* For upper division students. Individual projects, including the opportunity to work actively with the staff in the development of experiments and in tutorial sessions with students. Prer., consent of instructor.

Social Science

Soc.Sci. 199-1 to 3. Independent Study. For lower division students. Consent of instructor required.

Soc.Sci. 350-3. Film and Society. (Soc. 350.) A theoretical treatment of the role of the dramatic arts in society. Special emphasis on writings of Kenneth Burke. Contemporary films used to reveal the dynamics of stereotyping, victimization, and other social processes. Juniors and seniors only.

Soc.Sci. 440-3. Heritage of American Ideas. Major concepts in American thought such as democracy, individualism, equality, progress, reform, and freedom, with emphasis on their development and modification, consideration of the contributions of leading figures and movements influential in the shaping of American society.

Soc.Sci. 441-3. Heritage of American Ideas. Continuation of Soc.Sci. 440.

Soc.Sci. 491-3. Literary Works and Social Theory. Analysis and interpretation of anecdotal materials such as autobiographies, novels, and plays through the use of cognitive, culture-personality, psychoanalytic, and sociological theories.

Soc.Sci. 492-3. Literary Works and Social Theory. Continuation of Soc.Sci. 491.

Soc.Sci. 493-3. American Lives. *Spring.* Analysis of 19th-20th-century American autobiographies from the standpoint of literature, history, anthropology, and psychology. Attention will be given to what it meant to grow up in the United States from the 1850s to the 1970s.

Soc.Sci. 499-1 to 3. Independent Study. Consent of instructor required.

LINGUISTICS

Ling. 100-3. Language. A nontechnical exploration of human language for the general citizen. Emphasis on the basics of how language works, the creative aspects of language, and the languages of America today.

Ling. 150-3. Basic Traditional Grammar. A general course intended to present the fundamentals of grammar in the Western tradition. Emphasis is on making the concepts and uses of grammar (as exemplified in English and closely related foreign languages) understandable to the nonspecialist.

Ling. 210-2. Codes and Ciphers. An examination of the concepts of codes and coding, particularly in relation to communication, cryptography, digital computation, information theory, and linguistics.

Ling. 300-3. Introduction to Linguistic Science. A survey of the field of linguistics and an introduction to the methodology of linguistic analysis.

Ling. 330-3. Linguistic Analysis. Intensive practice in the analysis and description of language data. Prer., Ling. 300.

Ling. 401/501-3. The Nature of Grammars. Approaches to the description and explanation of language structure, language change, and language acquisition. Prer., Ling. 300. Not valid for linguistics Ph.D.

Ling. 424/524-2. Survey of the History of Linguistics. Historical survey of views on language, and examination of linguistic thought in all historical periods from Pardini to de Saussure. This course may not be substituted for Ling. 724, and it can not be counted toward the Ph.D. in linguistics.

Ling. 425/525-3. General Linguistics for Language Majors. Not open to those who have had Ling. 300 or to linguistics graduate students. The basic concepts, current theories, and terminology of linguistics with emphasis on their importance for and application to problems of second-language teaching.

Ling. 440/540-2. Introduction to Transformational-Generative Grammar. Conventions of representing and relating abstract syntactic and phonological structures: underlying forms, phrase structure rules, transformational rules, rule ordering. Justification of abstract structures, with emphasis on English syntax. Prer., Ling. 300.

Ling. 450/550-3. Linguistics in Education. Survey of modern linguistic theory and application to teaching English, reading, and foreign languages in elementary and high schools. Linguistics majors or linguistic graduate students may not count this course toward their degree.

Ling. 460/560-3. English Phonology for Teachers of English to Speakers of Other Languages. Articulatory phonetics of English, English phonological structure, and the relation between the spelling of American English and the pronunciation of the standard dialect. Some consideration of dialects other than the standard dialect. Prer., Ling. 300 or 425.

Ling. 461/561-3. English Structure for Teachers of English to Speakers of Other Languages. Description of the morphological and syntactic categories and structures of English. Prer., Ling. 300 or 425.

Ling. 462/562-3. Methods of Teaching English to Speakers of Other Languages. The theory of second-language teaching together with techniques for teaching and testing. Curriculum design, sequencing topics, drill and examination preparation, and classroom teaching techniques will all be covered. Prer. or coreq., Ling. 460/560 and 461/561.

Ling. 463/563-3. Practicum in TESOL. Professionally supervised practice teaching of English classes for non-natives. Enrollees will acquire classroom experience in pronunciation, grammar, reading and writing with students of varying ability, at first under careful supervision but with greater freedom as teaching proficiency is developed. Prer., three of the following: Ling. 460/560, Ling. 461/561, Ling. 462/562.

Ling. 493/593-3. Linguistic Phonetics. Introduction to the practical and theoretical aspects of phonetics. Training in recognition and production of speech sounds, lectures on the fundamentals of articulatory, acoustic, and auditory phonetics. Visits to the sound laboratory. Not valid for linguistics Ph.D.

Ling. 497/597-3. Introduction to Diachronic Linguistics. A course designed to familiarize the student with the terminology, methods, and theories dealing with phenomena of language change through time. Prer., Ling. 300 and 330 or consent of instructor. Not valid for linguistics Ph.D.

Ling. 498-3. Senior Seminar in Linguistics. Topics offered in the senior seminar will vary from year to year, depending on interest of faculty and prospective students. Offerings will be at an intermediate level of difficulty. Prer., Ling. 300, 330, 401, 493.

Ling. 499-1 to 3. Independent Study. Prer., permission of department chairman.

Ling. 591-3. Computer Applications in the Humanities. (Engl. 591.) General topics of humanities research capable of computer solution, such as literary text analysis for authorship, stylistics, linguistic structure, etc. No computer programming will be required or taught.

Ling. 600-2. An Introduction to Linguistic Scholarship. This course has two aims: acquisition of a bibliographical knowledge in the field of general linguistics; and the writing of technical reports, reviews, articles, etc., according to certain specific styles.

Ling. 611-2. Communication Theory and Linguistics. The application of communication theory to the description of language.

Ling. 633-3. Phonological Analysis and Theory. Analysis and description of phonological systems using and contrasting both structuralist and generative theories. Prer., Ling. 401/501; prer. or coreq., Ling. 493/593.

Ling. 634-3. Methods of Grammatical Analysis. Techniques for analysis and description of grammatical systems. Prer., Ling. 401/501.

Ling. 641-2. Phonological Theory. Phonetic and (morpho-) phonological representations: distinctive features, segments, prosodic structures, morphological structures. Phonological processes and their interaction. Naturalness conditions. Prer., Ling. 540 and 633, or consent of instructor.

Ling. 642-2. Syntactic Theory. Topics in syntactic theory, including the interaction of syntax with semantics and pragmatics, constraints on transformations, and introduction to the mathematical theory of grammars. Prer., Ling. 540 and 634, or consent of instructor.

Ling. 697-3. Advanced Diachronic Linguistics. Problems dealing with use of the comparative method, internal reconstruction, subgrouping, borrowing, semantic change, interpretation of written records, and the historiographic uses of diachronic linguistics. Prer., Ling. 401/501 and 497/597 or consent of instructor.

Ling. 699-2 to 4. Independent Study.

Ling. 717-3. Areal Linguistics. Study of linguistic features shared by numerous languages or dialects within a given region. Particular areas studied in each case will depend on the interests of the instructor and of the students. Prer., consent of instructor.

Ling. 724-2. History of Linguistics. This course will treat different topics chosen from the four or five "historical periods" covering the history of linguistics. It is intended to reveal the coherence of linguistic ideas in their historical setting. Prer., Ling. 600.

Ling. 730-2. Mathematical Linguistics. Diverse topics in applications of mathematical models to linguistic problems. Prer., consent of instructor.

Ling. 738-2. Seminar: General Dialectology. Principles of general dialectology with emphasis on problems involving geographical and social factors. Prer., consent of instructor.

Ling. 740-3. Advanced Syntax. Deeper analysis of one aspect of the language of an individual student's choice according to a particular theory of grammar. Each student is expected to produce a partial grammar of one linguistic topic in this course. Prer., Ling. 634, 640.

Ling. 741-3. Seminar: Advanced Phonology. Advanced topics in phonological theory. Prer., any two of Ling. 401/501, 493/593, 633, 641.

Ling. 750-2. Field Methods. A course intended to give the student experience in the collection of linguistic data from an informant. Some attention will be given to library research on the topic language. Prer., Ling. 633 or consent of instructor.

Ling. 771-2. Seminar: Communication and Language Design. A series of important papers in the subject areas is read and dissected with particular attention to the mutual implications of these two areas. Prer., consent of instructor.

Ling. 797-3. Seminar: Diachronic Linguistics. Application of various methods to a specific area of interest to the student. Considerable individual research will be expected. Progress reports and a formal, final report on individual investigations. Prer., Ling. 697 or consent of instructor.

Ling. 700-4 to 6. Master's Thesis.

Ling. 799-2 to 4. Special Problems.

Ling. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

African Linguistics

Afr. 321-3. Introduction to African Languages. Genetic classification, language families, typological features of African languages. Sociolinguistic problems in Africa. Prer., junior standing or consent of instructor.

Afr. 621-2. Introduction to African Linguistics. Covers classifications of African languages and provides a survey of the linguistic families of Africa. This course may be repeated for credit.

Afr. 643-2. Nominal Classification in African Languages. Presentation and explanation of the features of noun classification and review of theories dealing with the subject. Prer., basic courses in linguistics and consent of instructor.

Afr. 747-2. Seminar: Structure of Hausa. Detailed consideration of the problems of tone in Hausa. Verbal and noun systems are analyzed. Selected aspects of the syntax of Hausa.

Amerindian Linguistics

Amin. 101-5. Introduction to the Lakhota (Sioux) Language. Principal attention will be given to learning to speak the language, although reading will also be taught.

Amin. 102-5. Introduction to the Lakhota (Sioux) Language. Continuation of Amin. 101.

Amin. 201-3. Intermediate Lakhota. Grammar review, conversation, and reading. Prer., Amin. 101-102 or placement.

Amin. 202-3. Intermediate Lakhota. Continuation of Amin. 201.

Amin. 655-3. Survey of American Indian Language Structures. A relatively detailed survey of the structures of selected North American Indian languages. Languages treated will vary from year to year, but an attempt will be made to include a variety of structural types. Prer., Ling. 633, 634.

Amin. 752-2. Seminar: Siouan Historical Linguistics. Comparative study of the ten Siouan languages for which materials are available. Critique of existing reconstructions of Proto-Siouan. Reports and papers by students. Prer., Ling. 597 and 633.

Indo-European Linguistics

In.Eu. 402/502-3. Introduction to Indo-European Comparative Linguistics. Introduction to the comparative method and to reconstruction of protolanguages. Prer., knowledge of one Indo-European language other than English and either Ling. 300 or the consent of instructor.

In.Eu. 702-2. Seminar: Indo-European Phonology. Designed to cover the phonemic and prosodic systems of Proto-Indo-European, and the laryngeals. Prer., Ling. 597 and consent of instructor.

In.Eu. 101-3. Beginning Sanskrit. Introduction to Sanskrit phonology, morphology, syntax, and the writing system.

In.Eu. 102-3. Beginning Sanskrit. Continuation of 101. Sanskrit descriptive grammar and reading. Prer., Skt. 101.

In.Eu. 201-3. Intermediate Sanskrit. A rapid, intensive review of grammar. Reading of such texts as are appropriate to the student's abilities. Prer., Skt. 102.

In.Eu. 202-3. Intermediate Sanskrit. Continuation of Skt. 201. Readings in more difficult poetry and/or prose. Prer., Skt. 201.

Romance Linguistics

Rom. 451/551-2. Romance Linguistics I. Outline of the development of Vulgar Latin into the old and modern Romance languages. Detailed study of the historical phonologies of French, Italian, Portuguese, Provençal, Romanian, and Spanish. Prer., consent of instructor.

Rom. 738-2. Seminar in Romance Dialectology. An analysis of the historical relationships and comparative structures of East and West Romance. One major "dialect" will be selected and studied in detail. Selections may be from non-European Romance "dialects." Prer., Ling. 401/501, Rom. 551.

Rom. 751-2. Romance Linguistics II. This course will primarily study comparative Romance morphology. It will further serve as the basis for syntactic, etymological, and semantic studies in the Romance field. Prer., Rom. 551 or consent of instructor.

Rom. 790-2. Seminar: History of Romance Linguistics. The foundations and growth of the theoretical principles which led to present day Romance scholarship. Main emphasis will be on the modern era, beginning with 19th-century comparative/historical linguistics. Prer., consent of instructor.

Semitic Linguistics

Sem. 601-3. Introduction to Semitic Linguistics. A survey of the comparative structures of the principal "classical" Semitic languages: Arabic, Aramaic (Syriac), Akkadian (Assyro-Babylonian), Hebrew, Ugaritic, and Ethiopic (Gèez). Prer., Ling. 497/597, and two years of a Semitic language.

Sem. 781-2. Seminar: Comparative Semitic Linguistics. Discussion on particular problems in comparative Semitic linguistics. Research papers on approved topics. Prer., Sem. 601.

MATHEMATICS

Note: A prerequisite course must be completed with a grade of C or better.

Math. 099-3 (add-on credit). Introduction to Algebra. Arithmetic, factoring polynomials, rational functions, linear equations, radicals, quadratic equations. This is a controlled enrollment course, and no student will be allowed in this course without Department of Mathematics approval. Approval will only be given to students with a Mathematics Placement Code of MA-0 or to students with no more than one year of high school algebra. Note: This course does not count toward graduation.

Math. 101-3. College Algebra.¹ Simplifying algebraic expressions, factoring, linear and quadratic equations, inequalities, exponentials, logarithms, functions and graphs, complex numbers, binomial theorem. No credit for students with credit in Math. 110 or A. Math. 120. Prer., one yr. of high school algebra.

Math. 102-2. College Trigonometry.¹ Trigonometric functions, identities, solutions of triangles, addition and multiple angle formulas, inverse trigonometric functions, laws of sines and cosines. No credit for students with credit in Math. 110 or A. Math. 120. Prer., 1½ yrs. of high school algebra and 1 yr. of plane geometry, or Math. 101.

Math. 103-3. The Structure of the Number System. The natural numbers, integers, rational and real numbers, mathematical systems and properties of operations, and systems of numeration. For elementary majors for B.S. in education degree.

Math. 107-3. Algebra for Social Science and Business. A review of beginning algebra; systems of linear equations; an introduction to matrices, linear programming, and probability. Does not prepare students for Math. 110 or Math. 130. Prer., one yr. high school algebra.

Math. 108-3. Calculus for Social Science and Business. An intuitive treatment of beginning calculus; differentiation and integration of algebraic, logarithmic, and exponential functions with applications in business and the social sciences. No knowledge of trigonometry or analytic geometry is presupposed. Those planning to take more than one semester of calculus should take Math. 130 instead of Math. 108. Math. 130 carries only 2 hours credit if a student has credit in Math. 108. Prer., Math. 107 or 1½ yrs. of high school algebra.

Math. 110-5. College Algebra and Trigonometry.¹ Intended primarily for students who plan to take Math. 130. Equivalent to Math. 101 plus Math. 102. See descriptions for those courses. Students with credit in Math. 101 will receive only 2 hrs. credit in Math. 110. Students with credit in Math. 102 will receive only 3 hrs. credit in Math. 110. Prer., 1½ yrs. high school algebra and 1 yr. of plane geometry.

Math. 111-3. The Spirit and Uses of Mathematics I. Fall. For liberal arts students and prospective elementary teachers. Math. 111-112 meets one year of the humanities requirement of the College of Arts and Sciences, provided the student has not had Math. 230 or its equivalent at the time of graduation. Includes a study of the nature of mathematics, its methods, its relation with other disciplines, and its role in our society. Specific topics may include number theory, calculus, computing, Euclidean and non-Euclidean geometry, symmetry groups, graph theory, topology, logic, projective geometry. Prer., 1 yr. of high school algebra and 1 yr. of plane geometry.

Math. 112-3. The Spirit and Uses of Mathematics II. Spring. See explanation under Math. 111 above.

A. Math. 120-5. Algebra and Trigonometry for Engineers. For students who do not make a sufficiently high score on the mathematics placement test for the College of Engineering and Applied Science.

Math. 121-3. Geometry for the Elementary Teacher. Intuitive and logical development of the fundamental ideas of geometry, such as parallelism, congruence, measurement. For elementary majors for B.S. in education degree. Prer., Math. 103 or equivalent.

Math. 130-5. Analytic Geometry and Calculus I. Rates of change of functions, limits, derivatives of algebraic functions, applications of derivatives, integration. Students with credit in Math. 108 will receive only 2 hours credit in Math. 130. Prer., three years of high

¹Also available through correspondence study.

school mathematics, including trigonometry, or Math. 110 or 101 and 102. Note: A.Math. 135, 136, 235, and 236 is a sequence designed for engineering students.

A.Math. 135-4. Calculus for Engineers I. Rates of change, limits, derivatives of algebraic functions, applications, and integration. Prer., 2 yrs. of high school algebra, 1 yr. of geometry, 1/2 yr. of trigonometry, and an acceptable score on the mathematics placement test, or A.Math. 120.

A.Math. 136-4. Calculus for Engineers II. Continuation of A.Math. 135. Applications of the definite integral, transcendental functions, methods of integration, plane analytic geometry, polar coordinates, vectors, and parametric equations. Prer., A.Math. 135.

Math. 181-4. Mathematics for the Life Sciences. Probability, linear programming, game theory, and difference equations with motivation and applications from the life sciences. Prer., two years high school algebra or Math. 101.

Math. 182-4. Calculus for the Life Sciences. An intuitive development of differential and integral calculus; first order linear differential equations and continuous probability arising from mathematical models in biology. Students with credit in Math. 130 or A.Math. 135 will receive no credit in Math. 182. Students with credit in Math. 108 will receive only one additional hour in Math. 182. Prer., Math. 181 or adequate algebra and consent of instructor.

Math. 199-variable credit. Independent Study. Requires departmental approval and a departmental controlled enrollment card.

Math. 230-5. Analytic Geometry and Calculus II.¹ Continuation of Math. 130. Applications of the definite integral, transcendental functions, methods of integration, plane analytic geometry, polar coordinates, vectors, and parametric equations. Prer., Math. 130 or consent of department.

A.Math. 235-4. Calculus for Engineers III. Continuation of A.Math. 136. Completion of required work in the differential and integral calculus. Vector functions and derivatives, partial differentiation, multiple integrals, infinite series. Prer., A.Math. 136.

A.Math. 236-3. Introduction to Linear Algebra and Differential Equations. Vector spaces, matrices, determinants, systems of linear equations. Introduction to differential equations. (No credit to students having credit in both Math. 313 and Math. 443.) Prer., A.Math. 235.

Math. 240-4. Analytic Geometry and Calculus III. Continuation of Math. 230. Vector functions and derivatives, partial differentiation, multiple integrals, infinite series. Prer., Math. 230 or consent of department.

Math. 272-3. Introduction to Abstract Mathematics. A course designed to bridge the gap between lower-division mathematics courses and the more abstract and theoretical upper-division courses. The topics covered vary. Topics often included are informal logic, set theory, relations and functions, axiomatic systems with examples from algebra or geometry, number systems. Prer., Math. 230 or A.Math. 136.

Math. 281-3. Introduction to Statistics. Study of the elementary statistical measures. Introduction to statistical distributions, statistical inference, and hypothesis testing. Prer., Math. 110 or A.Math. 120.

Math. 311-3. Introduction to Theory of Numbers. A careful study of the set of integers: divisibility, congruences, arithmetic functions, sums of squares, quadratic residues and reciprocity, and elementary results on distributions of primes. Prer., Math. 240.

Math. 313-3. Introduction to Linear Algebra. Introduction to basic properties of systems of linear equations, vector spaces, linear independence, dimension, linear transformations, matrices, determinants. Prer., Math. 230 or A.Math. 136.

Math. 314-3. Introduction to Modern Algebra. A careful study of the elementary theory of groups, rings, fields, polynomials, group and ring homomorphisms, isomorphisms. Prer., Math. 272 or 313 or 311.

Math. 321-3. Euclidean and Non-Euclidean Geometries. Axiomatic systems. The foundations of Euclidean and Lobachevskian geometries. Prer., Math. 230.

Math. 352-3. Computable Functions. Turing computers, computable functions, the halting problem and noncomputable functions, Church's thesis, universal machines, Godel's incompleteness theorem, and undecidable theories. Prer., college algebra or consent of instructor.

Math. 413-3. Advanced Finite Mathematics I. (C.S. 413.) Basic methods and results in combinatorial theory. Enumeration methods, elementary properties of functions and relations, graph theory. Considerable emphasis is placed on applications. Prer., one semester of calculus.

Math. 414/509-3. Advanced Finite Mathematics II. (C.S. 514.) More advanced techniques in enumeration theory and graph theory. Finite groups, Polya's theory of counting, digraphs, finite rings and fields. Applications in computer science, switching theory, coding theory, etc. Prer., one semester of calculus.

Math. 422-3. Projective Geometry. An introduction to the study of synthetic projective geometry. The relation of the projective and affine planes. Coordinates in the projective plane. Prer., Math. 313.

Math. 426-3. Elementary Differential Geometry. Differential forms in Euclidean 3-space, vector fields, frame fields, Frenet formulas, calculus of differential forms on surfaces, geometry of surfaces, Gaussian curvature, second fundamental form. Prer., Math. 313, 432, or consent of instructor. Not given every year.

Math. 431-3. Advanced Calculus I. Calculus of one variable, the real number system, continuity, differentiation, sequences and series, convergence, uniform convergence, Taylor's theorem, integration. Prer., Math. 240 or A.Math. 235, and either Math. 313, 272, or A. Math. 236.

Math. 432-3. Advanced Calculus II. Calculus of several variables including continuity, differentiation and integration; implicit function theorem; inverse function theorem; Fourier series if time permits. Prer., Math. 431, and either Math. 313 or A.Math. 236.

Math. 433/507-3. Advanced Calculus III. *Not offered every year.* Vector fields; Green's, Stokes', and divergence theorems; Taylor's theorem for functions of several variables; calculus on manifolds if time permits. Prer., Math. 432 or consent of instructor, and Math. 313.

Math. 443/543-3. Ordinary Differential Equations. Elementary systematic introduction to linear n th order differential equations, including equations with regular singular points. Existence and successive approximations of solutions for linear and nonlinear equations. Prer., A.Math. 235 or Math. 240, and Math. 313 or A.Math. 236.

Math. 445-3. Introduction to Complex Variables. Theory of functions of one complex variable, including integrals, power series, residues, conformal mapping, and special functions. Prer., A.Math. 235 or Math. 240.

Math. 447/549-3. Introduction to Partial Differential Equations I. Boundary value problems for the wave, heat, and Laplace equations; separation of variables method, eigenvalue problems, Fourier series, orthogonal systems. Prer., A.Math. 236 or Math. 313 or 431, or 443.

Math. 448/550-3. Introduction to Partial Differential Equations II. Continuation of Math. 447. Boundary value problems, initial value problems, eigenvalue problems in higher dimensions, Sturm-Liouville problems, Fourier and Laplace transforms, approximation methods. Prer., Math. 447.

Math. 451-3. Introduction to Mathematical Logic. Sentential logic and first-order logic. Completeness theorems. Prer., two upper division courses in mathematics, or consent of instructor.

Math. 453/517-3. Boolean Algebras. Axioms, subalgebras, ideals, direct and free products, free algebras, representation theorem, completions. Prer., Math. 314.

Math. 455-3. Set Theory. A careful study of the theory of cardinal and ordinal numbers, definition by recursion, the statement of the continuum hypothesis, simple cardinal arithmetic, and other topics chosen by the instructor. Prer., Math. 240 or 272.

Math. 465-3, 466-3. Intermediate Numerical Analysis I, II. (C.S. 465, C.S. 466.) Solution of algebraic and transcendental equations, linear and nonlinear systems of equations. Interpolation, integration, solution of ordinary differential equations, least squares, sources of error and error analysis. Computer implementation of numerical methods. Matrix eigenvalue problems and summation of infinite series. Prer., for Math. 465 is C.S. 210, A.Math. 236 or Math. 313; prer. for Math. 466 is Math. 465.

Math. 472/510-3. History of Mathematics. A selection of topics in the history of mathematics from the earliest times to the present, with emphasis on Greek mathematics, the development of the

¹Also available through correspondence study.

calculus in the 17th century, and the history of algebra, analysis, and geometry in the 19th and 20th centuries. Prer., two upper division courses in mathematics.

Math. 481-3. Introduction to Probability Theory. Axioms, combinatorial analysis, independence and conditional probability, discrete and absolutely continuous distributions, expectation and distribution of functions of random variables, laws of large numbers, central limit theorems, simple Markov chains. Prer., A.Math. 235 or Math. 240.

Math. 482-3. Introduction to Mathematical Statistics. Point and confidence interval estimation. Principles of maximum likelihood, sufficiency, and completeness; tests of simple and composite hypothesis, linear models, and multiple regression analysis. Analysis of variance distribution-free methods. Prer., Math. 481.

Math. 486-3. Introduction to Stochastic Population Models. A study of mathematical models used in demography, epidemic theory, statistical genetics, and mathematical ecology, and their strengths and limitations. A survey of the mathematical techniques used in these applications. Prer., calculus plus some course in probability and/or statistics.

Math. 499-variable credit. Independent Study. Requires departmental approval and a departmental controlled enrollment card.

Note: Undergraduates must have departmental approval to take 500-level mathematics courses; 600-level courses are open *only* to graduate students.

Normally, the courses below are offered every year; courses offered in alternate years or irregularly are indicated by ¹.

Math. 501-3, 502-3. Introduction to Topology I, II. Elements of general topology, algebraic topology, differentiable manifolds. Prer., Math. 313, 314, 431, and 432.

Math. 505-3. Topics in Combinatorial Analysis.¹ Topics such as finite combinatorial analysis, combinatorial questions entering in topology, infinite permutations and transformations, graph theory. Prer., consent of instructor.

Math. 511-3. Theory of Numbers I. Divisibility properties of integers, congruences, diophantine equations, arithmetic functions, quadratic residues, distribution of primes, algebraic number fields. Prer., Math. 314.

Math. 512-3. Theory of Numbers II. Selected topics in algebraic and analytic number theory. Prer., Math. 511. Math. 513 and 535 are recommended.

Math. 513-3, 514-3. Modern Algebra I, II. Groups, rings and ideals, fields, polynomials, Galois theory. Prer., Math. 314.

Math 515-3. Linear Algebra I. Vector spaces, linear transformations, eigenvalues and eigenvectors, canonical forms. Prer., Math. 313.

Math 516-3. Linear Algebra II.¹ Prer., Math. 515.

Math. 519-3. A Survey of Abstract Algebra.¹ A study of topics in abstract algebra and their historical development and philosophical and cultural implications. Prer., consent of instructor.

Math 521-3, 522-3. Projective Geometry I, II.¹ Prer., Math. 422 or consent of instructor.

Math. 523-3, 524-3. Introduction to Differential Geometry, I, II.¹ Differential forms in Euclidean 3-space, frame fields, Frenet formulas, calculus of differential forms on surfaces, extrinsic and intrinsic geometry of surfaces, Riemannian geometry of differentiable manifolds, geodesics, curvature, the Gauss-Bonnet theorem. Prer., Math. 313 and 432.

Math. 531-3, 532-3. Introduction to Real Analysis I, II. Zorn's lemma, metric and normed linear spaces, completions, continuous functions, Riemann-Stieltjes and Lebesgue integration, measure theory. Prer., Math. 431.

Math. 533-3, 534-3. Partial Differential Equations I, II.¹ General theory, first order equations; classification of second order equations: theory and methods of solution of elliptic, parabolic, and hyperbolic types of equations; maximum principles; Green's functions; potential theory. Prer., Math. 431, 432.

Math. 535-3, 536-3. Functions of a Complex Variable I, II. Complex numbers and complex plane. Cauchy-Riemann equations, complex integration, Cauchy integral theory, infinite series and products, residue theory, conformal mapping, analytic continuation, singularities, elementary special functions. Prer., Math. 431.

Math. 537-3, 538-3. Topics in Applied Mathematics.¹ Selected topics in mathematical problems arising from various applied fields such as mechanics, electro-magnetic theory, economics, etc. Prer., consent of instructor.

Math. 539-3. Linear Integral Equations.¹ Theory and applications of linear integral equations. Prer., Math. 432 and 443.

Math. 541-3, 542-3. Calculus of Variations and Control Theory.¹ Classical necessary and sufficient conditions with emphasis on the simplest problems; the problem of Lagrange; Hamiltonian and Lagrangian mechanics. The problem of optimal control; the maximum principle of Pontryagin; controllability, applications. Prer., Math. 432, 443.

Math. 546-3. Theory of Automata.¹ The idea of computability will be discussed, with computational models ranging in complexity from a Turing machine up to a caricature of a modern digital computer. The formal theory of languages and its relation to these computational models will be explored. Prer., consent of instructor.

Math. 551-3, 552-3. Celestial Mechanics I, II.¹ Application of analytical dynamics to satellite motion. Gravitational potentials, the two-body problem, methods of determination of orbits, the three-body and n-body problem, and perturbation theory. Prer., Math. 443 and Phys. 322.

Math. 553-3, 554-3. Intermediate Mathematical Physics I, II. (Phys. 503, 504.) Survey of classical mathematical physics, starting with complex variable theory and finite dimensional vector spaces. Topics in ordinary and partial differential equations, the special functions, boundary value problems, potential theory, and Fourier analysis. Prer., Math. 431 and 432.

Math. 560-3. Numerical Analysis I. (C.S. 560.) Solution of linear systems, least squares approximations, nonlinear algebraic equations, interpolation, and quadrature. Prer., calculus, Math. 313; C.S. 210.

Math. 561-3. Numerical Analysis II. (C.S. 561.) Solution of ordinary and partial differential equations; matrix eigenvalue eigenvector problems. Prer., Math. 560.

Math. 562-3. Numerical Solution of Initial Value Problems. (C.S. 562.) Multi-step and single-step methods for ODE. Stability. Stiff equations. Difference schemes for heat and wave equations. Applications. Prer., C.S. 465 or 560, Math. 313, 443, 431, or 435.

Math. 563-3. Numerical Solution of Boundary Value Problems. (C.S. 563.) Finite difference solution of two-point boundary problems and elliptic problems. Methods of SOR, ADI, conjugate gradients. Finite element method. Nonlinear problems. Applications. Prer., C.S. 465, Math. 313, 431 or 435, 443.

Math. 564-3. Numerical Linear Algebra. (C.S. 564.) Direct and iterative solution of linear systems. Eigenvalue and eigenvector calculation. Error analysis. Reduction by orthogonal transformation. Prer., C.S. 465 or 560, Math. 313.

Math. 565-3. Numerical Methods for Optimization. (C.S. 565.) Linear programming. Unconstrained minimization, one dimensional search, gradient methods. Nonlinear and quadratic programming. Prer., C.S. 465 or 560, Math. 313.

Math. 566-3. Numerical Methods for Data Analysis. (C.S. 566.) Least squares fitting. Singular value decomposition. Fourier analysis of data. Surface fitting. Applications. Prer., C.S. 465 or 560, Math. 313, and 481 or 482.

Math. 567-3. Introduction to Approximation Theory.¹ (C.S. 567.) Normed linear spaces, convexity, existence and unicity of best approximations. Tchebycheff approximation by polynomials and other related families. Least square approximation and related topics. Rational approximation. Prer., Math. 431 and 432.

Math. 571-3, 572-3. Mathematical Logic I, II. Alternate years. First-order logic, completeness theorem, introduction to model theory, ultraproducts, Godel's incompleteness theorems, theory of recursive functions. Prer., Math. 451 and 455, or consent of instructor.

Math. 573-3, 574-3. Advanced Set Theory I, II. Alternate years. Cardinal and ordinal arithmetic, generalizations of Ramsey's theorem, independence of the axiom of choice and of the

generalized continuum hypothesis. Prer., Math. 455 and 451, or consent of instructor.

Math. 580-3. Sample Surveys.¹ Application of statistical sampling theory to the design of population surveys, including simple random, stratified, systematic, and cluster sampling. Ration estimates and cost minimization. Prer., undergraduate statistics or consent of instructor.

Math. 581-3, 582-3. Mathematical Statistics.¹ Mathematical theory of statistics. Topics covered will include distribution theory, estimation and testing of hypotheses, multivariate analysis, non-parametric inference. Prer., Math. 313 and 481, or consent of instructor.

Math. 583-3. Topics in Mathematical Probability.¹ Prer., advanced calculus and Math. 481.

Math. 584-3. Time Series Analysis.¹ Basic properties, linear extrapolation, and filtering of stationary random functions. Spectral and cross-spectral analysis. Estimation of the power spectrum using computers. Nonstationary time series. Comparison of various computer programs. Prer., Math. 481 or consent of instructor.

Math. 585-3. Introduction to Stochastic Processes.¹ A systematic study of Markov chains and some of the simpler Markov processes including renewal theory, limit theorems for Markov chains, branching processes, queueing theory, and birth and death processes. Applications to physical and biological sciences. Prer., Math. 481 and 431 or consent of instructor.

Math. 587-3. Statistical Methods in Research. Design and analysis of experiments, employing t-tests, chi-square tests, analysis of variance and covariance, regression analysis, distribution-free methods, graphical and other quick and approximate procedures with emphasis on applications in the behavioral, biological, and physical sciences. Prer., consent of instructor.

Math. 588-3. Statistical Methods for Data Analysis.¹ A continuation of Math. 587. The method of least squares in fitting linear and nonlinear models to data. Analysis of balanced, unbalanced, and unplanned experiments. Use of packaged computer programs. Practical aspects of applying statistical techniques to the analysis of data. Prer., Math. 587 or consent of instructor.

Math. 589-3. Introduction to the Theory of Games.¹ The principles of formulating problems of decision and choice, theory of two-person, zero-sum rectangular games, infinite games, n-person games and methods of solution, economics, and engineering. Prer., Math. 431 and 481 or consent of instructor.

Math. 593-3. Linear Programming.¹ (C.S. 593.) The general linear programming problem and commonly used techniques for its solution. Prer., Math. 313 and advanced calculus, or consent of instructor.

Math. 599-1 to 6. Independent Study. Subjects arranged to fit the needs of the particular student. Available only through the approval of the graduate committee.

Math. 603-3, 604-3. Algebraic Topology I, II.¹ Homology and cohomology theories, homotopy theory, obstruction theory, and applications. Prer., modern algebra and topology or consent of instructor.

Math. 605-3, 606-3. Topics in Topology.¹ Selected advanced topics to be chosen by instructor.

Math. 607-3, 608-3. Differential Topology I, II.¹ Differentiable manifolds, tangent bundles, vector fields, differential forms. Frobenius Theorem, Riemannian metrics, selected topics. Prer., Math. 501 and 502, 515, 531 and 532.

Math. 611-3, 612-3. Topics in Number Theory I, II.¹ May include theory of algebraic numbers, L-series and zeta functions, the zeta functions of an algebraic variety, character sums, multiplicative and additive number theory, Diophantine equations and approximations, or other topics chosen by instructor. Prer., Math. 512 or consent of instructor.

Math. 613-3, 614-3. Theory of Groups I, II.¹ Abelian groups, homomorphism, permutation groups, Sylow theorems, solvable groups, group representations and characters. Prer., modern algebra.

Math. 615-3, 616-3. Theory of Rings I, II.¹ Rings with minimum condition. Wedderburn theorems, Jacobson radical, Jacobson density theorem, commutativity conditions, algebras, Goldie theorems. Prer., modern algebra.

Math. 617-3, 618-3. Topics in Algebra.¹ Detailed study of advanced topics not covered in modern algebra or other courses, to be chosen by instructor. Prer., modern algebra. Math. 617 is not required for Math. 618.

Math. 621-3, 622-3. Algebraic Geometry I, II.¹

Math. 623-3, 624-3. Differential Geometry I, II.¹

Math. 625-3, 626-3. Mathematical Theory of Relativity.¹ Maxwell equations; Lorentz force; Minkowski space-time; Lorentz, Poincaré, and conformal groups; metric manifolds; covariant differentiation; Einstein space-time; cosmologies; unified field theories. Prer., consent of instructor.

Math. 627-3, 628-3. Topics in Geometry I, II.¹ Selected advanced topics to be chosen by instructor.

Math. 631-3, 632-3. Topics in Real Variables I, II.¹ Abstract measure theory, function spaces, and other topics. Prer., Math. 531-532 or consent of instructor.

Math. 633-3, 634-3. Topics in Complex Variables I, II.¹ Prer., Math. 535-536.

Math. 635-3, 636-3. Functional Analysis I, II. Introduction to such topics as: Banach spaces (Hahn-Banach Theorem, open mapping theorem, etc.), operator theory (compact operators and integral equations, spectral theorem for bounded self-adjoint operators), Banach algebras (the Gelfand theory). Prer., Math. 531-532.

Math. 637-3, 638-3. Harmonic Analysis.¹ Trigonometric series, periodic functions, Diophantine approximation, Fourier series. Bohr and Stepanoff almost periodic functions, positive definite functions, the L_1 and L_2 theory of the Fourier integral. Applications to group theory and differential equations. Prer., Math. 515 and 532.

Math. 639-3, 640-3. Topics in Analysis I, II.¹ Selected advanced topics to be chosen by the instructor.

Math. 641-3, 642-3. Topics in Linear Topological Spaces I, II.¹ Geometry of normed spaces. Convexity, weak topologies. Special spaces: function spaces, spaces of distribution. Prer., Math. 531-532.

Math. 643-3, 644-3. Topics in Operator Theory.¹ Topics in the theory of operators in linear spaces. Unbounded operators. Spectral theory. Applications to differential boundary-value problems, or to the theory of semi-groups of operators. Nonlinear theory. Prer., Math. 531-532 or consent of instructor.

Math. 645-3, 646-3. Topics in the Theory of Banach Algebras.¹ The Gelfand theory for commutative algebras, representation, theory, algebras of operators, function algebras, group algebras, applications to operator theory and to quantum mechanics. Prer., Math. 531-532 or consent of instructor.

Math. 647-3, 648-3. Theory of Ordinary Differential Equations I, II.¹ Prer., Math. 515, 532, and consent of instructor.

Math. 649-3, 650-3. Theory of Partial Differential Equations I, II.¹ Differentiation theory, Sobolev theory, *a priori* inequalities, variational methods. Existence and regularity theory for elliptic equations, hyperbolic equations, parabolic equations. Particular equations of mathematical physics. Prer., Math. 531-532.

Math. 651-3, 652-3. Asymptotics and Special Functions.¹ General theory of asymptotic expansions. The standard special functions such as the Gamma and Beta functions, Bessel functions, Legendre functions, and hypergeometric functions will be discussed and their asymptotic behavior studied. Prer., Math. 432 and 536.

Math. 653-3, 654-3. Advanced Mathematical Physics I, II. (Phys. 603, 604.) Hilbert space, theory of distributions, L^2 -spaces, Sobolev spaces, methods of functional analysis, spectral theory of operators, applications to quantum theory, and group theory. Prer., Math. 431 and 432, and Math. 445 or 535.

Math. 655-3, 656-3. Advanced Mathematical Physics III, IV.¹ (Phys. 605, 606.) Further topics in modern mathematical physics with applications. Prer., Math. 653, 654.

Math. 671-3, 672-3. Lattices and General Algebra I, II.¹ Modular, distributive, Brouwerian, Boolean lattices. Applications to algebra and topology. Homomorphism, congruence relations, direct factorization, free algebras, varieties. Prer., Math. 455, 513, 514.

Normally about half of the following seminars are given each year. The same seminar number may be repeated for credit several times.

Math. 687-3. Seminar: Geometry.
 Math. 688-3. Seminar: Topology.
 Math. 689-3. Seminar: Number Theory.
 Math. 690-3. Seminar: Algebra.
 Math. 691-3. Seminar: Analysis.
 Math. 692-3. Seminar: Functional Analysis.
 Math. 693-3. Seminar: Differential Equations.
 Math. 694-3. Seminar: Applied Mathematics.
 Math. 695-3. Seminar: Numerical Analysis.
 Math. 696-3. Seminar: Logic and Foundations of Mathematics.
 Math. 697-3. Seminar: Probability Theory and Statistics.
 Math. 698-3. Seminar.
 Math. 699-3. Seminar.
 Math. 700-4 to 6. Master's Thesis.
 Math. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

MEDIEVAL STUDIES

Medieval Studies 401-3. Medieval Culture I.
 Medieval Studies 402-3. Medieval Culture II.
 Medieval Studies 501-3. Medieval Culture I.
 Medieval Studies 502-3. Medieval Culture II.

MUSEUM

Musm. 401/501-4. Introduction to Museology. Spring. For majors in anthropology, biology, fine arts, geological sciences, history, or other museum-related subjects. Background in history and literature of museums, their objectives and methods; laboratory exercises in curatorship, exhibition theory, and administration. Prer., consent of instructor. Robinson and staff.
 Musm. 402-4, 502-3. Principles and Practice of Museology. Fall. Professional-level study of museum operations. Techniques of curatorship and museography in all fields; special concentration on field of student's choice. Prer., Musm. 401/501. Rohner and staff.
 Musm. 403-4, 503-3. Principles and Practice of Museology. Spring. Continuation of Musm. 402/502. Prer., consent of instructor.
 Musm. 421/521-3. Museum Internship in Anthropology.
 Musm. 422/522-3. Museum Internship in Botany.
 Musm. 423/523-3. Museum Internship in Geology.
 Musm. 424/524-3. Museum Internship in Techniques.
 Musm. 425/525-3. Museum Internship in Zoology.
 Musm. 426/526-3. Museum Internship in Entomology. Prer., for all museum internships, Musm. 401 and/or instructor's consent.
 Musm. 446/546-3. Museum Field Methods in Anthropology. Available only in summer. Archaeological field techniques including excavation, mapping, recording, photography, interpretation, and field laboratory.
 Musm. 447/547-3. Museum Field Methods in Botany. Botanical field techniques including collection, recording, photography, and preservation.
 Musm. 448/548-3. Museum Field Methods in Geology. Available only in summer. Paleontological and paleoecological field techniques including collecting, recording of geographic, stratigraphic, and quarry information; preservation; and interpretation, including applicable readings. Prer., for all field methods courses, instructor's consent.
 Musm. 449/549-3. Museum Field Methods in Zoology. Available only in summer. Methods and techniques for observing, collecting and preserving animals in the field. Prer., for all field methods courses, instructor's consent.
 Musm. 452/552-4. Malacology. Spring, alternate years. Biology of mollusks: morphology, classification, physiology, development, ecology, distribution, economics, and evolution of mollusks. Laboratory and field work will emphasize identification and biology of local land and freshwater molluscan fauna. Prer., general biology. Wu.
 Musm. 499-variable credit. Independent Study. Prer., consent of instructor.
 Musm. 599-variable credit. Independent Study. Prer., consent of instructor.

ORIENTAL AND SLAVIC LANGUAGES AND LITERATURES

Arabic

Arab. 101-5. Beginning Arabic. Fall.
 Arab. 102-5. Beginning Arabic. Spring. Prer., Arab. 101.
 Arab. 211-3. Second-Year Arabic. Fall. Prer., Arab. 102.

Chinese

Language Courses

Chin. 101-5. Beginning Chinese. Fall.
 Chin. 102-5. Beginning Chinese. Spring. Prer., Chin. 101.
 Chin. 211-5. Second-Year Chinese. Fall. Prer., Chin. 102.
 Chin. 212-5. Second-Year Chinese. Spring. Prer., Chin. 211.
 Chin. 311-3. Third-Year Reading and Composition. Fall. Prer., Chin. 212.
 Chin. 312-3. Third-Year Reading and Composition. Spring. Prer., Chin. 311.
 Chin. 411-3. Fourth-Year Reading and Composition. Fall. Prer., Chin. 312.
 Chin. 412-3. Fourth-Year Reading and Composition. Spring. Prer., Chin. 411.
 Chin. 421-3. Literary Chinese I. Fall. Prer., Chin. 212.
 Chin. 422-3. Literary Chinese II. Spring. Prer., Chin. 421.
 Chin. 431-2. Problems in Chinese Language. Fall. Prer., Chin. 102.
 Chin. 432-2. Problems in Chinese Language. Spring. Prer., Chin. 431.
 Chin. 499-variable credit. Independent Study.
 Chin. 599-variable credit. Independent Study.

Literature Courses (In English)

Chin. 385-3. Chinese Religion. (R.St. 385.) Fall.
 Chin. 483-3. Survey of Chinese Literature I. Fall.
 Chin. 484-3. Survey of Chinese Literature II. Spring.
 Chin. 485-3. Taoism. (R.St. 485, Phil. 485.) Spring. Consideration of the religious, philosophical, social, artistic, and other aspects of one of the two major native Chinese traditions. Prer., R.St. 385, Phil. 310, or consent of instructor.
 Chin. 486-3. Ancient Chinese Prose. Fall.
 Chin. 487-3. The Confucian Classics. Spring.

Hebrew

Hebr. 101-5. Beginning Hebrew. Fall.
 Hebr. 102-5. Beginning Hebrew. Spring. Prer., Hebr. 101.
 Hebr. 211-3. Second-Year Hebrew. Fall.

Japanese

Language Courses

Jap. 101-5. Beginning Japanese. Fall.
 Jap. 102-5. Beginning Japanese. Spring. Prer., Jap. 101.
 Jap. 211-5. Second-Year Japanese. Fall. Prer., Jap. 102.
 Jap. 212-5. Second-Year Japanese. Spring. Prer., Jap. 211.
 Jap. 301-2. Third-Year Conversation. Fall. Prer., Jap. 212.
 Jap. 302-2. Third-Year Conversation. Spring. Prer., Jap. 301.
 Jap. 311-3. Third-Year Reading and Composition. Fall. Prer., Jap. 212.
 Jap. 312-3. Third-Year Reading and Composition. Spring. Prer., Jap. 311.
 Jap. 411-3. Readings in Classical and Modern Japanese. Fall. Prer., Jap. 312.
 Jap. 412-3. Readings in Classical and Modern Japanese. Spring. Prer., Jap. 411.
 Jap. 431-2. Problems in Japanese Language. Fall. Prer., Jap. 102.

Jap. 432-2. Problems in Japanese Language. *Spring.* Prer., Jap. 431.

Jap. 499-1 to 3. Independent Study.

Literature Courses (In English)

Jap. 435-3. The Modern Novel: Japan and the West.

Jap. 483-3. Survey of Japanese Literature I. *Spring.*

Jap. 484-3. Survey of Japanese Literature II. *Fall.*

Jap. 485-3. Survey of Japanese Literature III. *Spring.*

Jap. 486-3. Modern Japanese Fiction.

Jap. 487-3. Japanese Poetry.

Oriental Languages and Literatures

O.L.L. 112-2. Structure and Writing of Chinese Characters. *Spring.* Prer., past or present study of Chinese or Japanese language.

O.L.L. 203-3. Introduction to Asian Literatures. *Fall.* Introduction to the literature, both classical and modern, of the main cultures of Asia. Readings in the poetry, drama, and fiction of China, Japan, India, and the Arab world.

O.L.L. 499-1 to 3. Independent Study.

Russian

Russ. 101-5. Beginning Russian. *Fall.* Introduction to the Russian language. Two different approaches are available. See department's General Information announcement.

Russ. 102-5. Beginning Russian. *Spring.* Continuation of Russ. 101. Prer., Russ. 101 or equivalent.

Russ. 103-3. Beginning Russian for Scientists and Social Scientists. *Fall.* An approach to Russian through the reading of texts in the student's special field of study.

Russ. 104-3. Beginning Russian for Scientists and Social Scientists. *Spring.* Prer., Russ. 103.

Russ. 201-5. Second-Year Russian. *Fall.* Reading, speaking, writing, and understanding contemporary Russian. Recommended to students who intend to continue their formal study of Russian into the third and fourth years. Prer., Russ. 102 or equivalent.

Russ. 202-5. Second-Year Russian. *Spring.* Continuation of Russ. 201. Prer., Russ. 201 or equivalent.

Russ. 211-3. Reading Russian. Reading of significant texts in Russian from the sciences, social sciences, and press. Prer., Russ. 102 or 104 or equivalent.

Russ. 212-3. Reading Russian. Continuation of Russ. 211. Prer., Russ. 211 or equivalent.

Russ. 301-3. Third-Year Russian. A review of Russian grammar is coordinated with reading, speaking, writing, and understanding modern Russian. Some texts from modern and 19th century Russian literature will be used. Prer., Russ. 202 or equivalent, or 211 or 212 and consent of instructor.

Russ. 302-3. Third-Year Russian. Prer., Russ. 301.

Russ. 303-2. Russian Conversation. Prer., Russ. 202 or equivalent.

Russ. 304-2. Russian Conversation. Prer., Russ. 202 or equivalent.

Russ. 314-3. Introduction to Russian Literature. Prer., Russ. 202, 211, or consent of instructor. The Russian literary language. Introduction to Russian literary style and stylization.

Russ. 320-2. Russian Phonetics. A practical approach to the pronunciation of modern standard Russian. Articulation of Russian speech sounds and intonation patterns through practice with tapes and printed materials. Prer., Russ. 202, 212, or consent of instructor.

Russ. 331-3. Readings From the Soviet Press and Periodical Literature. A study of Russian newspaper and journal texts, read in Russian, with balanced emphasis on language improvement and content. Prer., Russ. 212, or consent of instructor.

Russ. 332-3. Russian Science and Social Science Readings and Translation. Similar to Russ. 331, but with emphasis on technical writings in Russian and including practical training in techniques of translation from Russian into English. Prer., Russ. 212, or consent of instructor.

Russ. 351-3. Russian Poetry. Introduction to Russian poetry and poetics. Prer., Russ. 314, or consent of instructor.

Russ. 401-3. Advanced Pronunciation, Conversation, and Composition. Prer., Russ. 302 or consent of instructor.

Russ. 402-3. Advanced Pronunciation, Conversation, and Composition. Prer., Russ. 401.

Russ. 411-3. Masterpieces of Russian Literature. *Fall.* Readings in Russian of representative works of a single Russian author: for example, Dostoevsky, Gogol, Tolstoy, Chekhov, Pasternak, Solzhenitsyn. Prer., Russ. 302 or consent of instructor.

Russ. 412-3. Masterpieces of Russian Literature. *Spring.* Similar to Russ. 411, but with a different author. Prer., Russ. 302 or consent of instructor.

Russ. 431/531-3. Pushkin and His Time. A survey of Pushkin's major works and a study of his influence on Russian literature. Prer., Russ. 302 or consent of instructor.

Russ. 451/551-3. Twentieth-Century Russian Poetry.

Russ. 499-variable credit. Independent Study.

Russ. 532-3. Nineteenth-Century Russian Poetry.

Russ. 542-3. Gogol.

Russ. 546-3. Tolstoy.

Russ. 547-3. Chekhov.

Russ. 561-3. Twentieth-Century Russian Literature: Prose in the Soviet Union.

Russ. 569-3. Solzhenitsyn.

Russ. 592-3. History of the Russian Language. The place of Russian in relation to the other Slavic languages and thus ultimately in the Indo-European family, and its development as a literary language in historic context from the 10th century onward.

Russ. 593-3. Structure of Modern Russian. Universal and specific linguistic features of modern Russian examined for their relevance to the language's role as one of the vehicles of human communication and thought.

Russ. 599-variable credit. Independent Study.

Russ. 700-variable credit. Master's Thesis.

Russian Courses in Translation

Russ. 221-3. Introduction to Russian Culture. What Russians are like and how they got that way: development of national consciousness from feudalism through imperialism: Russian cookery, folk medicine, folklore, popular literature, religious thought, art, and architecture. Lectures, slides, films, guest speakers.

Russ. 222-3. Introduction to Soviet Culture. Forces shaping modern Soviet man's conception of himself. Evolution of Russian philosophy, literary satire, music, theatre, education, and ballet in the 20th century. Course is team taught: lectures, films, music, guest speakers.

Russ. 445/545-3. Dostoevsky. For graduate credit (545), readings are done in Russian.

Russ. 463-3. Soviet and East European Science Fiction. Contemporary (1957-present) science fiction literature by Soviet and East European authors. A background study will be made of pre- and post-revolutionary origins of the genre in Russia and a comparison with American science fiction on similar themes.

Russ. 465/565-3. Nabokov. The relation of Nabokov's Russian works to his English works with emphasis on his significance as a multinational European author.

Russ. 481-3. Nineteenth-Century Russian Literature. Background survey of Russian literature from 1000 to 1800. Russian writers and literary problems in the 19th century with emphasis on major authors: Pushkin, Gogol, Dostoevsky, Tolstoy, and Chekhov.

Russ. 482-3. Twentieth-Century Russian Literature. Emphasis on Soviet literature, major writers and problems, the theory and practice of Socialist Realism.

Slavic

Slav. 461-3. Ukrainian Literature, World War I to World War II. Prehistoric periods. Translated and borrowed literature of the 14th and 15th centuries. Prer., upper division standing or consent of instructor.

Slav. 471-3. Introduction to Ukrainian Civilization. A survey of Ukrainian history and culture from prehistoric to present times. Prer., upper division standing or consent of instructor.

Slav. 495-2. **Methods of Teaching Russian.**
 Slav. 501-3. **Introduction to Slavic Linguistics.**
 Slav. 503-3. **Old Church Slavonic.**
 Slav. 504-3. **Readings in Old Church Slavonic.**
 Slav. 512-3. **History of West Slavic Languages.**
 Slav. 599-variable credit. **Independent Study.**
 Slav. 800-0 to 8 (16 to 24 maximum). **Doctor's Thesis.**

PHILOSOPHY

Phil. 102-3. Ethics. Introductory study of major philosophies on the nature of the good for man, principles of evaluation, and moral choice.

Phil. 103-3. Ways of Knowing. An examination of various traditions of knowing and dealing with the world, such as those found in science, philosophy, art, mysticism, and primitive and modern religions.

Phil. 104-3. Philosophy and Society. Introduction to philosophical thought through critical analysis of the institutions of society. Representative topics: the university in American society, militarism, imperialism, racism, revolution, participatory democracy vs. representative democracy or others.

Phil. 105-3. Philosophy and Religion.¹ A philosophical introduction to problems of religion, such as the existence of God, faith and reason, religious language, etc.

Phil. 106-3. Philosophy and the Sciences. Consideration of topics and problems related to the physical and biological sciences, such as: freedom and determinism; mind and body; artificial intelligence; sciences and ethics; current theories of the universe, space, time, matter, energy, causality, etc.

Phil. 107-3. Philosophy and the Arts. Consideration of philosophic questions involved in the analysis and assessment of artistic experiences and of the objects with which the arts, including the literary arts, are concerned.

Phil. 108-3. Major Philosophical Issues. A selection of topics from several different areas of philosophy, cutting across several fields usually studied separately (e.g., logic, ethics, aesthetics).

Phil. 109-3. Philosophy and the Social Sciences. An analysis of methodology and evidence in such behavior fields as sociology, psychology, and anthropology. Consideration of the implication of these sciences for human values. Comparison with the methodologies and value implications of the natural sciences.

Phil. 110-3. Philosophy Through Literature. Introduction to philosophy through literature. Selected novels, plays, and short stories which exemplify traditional problems in philosophy.

Phil. 112-3. Introductory Logic. Introductory study of definition, informal fallacies, and the principles and standards of correct reasoning. Practice in analyzing, evaluating, and constructing frequently encountered types of arguments. Does not fulfill major requirement in logic.

Phil. 113-3. Seminar: Critical Writing and Reasoning. Intensive practice in writing with clarity and precision, and in the orderly development of arguments. Each section will focus on a core of readings dealing with a substantive topic. Check with department for specific topics.

Phil. 114-3. Technology and Human Values. An examination of the value presuppositions and implications of technology. Of particular interest to students in the sciences, engineering, business, and the health-related fields.

Phil. 165-3. Native American Philosophies. Examination of the philosophical thoughts and beliefs of various Indian tribes of North America.

Phil. 180-3, 181-3. Great Philosophical Ideas. Introductory course for the more able and interested student. Emphasis on reading and critical discussion of selected works from three or four major philosophers, ancient and modern, per semester.

Phil. 192-3. Open Topics in Philosophy. A variety of new courses at the introductory level for which existing descriptions are not appropriate. See current departmental announcements for specific content.

All courses at the 200 level require 3 hours of philosophy unless otherwise indicated.

Phil. 200-3, 201-3. Philosophical Foundations of Western Culture—Classical, Modern. Basic philosophical traditions of classical and modern western culture and the influence of these traditions on literature, art, and society.

Phil. 209-3. Philosophy and Psychology. Interdisciplinary course on issues where philosophy and psychology meet; for example, topics such as selfhood, motivation, psychotherapy, freedom, human behavior. Selected readings in philosophy and psychology.

Phil. 216-3. Metaphysics. Introductory study of philosophies concerning the nature of man and world.

Phil. 217-3. Theories of Knowledge. Introductory study of major philosophies concerning the basis, extent, and standards of knowledge and certainty.

Phil. 220-3. Classical Social Theories. Introductory study of major philosophies of the past in relation to political, economic, and social issues.

Phil. 221-3. Modern Social Theories. Philosophies of the 19th and 20th centuries and their relevance to social, political, and economic issues.

Phil. 241-3. Scientific Thought. Introduces students to the philosophic understanding of science by illustrating concrete examples of scientific thought, e.g., motion and the soul, how the peculiarly scientific analyses which have been provided by these notions arise out of common sense thinking.

Phil. 244-3. Symbolic Logic. Prer., sophomore standing.

Phil. 290-3. A Philosophical Classic. Detailed study of one major philosophic text which illustrates a variety of types of philosophical concerns. Emphasis on techniques for analysis, discussion, and assessment of philosophical argumentation. Such works as *Republic*, *Leviathan*, *Treatise of Human Nature*.

Phil. 292-3. Open Topics in Philosophy. A variety of new courses at the 200 level for which existing descriptions are not appropriate. See current departmental announcements for specific content.

Phil. 294-3. Philosophy and Women. Provides for the exploration of different approaches to the study of women.

Phil. 295-3. Existential and Psychoanalytic Theories of Women. A comparative analysis of the views of contemporary existentialist and psychoanalytic thinkers in regard to women and how these views relate to their theories of human nature.

All courses at the 300 level require 6 hours of philosophy unless otherwise indicated.

Phil. 300-3. History of Philosophy. Ancient and medieval. No prerequisite.

Phil. 301-3. History of Philosophy. Modern. No prerequisite.

Phil. 310-3. Chinese Philosophy. No prerequisite.

Phil. 315-3. Models of Medicine. An examination of such problems as the nature and evidence for current medical models: the roots of modern medicine in Greek thought; alternative models of medicine (Shamanistic, Eastern, Holistic); the medical model and psychoanalytic therapies; the concepts of mental health and physical health; the relation of medical and therapeutic models to theories of human nature. Prer., upper division standing.

Phil. 316-3. Ethical Issues In Medicine. An analysis of ethical problems involved in such issues as abortion, euthanasia, organ transplants, eugenics, the treatment of the patient as a person, and the institutional nature of the health care delivery system. Prer., upper division standing.

Phil. 317-3. Theories of Interpersonal Knowledge. Philosophical analysis of the notion of persons understanding (and misunderstanding) each other as persons, in contrast to objective cognition of things or events. Brief historical review of issues, followed by contemporary issues. Correlated to current developments in communication theory.

Phil. 318-3. History of Ethics. Selected readings representing major developments in the history of ethics.

Phil. 320-3. Social and Political Philosophy. Systematic discussion and analysis of such philosophic ideas as community, freedom, political power, violence, etc.

Phil. 328-3. Philosophy of Education. Reading and analysis of some selected writings in the philosophy of education, with special attention to theories of learning, knowledge, and choice.

¹Also available through correspondence study.

Phil. 330-3. Philosophy of Mind. Problems in the philosophy of mind, including the mind-body problem, knowledge of other minds, compatibility of free-will and determinism, etc., and discussion of such concepts as action, intention, desire, enjoyment, memory, imagination, dreaming, self-knowledge, etc.

Phil. 335-3. Metaphysics and Epistemology.

Phil. 340-3. Introduction to Philosophy of Science. Examination of some major concepts and problems of scientific thought; explanation, confirmation, causality, measurement, and theory construction.

Phil. 341-3. History of Science, Ancients to Copernicus. (Nat.Sci. 301.)

Phil. 342-3. History of Science, Copernicus to Newton. (Nat.Sci. 302.)

Phil. 343-3. History of Science, Newton to Einstein. (Nat.Sci. 303.)

Phil. 344-3. Perspectives of 20th-Century Science. (Nat.Sci. 304.)

Phil. 360-3. Philosophy of Religion. Nature of religion and methods of studying it.

Phil. 361-3. The Religions of Greece. (Clas. 361.) Prer., Clas. 110 recommended.

Phil. 370-3. Aesthetic Theory. Introduction to major theories of aesthetics and contemporary discussions of problems in aesthetics; i.e., the nature of art, the problem of evaluations in art.

Phil. 389-3. Philosophies of India. A study of the principal problems faced and the methods used by Hinduism and Buddhism. No prer.

Phil. 392-3. Open Topics in Philosophy. A variety of new courses at the 300 level for which existing descriptions are not appropriate. See current departmental announcements for specific content.

All courses at the 400 level require 9 hours of philosophy unless otherwise indicated.

Phil. 401-3. Studies in 17th-Century Philosophy.

Phil. 402-3. Studies in 18th-Century Philosophy.

Phil. 403-3. Studies in 19th-Century Philosophy.

Phil. 404-3. Twentieth-Century Philosophy. Study of two or three major philosophies prominent during the present.

Phil. 405-3. Studies in Contemporary Philosophy.

Phil. 407-3. Existentialist Philosophy.

Phil. 408-3. Introduction to Phenomenology. An examination of the contribution of phenomenology to selected topics in the theory of meaning, philosophy of mind, ontology, epistemology through a study of such philosophers as Husserl, Heidegger, Sartre, and Merleau-Ponty.

Phil. 409/509-3. Philosophy and Psychological Theory. Conceptual problems in psychological theories; e.g., issues such as models, metaphysical views, value assumptions, theory in psychotherapy. Selected readings in both philosophy and psychology. Prer., 9 hrs. of philosophy or psychology.

Phil. 410-3. American Philosophy.

Phil. 415-3. Ethical Theory. Selected problems in classical and contemporary ethical theories.

Phil. 416-3. Responsibility and Punishment. An examination of the concepts of moral and legal responsibility as well as an analysis of the nature of punishment and theories concerned with its justification. Prer., 9 hrs. of philosophy or instructor's consent.

Phil. 422-3. Representative Political Theories. Selected readings from Greek and Medieval philosophy, contract theories, historical theories, and contemporary functional theories.

Phil. 424-3. Philosophical Problems and Contemporary Culture. Issues and controversies in contemporary culture, their relation to modern theories of society, and their manifestations in the arts, science and technology, education, religion, and ethics. No prer.

Phil. 425-3. Marxism. An historical and systematic study of the principal themes of Marxist thought, from its Hegelian origins to its contemporary varieties, emphasizing in particular the works of Marx and Engels themselves.

Phil. 426-3. Philosophy of Law. Consideration of various views of the nature of law, its role in society, and its relation to other disciplines. Investigation of philosophic commitments which underlie and affect legal conceptions and procedures. No prer.

Phil. 427-3. Philosophy of History. Contemporary issues in critical and speculative theory of history, including the problems of methodology, explanation, values, and the relationship between history and social philosophy. No prer.

Phil. 442-3. Topics in Philosophy and Science. Fairly detailed examination of certain areas in the sciences having philosophical interest. Subtitles of the course vary from year to year and may include some of the following: psycholinguistics; automata theory; evolution theory; cosmology; psychoanalysis.

Phil. 443/543-3. Logical Theory. Prer., Phil. 144 or 244.

Phil. 444/544-3. Mathematical Logic. Prer., Phil. 244.

Phil. 446-3. Theories of Human Nature.

Phil. 467-3. Problems in Greek Philosophy. (Clas. 467.) Discussion of philosophers outside the Platonic and Aristotelian schools. Prer., 9 hrs. of philosophy or classics.

Phil. 470-3. History of Aesthetics. Study of the principal historical systems of aesthetic inquiry, tracing the development of central themes in such writers as Plato, Aristotle, Plotinus, Kant, and Hegel.

Phil. 473-3. Philosophy and Literature. No prer.

Phil. 474-3. Philosophy and Literature: Philosophical Sources of Literature. Study of individual philosophers and philosophic movements which are significant for the understanding of literature.

Phil. 485-3. Taoism. (R.St. 485; Chin. 485.)

Phil. 489-3. Comparative Oriental and Western Philosophies. Recommended preparation, Phil. 300 and 301.

Phil. 491-3. Studies in Systematic Philosophy: (Philosopher X). Intensive study of one systematic philosophy with attention to the scope, methods, and integrity accomplished by it. Prer., 6 hours of philosophy.

Phil. 492-3. Study of a Philosophical Masterpiece. Intensive study of a single philosophical masterpiece, with special emphasis on disciplines of reading, analysis, and comprehension. Prer., 6 hours of philosophy.

Phil. 493-3. Open Topics in Philosophy. A variety of new courses at the 400 level. See current departmental announcements for specific content.

Phil. 494-variable credit. Tutorials in Philosophy. Three-hour option: intensive criticism of student's philosophical writing. Students, working in pairs, will meet every two weeks with professor. Each student will present an essay on a specified topic—one essay will be read aloud (20 min.) and criticized; the other will be given written criticism. Six-hour option: a common theme will be provided by a full course of formal lectures; tutorials will explore variations of the major theme. Prer., 9 hrs of philosophy.

Phil. 497-3. Major Seminar.

Phil. 498-3. Special Topics in Philosophy. Seminars not listed as courses in which the instructor meets regularly with three or more students to discuss special topics in philosophy.

Phil. 499-variable credit. Independent Study.

All courses at the 500 and 600 levels require 12 hours of philosophy unless otherwise indicated.

Phil. 500-3. Medieval Philosophy.

Phil. 501-3. Renaissance Philosophy. Study of the writings of some major Renaissance philosophers.

Phil. 505-3. Graduate Proseminar. A survey of contemporary philosophical issues and methods, designed as an introduction to graduate study for entering graduate students.

Phil. 508-3. Ethics. Representative positions in normative ethics and meta-ethics.

Phil. 510-3. Topics in the History of Philosophy.

Phil. 515-3. Readings in the History of Science.

Phil. 522-3. Social and Political Philosophy. Systematic study of traditional and current theories of the philosophical justification of kinds of social and political orders, etc. Prer., 12 hours philosophy or consent of instructor.

Phil. 524-3. Philosophy and Contemporary Culture.

Phil. 530-3. Philosophy of Mind. Some of the main topics in philosophy of mind, such as the mind-body problem, the problem of knowledge of other minds, etc.; and discussion of such concepts as consciousness, self-knowledge, action, explanation of behavior, intention, dreaming, sensations, etc.

Phil. 534-3. Epistemology. A study of some of the main topics of epistemology such as skepticism, the foundations of knowledge, perception, introspection, belief, certainty, the analytic-synthetic distinctions, etc.

Phil. 538-3. Metaphysics. Traditional and contemporary theories of the basic categories used to describe nature and man's relationship to it, including such concepts as substance, identity, space and time, causality, determinism, systematic ontology, etc.

Phil. 542-3. Philosophy of Science. Topics connected with development and nature of science; structure of scientific theories, testing of hypotheses. Theory of decisions in science and ethics. Basic conceptions and models of abstraction in history of science.

Phil. 549-3. Philosophy of Language. Study of some of the main topics in the philosophy of language, such as meaning and theories of meaning, translation, speech acts, rules of language, references, relevance of psycholinguistics, language and thought, language and ontology, etc.

Phil. 560-3. Philosophy of Religion. A study of topics falling under the philosophy of religion such as proofs for God's existence; religious language; mysticism; psychology of religion; modern theological movements; miracles; and study of individual theologians.

Phil. 565-3. Analytic Philosophy. A survey of representative philosophers, methods, or problems in the 20th-century analytic tradition.

Phil. 570-3. Aesthetics. An analysis of the principal topics of aesthetics, including such issues as the formal structure of aesthetics, the nature of critical judgments, and the status of the work of art.

Phil. 580-3. Philosophy of Plato. (Clas. 580.)

Phil. 581-3. Philosophy of Aristotle. (Clas. 581.)

Phil. 582-3. Philosophy of Hume.

Phil. 583-3. Philosophy of Kant.

Phil. 584-3. Philosophy of Spinoza.

Phil. 585-3. Philosophy of Dewey.

Phil. 586-3. Philosophy of Wittgenstein.

Phil. 587-3. Russell-Moore.

Phil. 588-3. Locke, Berkeley, Hume.

Phil. 589-3. Philosophy of Hegel. Textual explication of Hegel's *Logic* and his *Phenomenology of the Spirit*, with special emphasis on the latter.

Phil. 591-3. St. Thomas Aquinas. Study of major writings of St. Thomas.

Phil. 592-3. Philosophy of Husserl.

Phil. 594-3. Topics in Recent Philosophy.

Phil. 597-3. Seminar: Comparative Philosophy. Seminar in the problems and literature of relating non-Western philosophical methods, traditions, and results to Western equivalent or para-equivalents.

Phil. 598-3. Special Topics in Philosophy. Seminars not listed as courses in which the instructor meets regularly with three or more students to discuss special topics in philosophy. Prer., 12 hours of philosophy and consent of instructor.

Phil. 599-variable credit. Independent Study.

Phil. 620-3. Seminar: Ethics.

Phil. 626-3. Seminar: Philosophy of Law.

Phil. 630-3. Seminar: Epistemology.

Phil. 640-3. Seminar: Logic.

Phil. 643-3. Methods of Social Science.

Phil. 645-3. Seminar: Metaphysics.

Phil. 646-3. Seminar: Phenomenology.

Phil. 662-3. Seminar: Political Theory.

Phil. 665-3. Seminar: Philosophy of Religion.

Phil. 670-3. Seminar: Aesthetics.

Phil. 690-3. Master's Research.

Phil. 700-4 to 6. Master's Thesis.

Phil. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Courses in other individual philosophers will occasionally be given. Prer., consent of instructor.

PHYSICAL EDUCATION AND RECREATION

Physical Education

P.E. 235-1. Conditioning.

P.E. 236-1. Fencing.

P.E. 237-1. Golf.

P.E. 238-1. Gymnastics.

P.E. 239-1. Badminton.

P.E. 240-1. Recreational Sports. Archery, bowling, racquetball, table tennis.

P.E. 241-1. Tennis.

P.E. 242-1. Track and Field.

P.E. 243-1. Wrestling.

P.E. 260-1. Activities of Low Organization.

P.E. 261-1. Baseball.

P.E. 262-1. Basketball.

P.E. 263-1. Field Hockey.

P.E. 264-1. Flag Football/Speedway.

P.E. 266-1. Soccer, Speedball.

P.E. 267-1. Softball.

P.E. 268-1. Volleyball.

P.E. 269-4. Applied Anatomy and Physiology. Anatomy and physiology as applied to use and problems in teaching health and physical education and in coaching athletics. Includes study of the systems of the body and their functions. Prer., EPOB 101-102 or Biol. Sci. 103-104, chemistry, or Anthro. 201-202.

P.E. 275-2. Sports Officiating.

P.E. 280-2. Scientific Bases for Human Movement. Physiological, anatomical, and biomedical bases for human movement. Laboratory participation using biomedical instrumentation is emphasized.

P.E. 290-no credit. Introduction to Physical Education. Introduction to physical education as a profession and to the scientific bases of human movement including physiological, psychological, and sociological aspects.

P.E. 293-2. Survey of Contemporary Health. A survey of selected health problems of contemporary man.

P.E. 295-2. Environmental Health. The impact of the environment on man's health including the effects of population, pollution, communicable diseases, and climate.

P.E. 299-variable credit. Elective Activity. Only by consent of departmental chairman.

P.E. 300-2. Coaching Baseball. Prer., P.E. 261 or consent of instructor.

P.E. 301-2. Coaching Basketball. Prer., P.E. 262 or consent of instructor.

P.E. 303-2. Coaching Football. Prer., consent of instructor.

P.E. 305-2. Coaching Gymnastics. Prer., P.E. 238 or consent of instructor.

P.E. 308-2. Coaching Swimming. Prer., consent of instructor.

P.E. 309-2. Coaching Track and Field. Prer., P.E. 242 or consent of instructor.

P.E. 311-2. Coaching Wrestling. Prer., P.E. 243 or consent of instructor.

P.E. 340-2. School Health Education. Community and child health as related to the school health program; methods and materials for health teaching. Prer., physiology or consent of instructor.

P.E. 342-3. Nutrition and Health. The basic principles of nutrition and their relationship to health.

P.E. 345-2. Safety Education. Introductory course in safety for administrators and teachers on both the elementary and secondary levels. Fulfills safety education requirements for teachers of driver education.

P.E. 346-2. Introduction to Adapted Physical Education. Overview of adaptive physical education; terminology, scope, programs in action—field observations. Not open to freshmen.

P.E. 347-2. Adapted Activities. For professional students. Basic skills, methods and teaching techniques for adapted activities: swimming, volleyball, bowling, track and field, etc. National programs for participation, teacher liability.

P.E. 350-3. Human Development and Movement Behavior. Development from infancy through adulthood with emphasis upon interrelationships which affect behavior, performance, and personality. Prer., P.E. 290 or consent of instructor.

P.E. 369-3. Sports Humanities. Characteristics and values of sports in contemporary society with reference to individual and societal values assigned sport in past cultures.

P.E. 371-3. Psychosocial Aspects of Sport and Physical Activity. Behavioral and social phenomena associated with sport. Personality and motivational factors related to participation. Spectator and crowd characteristics.

P.E. 372-3. Motor Learning and Performance. An introduction to theories of perceptual motor learning and variables affecting motor performance; applications to teaching and coaching motor activities are emphasized; laboratory sessions and individual research projects are required.

P.E. 399-variable credit. Independent Study (Physical Therapy). Only by consent of adviser.

P.E. 401-1 to 3. Professional Seminar: Physical Education. Presentation of special aspects of current practices, materials, and trends in physical education.

P.E. 402-1. Seminar in Teaching. Sophomore year. Introduction to teaching physical education in elementary and secondary schools.

P.E. 410-2. Basic Movement. The teaching of basic movement in the elementary school stressing general developmental activities and rhythms using a guided discovery and problem-solving approach. Program experiences allowing children to use their imagination and creative skill.

P.E. 413-2 to 4. Administration, Curriculum, and Evaluation in Physical Education. Processes and practices in program development; operation and evaluation in modern educational settings.

P.E. 417-3. Physical Education in the Elementary School. (T.Ed. 417.) Activities, program planning, teaching methods for grades 1-6. Prer., P.E. 260, 290, and 350.

P.E. 418-2. Theory of Athletic Coaching. Fundamental and technical problems in connection with coaching of athletic teams. Prer., P.E. 290, 350 and 7 of 10 required credits in professional activity courses P.E. 230-268.

P.E. 419-2. Organization and Administration of Interschool Athletics. Emphasizing business methods in purchase and distribution of supplies, maintenance of equipment, scheduling, and facilitating contests.

P.E. 440-3. Methods and Materials for Teaching Health. Methods used in teaching of health and safety in secondary schools.

P.E. 441-2. School Health Programs for Elementary Schools. Organization and administration; school health services; environmental health; instruction; relationship to state and local agencies.

P.E. 445-3. Disabilities and Motor Development. Survey of orthopedic and perceptual motor conditions encountered within the realm of special physical education, suggested screening and corrective procedures.

P.E. 446-2. Prevention and Treatment of Athletic Injuries.

P.E. 447-2. Physical Education for the Mentally Retarded. Adapting activities, teaching methods, and techniques for effective use with the mentally retarded; knowledge of types, etiologies, and prognosis for mental retardation. Prer., P.E. 350 and T.Ed. 412.

P.E. 448-3. Gerontology in Physical Education and Recreation. Designed to create an awareness of aging as a developmental process and to foster an understanding of the older person in a changing social milieu. Physiological, psychological, and sociological aspects of aging will be examined with emphasis given to methods by which physical and recreational needs may be met.

P.E. 449-2. Seminar-Practicum in Adapted Physical Education and Recreation. Theory and practice in therapeutic aspects of physical education and/or recreation. Readings, discussions on current trends and problems. Prer., P.E. 346 or consent of instructor.

P.E. 454-3. Biomechanics of Human Movement (Kinesiology). Mechanical and anatomical principles as a basis for analysis of movement; application made to the teaching of physical activity; classroom and laboratory experience. Prer., P.E. 290 (physical education majors) and anatomy or consent of instructor.

P.E. 458-3. Methods of Teaching Physical Education in Secondary Schools. (T.Ed. 458.) Prer., P.E. 290, 350, and 7 of 10 re-

quired credits completed or current enrollment in professional activity courses P.E. 235-268.

P.E. 466-3. Physiology of Human Performance. The effects of various types of exercise upon body structure and function. Prer., P.E. 290 (physical education majors), anatomy, and physiology, or consent of instructor.

P.E. 468-2. Human Developmental Physiology. The development of physiological systems in humans and the functional interrelationships of these changing systems. Habituation, adaptation, and genetic influence on health and disease. Prer., anatomy and physiology or consent of instructor.

P.E. 484-2. Physical Education for the Elementary School. (For elementary education majors only.) A study of activities, teaching methods, and program planning for grades 1-6. This course is specially designed for the elementary education major who wishes to gain some experience of the teaching of physical education.

P.E. 490-3. Introduction to Research in Health, Physical Education, and Recreation. An introduction to types of research, the methods for accomplishing research, and the skills necessary to complete research in the fields of health, physical education, and recreation. Prer., P.E. 290 and junior standing.

P.E. 499-variable credit. Independent study. Prer., consent of instructor.

Following the description of each course is a code indicating the semester and year in which the course is normally offered. Occasionally changes are made due to student needs, faculty sabbaticals, and the like. The abbreviations are as follows: *F* = fall, *S* = spring, *Su* = summer, *E* = even-numbered years, *O* = odd-numbered years. For example, a course marked *S - E* is offered in the spring of even-numbered years (i.e., 1980, 1982, etc.) A course marked *F* is offered every fall.

P.E. 501, 502, 503-1 to 3. Seminar: Physical Education. Presentation of special aspects of current practices, materials, and trends in physical education. The functions of these topics in contemporary physical education are analyzed or experienced.

P.E. 510-3. Teaching Elementary Physical Education. *Su - E.* An investigation of major methods and strategies for teaching motor skills applicable mainly to the elementary school child. Practical experience with children will be provided.

P.E. 513-2. Administration of Aquatic Programs. *Su - E.* Design, construction, and maintenance of swimming pools; organization and administration of swimming programs in school, public, and private facilities.

P.E. 514-3. Current Trends in Teaching Physical Education. *F.* An examination of current trends and innovative teaching techniques and methods in physical education at all levels.

P.E. 515-2. Physical Fitness Bases for School and Community Program. *Su - E.* Lect., demonstration, and participation techniques are used to examine the factors involved in total fitness. Development, maintenance, and evaluation of physical fitness and health aspects of high-level wellness are presented.

P.E. 538-3. Recreation Leadership at the Administrative Level. *F.* Designed to study the characteristics of leadership as they relate to influencing the delivery of recreational leisure services in public and private agencies. Concise content includes decision making, communications, group dynamics, and techniques in leadership assessments.

P.E. 539-3. Organization and Administration of Community Recreation. *S.* Analysis, synthesis, and evaluation of administrative organization and operations of community recreation/leisure delivery systems. Course includes a community assessment project.

P.E. 540-3. Seminar: Health. *F - O.* Presentation of special aspects, current practices, materials, and trends in health. Individual investigations of problems selected by class members will be presented to the class.

P.E. 552-3. Physical Growth and Motor Development. *F.* Evaluation of current literature pertaining to physical growth; implications of growth patterns for performance of physical activities.

P.E. 554-3. Analysis of Human Movement. *F-O, S-O.* Mechanical and muscular analysis of and physical basis for performance of sports skills. Development of mechanical principles and their application to movement. Prer., kinesiology.

P.E. 559-3. Advanced Techniques of Athletic Training. *S-E, Su-O.* Lectures and laboratory presentations relative to medical and physical aspects of athletic training, nutrition in sports, physical rehabilitation and injury prevention, minimization and management.

P.E. 566-3. Human Performance Laboratory Techniques. *S.* Laboratory procedures and biomedical instrumentation pertinent to human performance laboratories are presented through lecture and laboratory participation.

P.E. 572-3. Motor Learning. *F.* Presumes a background in learning theory. Critical analysis of theories and conditions affecting motor learning and modification or performance. Laboratory sessions and individual research projects required. Prer., undergraduate course in educational psychology of behavioral psychology.

P.E. 592-2. Applications of Statistics in Health, Physical Education, and Recreation. *S, Su-O.* Considerations of descriptive, inferential, and correlational statistics and how they apply specifically to health, physical education, and recreation data. Introduction to related computer programs.

P.E. 601, 602-1 to 3. Seminar: Physical Education. *F, S, Su.* Presentation of special aspects of current practices, materials, and trends in physical education.

P.E. 610-3. Evaluation and Accountability in Physical Education. *S-E, F-E.* Motor performance, knowledge, skill, classification, and attitude tests are presented with the statistical methodology necessary for their utilization. Construction, administration, and revision techniques are examined.

P.E. 614-2. Sports Competition Seminar. *Su-O.* An opportunity to investigate and analyze some of the common practices and policies of sports competition. Current theories and philosophies will be presented and discussed.

P.E. 620-3. Administration of Physical Education and Athletics. *F.* Affords an examination and analysis of modern administrative practices in physical education and athletics. Current problems of the teacher, coach, and administrator are reviewed in the context of administration and management.

P.E. 631-3. Trends in Recreation. *Su-E.* Analysis of changing political, social, economic, and industrial orders and the possible influences on leisure-time pursuits.

P.E. 634-2. Joint School-Community Recreation. *Su-O.* Special emphasis on administrative problems in rural communities and situations calling for coordination of recreation agencies.

P.E. 635-2. Seminar: Recreation. *Su-E.* Assigned readings, discussions, analysis, and presentation of problems effected by class members for individual investigation.

P.E. 638-3. Recent Research and Literature in Recreation. *Su-O.* Review and evaluation of reports of recent research in physical education, recreation, and related fields; review of reports of professional committees, conferences, and yearbooks.

P.E. 640-3. Physical Education and Recreation for the Handicapped. *S.* Analysis of general and specific topics pertaining to the handicapped student; emphasis on current research and use of therapeutic measures. Prer., human anatomy, human physiology, biomechanics of human movement.

P.E. 659-3. Sports Medicine. *Su-O.* Investigation and demonstration of applied exercise physiology, medicine, biopsychology, and other related disciplines contributing to the assessment and improvement of human physical performance.

P.E. 660-3. Physiological Basis for Physical Activity. *F.* Immediate and long range adaptations of the body to exercise. Adjustment of selected body systems to the stress of physical activity. Prer., college physiology or physiology of exercise.

P.E. 662-3. Metabolic Adaptation to Exercise. *S-E.* An assessment of metabolic functions in man during, and as a result of, physical activity. Energy sources and metabolic pathways are presented and evaluated. Prer., college physiology.

P.E. 670-3. Sociological Basis for Physical Education. *S.* An examination of the interrelationships between human movement and sociocultural variables with emphasis upon the social structure and dynamics of sports groups.

P.E. 675-3. Psychology of Sport. *S-E, F-E.* Behavioral phenomena associated with sport, the participant, and coach. Prer., educational psychology, psychology of learning.

P.E. 679-3. Psychological Basis for Human Performance. *S.* An advanced course dealing in depth with specialized topics relevant to motor learning and performance. Critical analysis of theories and research concerning skill acquisition. Discussion, evaluation, and pursuit of research interests and projects of students and faculty. Prer., some undergraduate psychology and/or educational psychology dealing with learning theory, or consent of instructor.

P.E. 680-3. Historical Basis of Physical Education and Recreation. *S-O.* A cultural historical development of physical education, health, recreation, and dance from ancient times to the 19th century. United States physical education from colonial days to current era.

P.E. 685-3. Interpretation of Physical Education. *F.* Interpretation of the meaning of physical education in contemporary cultural and educational settings. Examination and analysis of values associated with human movement and physical activity.

P.E. 688-3. Philosophical Basis of Physical Education and Recreation. *F.* An analysis of the various philosophies influencing educational thought and their implementation in health, physical, and recreation education.

P.E. 690-3. Methods of Research in Health, Physical Education, and Recreation. *F, S, Su-E.* Delineation of research problems; types of research; design of experiments; specific research procedures and tools; instruction in preparation of proposals, research papers, and thesis.

P.E. 699-1 to 3. Research Project. *F, S, Su.* Required for Plan II. Scholarly investigation of a selected topic utilizing literature and/or experimental techniques. Adviser required.

P.E. 700-4 to 6. Master's Thesis. *F, S, Su.*

Recreation

Rec. 112-2. Recreational Activities. Theory, practice, and innovation of softball, volleyball, golf, and archery, as well as individual and dual games for the handicapped.

Rec. 201-3. History and Philosophy of Recreation and Leisure. Historical development of the recreation/leisure profession. Analysis of the historical development of a philosophy of leisure with special application to our present American society.

Rec. 213-3. Organization of Sports Programs. Organizational patterns of recreational, intramural, extramural, and competitive sports programs. Consideration of funding, promotion, and administration of different types of programs. Consideration of funding, promotion, and administration of different types of programs.

Rec. 222-2. Camp Leadership. Modern principles of camping, camp programs, and counselor training.

Rec. 310-3. Introduction to Community Recreation. An overview of community recreation including professional preparation, programs, facilities, fiscal management, relation to other community services, and administrative responsibilities.

Rec. 320-3. Introduction to Outdoor Recreation. Begins an investigation into the conceptual, phenomenal, behavioral, social, ethical, and environmental aspects of outdoor recreation.

Rec. 322-2. Wilderness Camping Practicum. Designed in three stages providing opportunities for group and solo wilderness camping. Additional fee required.

Rec. 330-3. Introduction to Therapeutic Recreation. A study of the developing history, philosophy, and theory of the recreational and leisure services designed to meet the varying needs of individuals who are handicapped or disabled.

Rec. 340-3. Introduction to Commercial Recreation. The development of commercial recreation in the American society, the impact of private recreation on public recreation programs, the many and varied opportunities will be covered. Field trips and guest lecturers will supplement the lectures.

Rec. 400-2. Senior Seminar in Recreation. Extensive readings and analysis of the recreation profession and the concepts of leisure. Students are required to have an oral interview for a bonafide position.

Rec. 401-3. Program Planning in Recreation. To acquaint the student with the basic principles in developing a well rounded recreation program with specific objectives.

Rec. 405-3. Organization and Evaluation in Recreation. The study of organizational structures of the several types of recreational services and evaluative techniques used to determine the effectiveness of these structures are related to administration of programs, policies, and publics.

Rec. 410-3. Community Recreation Administration. Organization and administration of recreation; forces, resources, and interests required to provide programs for various kinds of groups, agencies, and institutions.

Rec. 417-1-3. Fieldwork in Community Recreation. The study of organizational structures in various types of recreational settings and the various methods of evaluating the effectiveness of these structures and their several facets. Forty-five contact hours for each hour of credit may be gained from any one agency.

Rec. 418-8. Internship in Community Recreation. Orientation to the total program including progressive steps toward full responsibility.

Rec. 419-1 to 3. Independent Study in Community Recreation. Prer., consent of instructor.

Rec. 420-3. Management of Parks and Recreation. Lect., fieldwork and lab. Experience in parks and recreation administration. Problems in management, evaluation of park and recreation facilities.

Rec. 427-1 to 3. Fieldwork in Outdoor Recreation. See course description under Rec. 417.

Rec. 428-8. Internship in Outdoor Recreation. See course description under Rec. 418.

Rec. 429-1 to 3. Independent Study in Outdoor Recreation. Prer., consent of instructor.

Rec. 430-3. Techniques in Therapeutic Recreation. Study of various techniques used in recreational and leisure services designed and adopted to meet varying abilities of disabled and handicapped individuals in hospitals, schools, rehabilitation centers, and recreation centers. Prer., Rec. 330 or consent of instructor.

Rec. 437-1 to 3. Fieldwork in Therapeutic Recreation. See course description under Rec. 417.

Rec. 438-8. Internship in Therapeutic Recreation. See course description under Rec. 418.

Rec. 439-1 to 3. Independent Study in Therapeutic Recreation. Prer., consent of instructor.

Rec. 440-3. Financial Management for Recreation. Specific techniques of management currently being utilized in the profession. Bids, grants, tax expenditure justifications, and specific program accounting will be accented.

Rec. 447-1 to 3. Fieldwork in Commercial Recreation. See course description under Rec. 417.

Rec. 448-8. Internship in Commercial Recreation. See course description under Rec. 418.

Rec. 449-1 to 3. Independent Study in Commercial Recreation. Prer., consent of instructor.

Note: Students interested in Fieldwork in Recreation, see Rec. 417, 427, 437, 447. Students interested in Internship in Recreation, see Rec. 418, 428, 438, 448. Students interested in Independent Study in Recreation, see Rec. 419, 429, 439, 449.

PHYSICS AND ASTROPHYSICS

The following courses are offered specifically for nonmajors: Natural Philosophy, Phys. 103, 104; General Astronomy, Phys. 105, 106; General Physics, Phys. 201, 202; Energy in a Technical Society, Phys. 207; Physics of Contemporary Social Problems, Phys. 208; Introductory Modern Physics, Phys. 303, 304; and Introductory Electronics, Phys. 370, 375.

Students wishing further information concerning physics should contact the office of the Department of Physics and Astrophysics.

Phys. 103-3, 104-3. Natural Philosophy. Three lect. per wk. plus three evening exams in the semester. An introductory course for humanities and social science majors. Topics range from Newtonian mechanics to modern physics. Emphasizes the social and historical aspects of physics and its connection to the humanities. Outside readings will be chosen from these areas.

Phys. 105-3. General Astronomy. (A.G. 111.) Principles of modern astronomy for non-science majors, summarizing our present knowledge about the earth, moon, planets, and the origin of life. In both Phys. 105 and Phys. 106, emphasis is placed on how our knowledge is obtained, on concepts rather than details, and what problems remain to be solved. In both courses there is considerable use of the Fiske Planetarium, but only limited use of telescopes. Those students desiring more extensive laboratory and observing experience should also register for Phys. 125 or Phys. 126.

Phys. 106-3. General Astronomy. (A.G. 112.) Principles of modern astronomy for non-science majors summarizing our present knowledge about the sun, stars, birth and death of stars, galaxies and the structure and origins of the universe. Phys. 105 and 106 can be taken in either order.

Phys. 111-4. General Physics. Two lect., two rec. per wk., plus four evening exams in the semester. First semester of 3-semester sequence for science and engineering students. Covers kinematics, dynamics, momentum of particles and rigid bodies, work and energy, gravitation, simple harmonic motion, and introduction to thermodynamics. Prer., knowledge of algebra, geometry, and trigonometry; coreq., calculus through derivatives and indefinite and definite integrals of polynomials and trigonometric functions, as typically covered in Math. 130 or A.Math. 135.

Phys. 112-4. General Physics. Two lect., two rec. per wk., plus four evening exams in the semester. Second semester of 3-semester introductory sequence for science and engineering students. Covers electricity and magnetism, wave motion, and geometric optics. Prer., Phys. 111; coreq., Math. 230 or A.Math. 136.

Phys. 114-1. Experimental Physics. To be taken concurrently with Phys. 112. One lect., one 2-hour lab. per wk.

Phys. 115-2. Experimental Physics. To replace Phys. 114 and to be taken concurrently with Phys. 112 for physics majors in Plan 3. Two 2-hour labs. per wk. Registration by special arrangement with A. Bartlett.

Phys. 125-1. General Astronomy Laboratory. (A.G. 121.) Optional lab. for Phys. 105, involving observatory, planetarium, and laboratory experience, emphasizing the planetary system. One scheduled hour per wk. plus additional day and night time hours to be arranged.

Phys. 126-1. General Astronomy Laboratory. (A.G. 122.) Optional lab. for Phys. 106, involving observatory, planetarium, and laboratory experience, emphasizing sun, stars, and galaxies. One scheduled hour per wk. plus additional day and night time hours to be arranged.

Phys. 201-5, 202-5. General Physics.¹ Three demonstration lectures, one recitation, and one lab. per wk. plus four evening exams in the semester. Phys. 201 covers mechanics, heat, and sound; 202 covers electricity and magnetism, light, and modern physics. An elementary but thorough presentation of the fundamental facts and principles of physics. Majors in mathematics, chemistry, and others taking calculus are urged to take instead Phys. 111, 112, 114, 213, and 215. Prer., 1½ years high school algebra and satisfactory grade on mathematics placement test.

Phys. 207-3. Energy in a Technical Society. Three lect. per wk. Various aspects of energy: the physics involved in the sources and uses of energy in our society, the state of depletion of the fossil fuels, nuclear energy, solar energy, and other alternative sources of energy and their possible effects on the environment. No background in physics is required.

Phys. 208-3. The Physics of Contemporary Social Problems. Three lect. per wk. Continuation of Phys. 207. Various contemporary areas of concern such as air and water pollution, transportation, resources, and communications are discussed from the point of view of the physical principles involved and the impact on society. The object of this course is to understand the scientific questions involved in making decisions in these areas. No background in physics is required.

¹Also available through correspondence study.

Phys. 213-3. General Physics. Two lect., one rec. per wk. Third semester of introductory sequence for science and engineering students. Covers thermodynamics, physical optics, and introductions to special relativity, quantum theory, atomic physics, solid state, and nuclear physics. Prer., Phys. 112 and 114.

Phys. 214-3. Introductory Modern Physics. Three rec. per wk. A continuation of the modern physics topics from Phys. 213. Introduces mathematical techniques required for a quantitative understanding of the phenomena of modern physics, including vector algebra and vector calculus, Fourier analysis, and some of the differential equations of physics. Prer., E.Phys. 213.

Phys. 215-1. Experimental Physics. One lect., one 2-hour lab. per wk. To accompany E.Phys. 213. The course includes many experiments of modern physics, including atomic physics, solid state physics, electron diffraction, radioactivity, and quantum effects.

Phys. 216-2. Experimental Physics. To replace Phys. 215 and to be taken concurrently with Phys. 213 for physics majors in Plan 3. Two 2-hour lab. per wk. Registration by special arrangement with A. Bartlett.

Phys. 303-3, 304-3. Introductory Modern Physics.¹ (Not for physics majors.) Three lect.-rec. per wk. to follow non-calculus general physics such as Phys. 101-102 or 201-202. Students with calculus should register instead for Phys. 213 and 215. For non-majors who wish to enlarge their understanding of the theory and applications of these topics, which include atomic and nuclear structure, elementary particles, relativity, cosmology, and quantum mechanics. Emphasizes the change in the scientists' view of nature in the 20th century. Also includes special topics and applications in the students' fields of interest. Prer., general physics and trigonometry, or consent of the instructor. Phys. 303 is prerequisite for Phys. 304.

Phys. 317-2, 318-2. Junior Laboratory. One lect. and one 3-hour lab. per wk. Includes experiments on data handling, electrical measurements, electronics, optics, vacuum techniques, heat and thermodynamics, mechanics, and modern physics. Emphasis will be on developing basic skills and on design of experiments. Each student will carry at least one project experiment each semester. Coreq. for Phys. 317 is Phys. 331. Phys. 317 is prer. for Phys. 318.

Phys. 321-3. Classical Mechanics. Three rec. per wk. Newtonian mechanics, oscillations, Lagrange's and Hamilton's equations, central forces, and scattering. Analytical procedures employing the methods of vector analysis and calculus. Prer., A.Math. 236 or equivalent.

Phys. 322-3. Classical Mechanics and Quantum Mechanics. Three rec. per wk. Non-inertial reference frames, rigid body motion, coupled oscillators, introduction to quantum mechanics, Bohr theory, simple solutions to the Schrodinger equation, and perturbation theory. Prer., Phys. 321.

Phys. 331-3, 332-3. Principles of Electricity and Magnetism. Elements of mathematical theory of electricity and magnetism, including electrostatic, magnetostatics, polarized media, direct and alternating current theory, introduction to electromagnetic fields, waves, and special relativity. Prer. for Phys. 332 is Phys. 331.

Phys. 341-3. Thermodynamics and Statistical Mechanics. Statistical mechanics applied to macroscopic physical systems; statistical thermodynamics, classical thermodynamic systems; applications to simple systems. The relationship of the statistical to the thermodynamic points of view is examined. Prer., Phys. 321.

Phys. 361-3. Principles of Modern Astronomy. (A.G. 321.) *Fall.* Nonmathematical approach to problems of modern astronomy. Course attempts to summarize present knowledge of universe—how it is obtained, and how it is related to other branches of natural sciences; the solar system, the sun and its activity, the stars, galaxies, and the universe at large are discussed. The relevant physical processes are reviewed. Prer., junior standing or consent of instructor.

Phys. 365-3. The Earth's Atmosphere and Oceans. (A.G. 391.) *Fall.* The physical structure and processes occurring in the atmosphere and oceans. Radiation and cloud physics. Atmospheric winds and ocean currents. The general circulation. Gulf and jet streams and the formation of severe storms. Prer., general physics and calculus.

Phys. 366-3. Planetary Physics. (A.G. 392.) *Spring.* The evolution of the solar system and formation of the inner and outer planets. The evolution of planetary atmospheres and formation of

ionospheres. Planetary radiation belts and interplanetary particles and fields. Prer., general physics and calculus.

Phys. 367-3. Astrophysics. (A.G. 393.) *Fall.* The physical characteristics of interplanetary material, the sun, other stars, interstellar matter, and galaxies. Physical processes considered include the behavior of ions and electrons in the magnetic fields of the earth and the sun, origin and propagation of the various radiations in space, generation of energy and chemical elements in stars, and cosmic electro-dynamical processes. Prer., general physics and calculus.

Phys. 370-3. Practical Electronics and Laboratory Instrumentation. *Spring.* Not for physics or electrical engineering majors. This course is intended to meet the needs of chemists, engineers, biologists, psychologists, science teachers, etc. Elementary DC and AC circuit analysis and electrical measurements, diodes and transistors, power supplies, linear and digital integrated circuits. Emphasis is on understanding circuit operation and characteristics. Prer., algebra, trigonometry, general physics; coreq., Phys. 375.

Phys. 375-1. Electronic Instrumentation Laboratory. *Spring.* Not for physics majors. The lab. course to be taken concurrently with Phys. 370. Experiments are chosen to illustrate the lecture material covered in Phys. 370, and are synchronized with it. Use of modern electronic test instruments is included.

Phys. 440-3. Introduction to Controlled Fusion. (A.G. 440.) Overview of research in controlled thermonuclear fusion for peaceful power uses; world energy problems reviewed; fusion compared to other energy sources; elementary plasma physics relevant to fusion reactor concepts; confinement schemes (toroidal devices, magnetic mirrors, magnetic pinches, laser-plasma systems); nuclear reactions; Lawson criterion for demonstration of reactor feasibility; minimum B; heating methods. Prer., Phys. 321, 332, or consent of instructor.

Phys. 446-3. Solid-State Physics. (E.E. 434.) Primarily for senior physics majors. Crystal structure lattice dynamics, band theory, semiconductors, ferromagnetism, etc.

Phys. 451-3. Light. Basic electromagnetic theory of light, using Maxwell's equations. Examples in geometrical optics; extensive applications in physical optics including diffraction and polarization. Spectra, including Zeeman effect and fluorescence. Recent advances in experimental techniques: microwaves, optical masers, image converters, etc. Prer., Phys. 332.

Phys. 455-1. Light Laboratory. One 3-hr. lab. per wk. Lab. experiments to supplement Phys. 451. Emphasis on techniques as well as basic principles.

Phys. 461-2, 462-2. Physics Honors.

Phys. 491-3, 492-3. Atomic and Nuclear Physics. Topics include a quantum mechanical treatment of the one-electron atom, atomic shell structure, atomic and molecular spectroscopy, band theory of solids, X-rays, nuclear properties, radioactivity, and the properties of the fundamental particles. Prer., Phys. 322 and 332.

Phys. 495-2, 496-2. Senior Laboratory. One lect., one lab. per wk. to be taken with Phys. 491, 492. Experiments introduce the student to realities of experimental physics so that he will gain a better understanding of theory and an appreciation of the vast amount of experimental work done in the physical sciences today. For students registered for Phys. 496 and not 455, and with 451 as a prerequisite, some experiments from the light laboratory can be included on a replacement basis. Prer., consent of the instructor.

Phys. 500-credit to be arranged. Selected Topics for Independent Study. Subject matter to be arranged. Prer., consent of instructor.

Phys. 501-3. Health Physics. *Spring.* Two lect., one lab. per wk. Health Physics is a course to provide job-oriented skills. Topics covered include radiation dosimetry, radiation biophysics, radioecology, reactor health physics, and medical physics. The labs include exercises with radioactive isotopes as well as tours of off-campus facilities. Prer., consent of instructor.

Phys. 503-3, 504-3. Intermediate Mathematical Physics I, II. (Math. 553, 554.) Survey of classical mathematical physics, starting with complex variable theory and finite dimensional vector spaces. Topics in ordinary and partial differential equations, the special functions, boundary value problems, potential theory, and Fourier analysis. Prer., Math. 431 and 432 or equivalent.

¹Also available through correspondence study.

Phys. 505-3. Science Communication Seminar. (Jour. 599.) Study and practice of public interest writing in science and technology. Writers' understanding of science, scientists' understanding of writing for communication to the general public. Practice through writing and discussion with those engaged in public interest science.

Phys. 515-3. Introductory Plasma Physics. (A.G. 515.) Basic phenomena of ionized gases; particles in external fields; Debye screening; linear electrostatic and electromagnetic wave dispersion relations, propagation, and instabilities; collisionless wave theory; Landau damping and other interactions between waves and particles: applications to astrophysical and fusion plasmas. Prer., A.G. 554 or equivalent, Phys. 631.

Phys. 516-3. Theoretical Plasma Physics. (A.G. 516.) Theoretical analysis of collective phenomena in high temperature plasmas. MHD equilibria and stability, resistive instabilities, microinstabilities and universal modes. Collisionless shock waves and radiation phenomena. Prer., A.G./Phys. 515 or consent of instructor.

Phys. 517-3. Waves and Fluctuations in Plasmas and Other Dispersive Media. (A.G. 517.) General dielectric theory of electromagnetic and electrostatic waves in linear dispersive media, examples drawn mainly from plasma physics; inhomogeneous wave propagation and energy flow; fluctuations and correlation functions; generalized Kirchoff's law, fluctuation-dissipation theorems, Cerenkov emission; radiation scattering; collisional and transport phenomena; collisionless waves and wave particle interactions in a magnetic field. Prer., A.G./Phys. 515 or consent of instructor.

Phys. 560-3, 561-3. Introduction to Theoretical Physics. A survey of both classical and modern theoretical physics for nonmajors. Classical mechanics with Lagrangian and Hamiltonian formalisms, special relativity, classical electrodynamics, quantum mechanics, structure of matter, statistical thermodynamics, radiation processes and scattering theories. Prer., consent of instructor.

Aph. 580-3. Introduction to Modern Astrophysics. (A.G. 580, Aero. 571.) Physical characteristics, distribution, and space motion of stars and stellar systems; internal structure and evolution of stars; structure of stellar atmospheres; interstellar matter and gaseous nebulae. Prer., senior standing or consent of instructor.

Phys. 585-3. Gravitational Theory. (Theory of General Relativity.) *Alternate years.* Three lect. per wk. Einstein's relativistic theory of gravitation is presented from geometric viewpoint; applications to astrophysical problems (gravitational waves, stellar collapse, etc.) are given.

Phys. 590-3. Introduction to Space Science. (Aero. 590.) A survey of space technology and space research. Topics include historical developments, the space environment, flight dynamics, rocket propulsion, space vehicle design, communications and control, man in space, and scientific research from space vehicles. Prer., consent of instructor.

Phys. 596-2. Modern Physics Laboratory. One lect., one lab. per wk. Experiments in nuclear physics, atomic physics, and condensed matter introduce the student to a variety of techniques useful in contemporary research. Students with limited background in laboratory work are urged to take this course.

Phys. 602-2. Design and Analysis of Experiments. Intended to aid students in planning and carrying out experiments. Methods for estimating expected noise level and maximizing signal-to-noise ratio. Topics in electronics, optics, vacuum techniques, and statistics. Examples from various areas of low energy experimental physics at the University of Colorado.

Phys. 603-3, 604-3. Advanced Mathematical Physics I, II. (Math. 653, 654.) Hilbert space, theory of distributions, L^2 -spaces, Sobolev spaces, methods of functional analysis, spectral theory of operators, applications to quantum theory, and group theory. Prer., Math. 431 and 432, and Math. 445 and 535.

Phys. 605-3, 606-3. Advanced Mathematical Physics. (Math. 655, 656.) Further topics in modern mathematical physics with applications. Prer., Phys. 603, 604.

Phys. 621-3. Theoretical Mechanics. Variational principles, Lagrange's equations, Hamilton's equations, motion of a rigid body, relativistic mechanics, transformation theory, continuum mechanics, small oscillations, Hamilton-Jacobi theory.

Phys. 625-3, 626-3, 627-3. Introduction to Quantum Mechanics. Quantum phenomena, relation to classical physics, Schroedinger

and Heisenberg picture, application to problems, approximation techniques; angular momentum; scattering theory; Pauli spin theory; radiation theory; relativistic wave equations with simple applications; introduction to field theory and second quantization. Coreq., Phys. 621 for Phys. 625; Phys. 631 for Phys. 626.

Phys. 628-3. Advanced Quantum Theory. Quantum theory of fields, elementary particles, symmetry laws, and topics of special interest. Prer., consent of instructor.

Phys. 631-3, 632-3. Electromagnetic Theory. Electromagnetic fields; applications of Maxwell's equations to electromagnetic wave propagation, and fundamental properties of light; relativistic electrodynamics, radiation theory. Prer., Phys. 331-332, or equivalent; Phys. 603 or equivalent is recommended.

Phys. 644-3. Statistical Mechanics. Classical and quantum statistical theory, including the study of both equilibrium and non-equilibrium systems. Topics covered in Phys. 644 include kinetic theory, degenerate gases, macrocanonical and grand canonical ensembles, and irreversible processes. Prer., Phys. 625-626.

Phys. 652-3. Atomic, Molecular, and Nuclear Processes. *Alternate years.* Study of physical processes of importance in astrophysics, including atomic and molecular spectrum lines, absorption, ionization, recombination, collision processes involving electrons or heavy particles, line broadening, nuclear reaction mechanisms and rates, neutrino processes.

Phys. 653-3. Topics in Chemical Physics. *Alternate years.* A broad survey is made of molecular structure as deduced primarily from molecular spectra. Topics selected from interaction of radiation with matter, molecular rotation, molecular vibration, molecular electronic energy levels, structural information provided by nuclear magnetic resonance, electron spin resonance and molecular-beam spectroscopy, structural information provided by electron, neutron and X-ray diffraction, molecular optical dispersion phenomena. Prer., introductory quantum mechanics, Phys. 322, Chem. 552, or equivalent.

Phys. 656-3. Atomic and Molecular Spectra. Theory of atomic structure and spectra, including coupling of angular momenta, tensor operators, energy levels, fine and hyperfine structure, transition probabilities, Zeeman and Stark effects. Molecular spectra: electronic, vibrational, and rotational states. Rotation matrices, symmetric top.

Aph. 660-3. Stellar Astrophysics. Introduction to basic astronomical data and techniques; stellar classifications; stellar motions; stellar populations, star clusters, HR diagrams, semiempirical approach to stellar evolution.

Aph. 661-3. Stellar Atmospheres. Stellar energy distributions, radiative transfer, stellar atmospheres; line absorption coefficient, broadening mechanisms, line formation in stellar atmospheres; applications to stellar spectroscopy. Prer., Aph. 660 or equivalent.

Aph. 662-3. Stellar Interiors. Solar photosphere, chromosphere, and corona; solar activity and solar wind; physical basis for stellar interiors, opacity, energy transfer, stellar models, stellar evolution; elementary pulsation theory, variable stars. Prer., Aph. 660 or equivalent.

Aph. 663-3. Physics of the Interstellar Medium. Properties of interstellar matter; galactic structure and dynamics; radio astronomy, emission processes and measurement, galactic and extra-galactic radio sources; X-ray and gamma-ray astronomy; introductory cosmology. Prer., Aph. 660 or equivalent.

Aph. 664-3. The Sun. (A.G. 533.) Physical processes of the sun, including the interior, photosphere, chromosphere, and corona. Topics covered include properties of the electromagnetic spectrum (X-ray, UV, visible and radio wavelength), magnetic fields, velocity fields, and flare phenomena and interpretation.

Aph. 665-3. Observational Astronomy. An introduction to the observational techniques of modern astronomy. Topics include optical, photographic, and electronic instrumentation for astronomical observation and the basic principles involved in their operation.

Aph. 666-3. Galaxies and Cosmology. Galaxies: classification, structure, content, dynamics; radio galaxies; quasars; clusters of galaxies; extra-galactic X-ray sources. Cosmology and cosmogony: cosmic distance scale, Hubble's law, source counts, physics of the early universe, chemical evolution of galaxies.

Phys. 685-3. Theory of Relativity. Principles and applications to physics of the special and general theories of relativity.

Phys. 687-3, 688-3. Nuclear Physics. 688, *alternate years*. Intrinsic properties of nucleons and the nucleon-nucleon interaction, nuclear models, scattering of nucleons by nuclei in terms of an optical model, and nuclear reactions.

Phys. 690-3, 691-3. Theory of the Solid State. 691, *alternate years*. Stresses application to the solid state of physical concepts basic to much of modern physics, single-particle approximation and the energy-band description of electron states in solids, pseudopotential theory applied to ordered and disordered systems, dynamical behavior of electrons in solids, lattice dynamics, Hartree-Fock and random-phase approximation in solids, many-body aspects of magnetism and super-conductivity.

Phys. 692-3, 693-3. Theory of Elementary Particles. 693, *alternate years*. Systematics of elementary particles; quantum numbers, Lorentz group and spin; the S-matrix and invariant amplitudes; analytical properties of amplitudes; dispersion relations; dynamical calculation of quantum numbers and masses; elementary particle spectroscopy; higher symmetries.

Phys. 695-variable credit. Special Topics in Physics. Various topics such as group theory in quantum mechanics, collision theory, Lawer theory, plasma spectroscopy, etc., offered intermittently depending on demand.

Aph. 696-variable credit. Special Topics in Astrophysics. Various topics such as stellar atmospheres and interiors, stellar spectra, variable stars, aerodynamic phenomena, cosmology, etc., offered intermittently depending on demand.

Phys. 700-4 to 6. Master's Thesis. An approved problem in theoretical or experimental physics under the direction of staff members. Intended to introduce the student to procedures in research and development work. Work of an original nature is expected.

Phys. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis. An investigation in some special field of physics approved and supervised by staff members. It must meet general requirements of the Graduate School and should be of sufficient value to warrant publication. The thesis will not be approved by the Department of Physics and Astrophysics until the manuscript is in acceptable form to be submitted for publication.

POLITICAL SCIENCE

Note: A course listed below is not necessarily offered every year.

American Government and Politics

P.Sc. 100-3. Introduction to Political Science.¹ Introduction to the study of politics. The political system and its environment. Course is designed to familiarize the student with basic concepts of political science, features of the political process, types of political institutions, and political behavior. Required of majors.

P.Sc. 101-3. American Government I.¹ First semester of a full-year course in American government, providing a detailed analysis of American political institutions and procedures. Especially for freshmen, but open to all, except those who have credit in P.Sc. 110.

P.Sc. 102-3. American Government II.¹ Continuation of P.Sc. 101. Especially for freshmen, but open to all. Not open to those who have credit in P.Sc. 110.

P.Sc. 110-3. The American Political System. Emphasis upon interrelations among levels and branches of government, formal and informal institutions, processes, and behavior. Required of majors who do not take P.Sc. 101-102. Prer., P.Sc. 100. Not open to those who have credit in P.Sc. 101 and/or 102.

P.Sc. 112-3. Asian Americans in United States Politics. Politics of the Asian American sector in the United States: legacies of Asian political culture; development, patterns, and roles of Asians in American politics; contemporary trends and prospects.

P.Sc. 353-3. Workshop on the Modern Positive State: The Economic and Political Orders. This course will involve both an intensive reading period devoted to the study of the modern capitalist state and a research period directed toward an understanding of the contours of federal government policy in the United States.

P.Sc. 400-3. Government Regulation of Business. Consideration of theory and practice of government relationship to business and professional activity on both state and national levels. Analysis of selected regulatory programs and policies and their impact on the constitutional system. Not open to freshmen and sophomores.

P.Sc. 402-3. Legislatures and Legislation. Structure and organization of legislatures and process of statute law-making.

P.Sc. 403-3. Political Parties and Pressure Groups. Practice of party politics in the United States. Nature, structure, organization, and functions of political parties and pressure groups. Analysis of pressure politics and political behavior.

P.Sc. 404-3. Advanced American Government: The Presidential-Congressional System. Intensive examination of the presidential-congressional system of government; organization and processes of Congress; presidential selection, functions and powers; growth and development of the executive.

P.Sc. 405-3. Public Opinion and Political Behavior. Measurement of public opinion and evaluation of its impact on governmental policy formation, including survey research techniques and field work in opinion sampling.

P.Sc. 406-3. State Government and Administration. Present-day national, state, and interstate relations; constitutional development; legislative, executive, and judicial processes and problems; administrative organization and reorganization; state finances; major state services; future of the states. Special attention is given to the government of Colorado.

P.Sc. 407-3. Urban Politics. Examination of the structure of political and social influence in urban areas; selection of urban leadership; relationship of the political system to governmental and social institutions.

P.Sc. 408-3. Municipal Government and Administration. Municipalities and relationships to the states and the national government; local politics; forms of municipal government; application of ideas and techniques of public administration to management of municipal affairs; activities of cities, e.g., planning, public utilities, law enforcement, fire protection.

P.Sc. 409-3. Comparative Metropolitan Systems. Comparative analysis of the major metropolitan systems of North America and Europe: the structural environment, decision-making in the bureaucracies and political groupings, governmental interaction and communication.

P.Sc. 451-3. Black Politics. Elitism and black powerlessness; black interest groups; base, structure, and functions of black political organizations; goals and political styles of black politicians; community control; trends (radicalism and separatism vs. accommodation) and future of black politics in the United States.

P.Sc. 452-3. Urban Policy Analysis. Examination of the processes whereby governments formulate, implement, and evaluate programs designed to deal with major social and economic problems. Special emphasis on an evaluation of urban programs in welfare, education, law enforcement, housing, and urban renewal.

P.Sc. 453-3. Social Issues and Government Response. The economic evaluation of domestic public policy in the U.S. The relationship between the intentions of legislation and the effects of government outputs is emphasized. Particular areas of inquiry include poverty and welfare, education, and regulation.

P.Sc. 454-3. War, Peace, and Strategic Defense. The role of force in American foreign policy, especially in relation to other super-powers. Particular emphasis is placed on the political and economic analysis of strategic forces and their effects. Arms control treaties and negotiations are studied.

P.Sc. 455-3. The Mexican American in Politics. (Ch.St. 455.) Analysis of the social, cultural, and economic factors which affect political behavior of Mexican Americans. Special attention will be paid to the Mexican American cultural heritage and to relations between Mexican Americans and Anglo Americans.

P.Sc. 456-3. Bureaucratic Power in American Politics. Examines public agencies as political actors engaging in public policymaking including sources of bureaucratic power; securing public support; relationships with legislature, political executives, interest groups, and other agencies; and an analysis of the freedom and limitations resulting from these relationships.

¹Also available through correspondence study.

P.Sc. 457-3. Political Socialization. An examination of the social and cultural forces that teach people their status in society, along with appropriate values, norms, and behaviors.

P.Sc. 480-3. Internship in Government. Working individually under the guidance of a public official, students will be assigned to projects selected for their academic suitability as well as for their value to the official. A biweekly seminar will be held by the instructor to evaluate experiences, discuss relevant readings, or present project papers. Since prior approval by both the instructor and the public official is required, prospective students should make their interest known before early registration. Prer., 15 hours of political science.

See also P.Sc. 423 and 475 listed under International Relations; 210, 434, 435, 436, and 437 listed under Public Administration, and 444, 445, 447, 448, and 449 listed under Political Theory and Public Law.

Graduate courses open to qualified seniors are P.Sc. 501, 502, 504, 505, 509, 553, 554. See also P.Sc. 523 listed under International Relations; 532, 535, and 536 listed under Public Administration; 547 and 549 listed under Law and Politics; and 545 under Political Philosophy.

Comparative Politics

P.Sc. 201-3. Introduction to Comparative Politics I: Developed Political Systems. Comparison of legal-institutional features; social, economic, ideological forces; patterns of recruitment and decision making in other developed politics. Emphasis on persistent elements and postwar innovations in Britain, France, Germany, Russia. Closed to those with credit in P.Sc. 211 and/or 212.

P.Sc. 202-3. Introduction to Comparative Politics II: Developing Political Systems. Comparison of political features of the developing politics within the non-Western world. The traditional political culture, nationalism, political integration, political structures, and groups in developing societies, modes of recruitment, the style of development politics, implications of planned socioeconomic change.

P.Sc. 203-3. Introduction to Asian Politics. Survey of selected political systems of East, Southeast, and South Asia. Systematic examination of the nationalist era and political history; consideration of regional and international politics in the area and their effects on the domestic politics in the selected systems.

P.Sc. 211-3. Governments of Great Britain and France. Governments and politics in present-day Great Britain and France, especially in comparison with the U.S. government. Emphasis on postwar reform legislation in U.K. and recent party politics in France. Not open to those who have credit in P.Sc. 201.

P.Sc. 212-3. Governments of Germany and Russia. Government and politics in present-day Russia and Germany. Development and present status of Bolshevik theory and practice. Democratic and totalitarian trends in German governments, past and present. Not open to those who have credit in P.Sc. 201.

P.Sc. 410-3. Advanced Comparative Politics—Western Europe. An intensive comparative analysis of the political systems and processes of the Western European democracies. Political culture and constitutionalism; executive-legislative relationships; parties and interest groups; administrative processes and the impact of social changes on political institutions.

P.Sc. 411-3. Third World Politics. Examination of the political process in the non-Western world. Survey of different methodological approaches to the study of the non-Western systems. The components of political development. Effective political units in a transitional society. Prevailing “styles” of political action.

P.Sc. 412-3. The Canadian Political System. The political practices and institutions of Canada. Monarchy, Parliament, administration, and courts; federal-provincial relations; provincial and local government; political parties and political behavior at all levels; Canadian relations with the United States and with the Commonwealth.

P.Sc. 413-3. Latin American Political Systems. Impact of social, cultural, and economic variables on the political system. Key political groups. Varying patterns of political organization and behavior. Sources of conflict and violence. Major developmental problems and obstacles to change.

P.Sc. 415-3. Political Systems of the Middle East and North Africa. Comparative analysis of the political process in the Middle East and North Africa. Islamic political theory and its contemporary manifestation. The role of nationalism and the “quest for modernity” in the development of this region. Programmed modernization in transitional politics.

P.Sc. 416-3. Political Systems of China, Japan, and Korea. Contemporary government and politics in China, Japan, and Korea. Analysis of selected political structures, processes, and problems in the light of changing patterns of sociopolitical thought and behavior and economic conditions. Comparisons with other nations.

P.Sc. 417-3. Eastern European Communism; Soviet Satellites and Yugoslavia. Developments in the Soviet satellites and Yugoslavia, their governmental organizations, and their relation to the Soviet Union and the West.

P.Sc. 418-3. Government and Politics in Southeast Asia. Analysis of the organization and functioning of government and politics in selected countries of Southeast Asia, with attention given to the nature of the social and economic environments which condition them.

P.Sc. 419-3. Political Systems of Sub-Saharan Africa. Analysis of major types of political systems in Sub-Saharan Africa and intensive case studies of selected countries exemplifying each type. Anticolonial movement and adoption of new political institutions and values. Special political problems of multiracial and multicultural societies.

P.Sc. 460-3. Governments of South Asia. The study of the political systems of India, Pakistan, Ceylon, and Nepal. The impact of British rule on the development of political institutions on the subcontinent as well as the problems of political development at all levels will be considered.

P.Sc. 461-3. Israel and Jewish Political Culture. Historical and contemporary political responses by Jews to the conditions of diaspora and statehood. Israel, American Jewry, and the Soviet Jewish community are emphasized as contemporary manifestations of Jewish political culture.

P.Sc. 463-3. Problems in Latin American Politics. Analysis of selected political problems of specific countries. Focus will vary from year to year. Emphasis on political change and conflict. May be taken independently of P.Sc. 413.

P.Sc. 466-3. Problems in Japanese Politics and Diplomacy. An intensive examination of selected contemporary features and problems of Japan's internal politics and of Japan's relations with other nations in various parts of the world, e.g., the impact of Japan's economic power and its domestic roots.

P.Sc. 467-3. The Military in Politics. An analysis of the sources and uses of the political power of the armed forces, the causes and consequences of military intervention in politics, and contrasting patterns of civil-military relationships in Western and non-Western societies. Prer., P.Sc. 201 and 202, or consent of the instructor.

See also P.Sc. 409 listed under American Government; 470 listed under International Relations; and 490 listed under Political Theory and Public Law.

Graduate courses open to qualified seniors are P.Sc. 510, 511, 512, 513, 516, 517, 518, 519, 560, 561, 566. See also P.Sc. 509 listed under American Government; 538 and 539 listed under Public Administration; and 590 listed under Empirical Theory and Methodology.

International Relations

P.Sc. 222-3. Contemporary World Problems. Examination of such forces and trends as the gap between rich and poor states, China, the Middle East imbroglio, racism in southern Africa, weapons and armaments, the United Nations, natural resources and sovereignty, the Third World, and the shift from bipolarity to regional multipolarity.

P.Sc. 270-3. International Violence. Introduction to knowledge about international violence. Various approaches to the experience of war are discussed: national policy decisions, personal tragedy, and war as a disease. The course then concentrates on ecological causes of war, found in the global system, and ways in which decision-makers and ordinary citizens can choose peace.

P.Sc. 421-3. International Relations. Readings and discussion of the actors, international interaction, and the international system. Emphasis on assessing relationships between concepts, approaches, goals, methods, and substance of relations among states and on trends which transcend sovereignty.

P.Sc. 423-3. American Foreign Policy. Examination of the foundations, assumptions, objectives, and methods of U.S. foreign policy. Special attention to the domestic and external problems of adapting U.S. policy to the changing world environment.

P.Sc. 425-3. International Organization. The objective of this course is to analyze the phenomenon known as international organization, to determine whether it is an effective instrument for achieving peace and security and for the promotion of human welfare.

P.Sc. 426-3. International Law. An investigation of the body of law which regulates relations between nation states and provides a framework for the solving of common problems. Its nature and effectiveness will be explored as well as its adaptability to a changing environment.

P.Sc. 428-3. International Behavior. Presentation of alternate theoretical frameworks for the explanation of international processes. Theories of conflict behavior and social organization are applied to problems of war and peace.

P.Sc. 429-3. Alternative World Futures. This course aims to help students think about the future of the world in a systematic way. Major sections focus on different methodological approaches to world futures.

P.Sc. 470-3. The European Community. Europe in the international system; European and Atlantic regionalism; the council of Europe, WEU, and other political institutions. Political, military, and economic integration: EEC and NATO, OEEC, EFTA, and EURATOM. Theories of integration; problems of partnership, rival nationalisms, and interdependence.

P.Sc. 472-3. Soviet Foreign Policy. Foreign policy of the Soviet Union, including the international Communist movement, its ideological bases, its impact on international politics, and its relations to domestic developments in the U.S.S.R.

P.Sc. 473-3. The Middle East and World Affairs. Evolution and revolution in the Middle East. The character of nationalism in the area. Analysis of intraregional and international problems affecting the Middle East with special emphasis on the Arab-Israeli imbroglio.

P.Sc. 474-3. Sub-Saharan Africa in World Affairs. An examination of the international behavior of the new Africa. Includes pre-independence antecedents and post-independence determinants, motives, techniques, and results of African state relations in the inter-African and world-wide settings.

P.Sc. 475-3. Africa in U.S. Foreign Policy. Examination of historical objectives, methods, and results of U.S. policy toward black Africa. Special attention to areas under foreign or minority rule, ethnic factors, potency of economic and political variables, and stresses between alliance policy and sympathy for self-determination.

P.Sc. 476-3. International Relations of China, Japan, and Korea. Major developments in the modern relations of China, Japan, and Korea with each other and with other world regions. Analysis of selected issues in contemporary East Asian international politics.

P.Sc. 477-3. Latin America in World Affairs. Patterns of United States-Latin American relations. Relations with Europe, communist states, and Third World. Major considerations in foreign policy formation. Dependency and foreign penetration. Regional integration.

P.Sc. 479-3. Senior Seminar: International Affairs. An interdisciplinary course designed primarily to help majors in international affairs bring together, review, and apply what they have learned in their IA courses in the various disciplines and geographic areas. Emphasizes interrelation between fact and theory. For seniors only.

See also P.Sc. 490 listed under Political Theory and Public Law.

Graduate courses open to qualified seniors are P.Sc. 521, 523, 525, 526, 527, 528, 574. See also P.Sc. 590 listed under Empirical Theory and Methodology.

Public Administration

P.Sc. 210-3. Introduction to Public Policy Analysis. A study of the policy making processes in American government, the factors which shape public policy decision, and the issues and questions which are relevant to political inquiry.

P.Sc. 432-3. Public Administration. Role of administration in government; trends in American public administration; problems in organization; techniques of management.

P.Sc. 434-3. National Security Organization and Policymaking. Analysis of the governmental structure and the policy-making processes for American national security planning, decision making, and action.

P.Sc. 435-3. The Environment and Public Policy. Consideration of constitutional, political, and geographic factors in the development of public policy affecting the use of natural resources and management of the environment; organization, procedures, and programs for use of natural resources; administration of environmental policies.

P.Sc. 436-3. Politics of Expertise. Examines the interactions of politicians and professional and technical experts in the formulation and implementation of federal policies.

P.Sc. 437-3. Public Priorities: Revenues and Program Expenditures. Public goals as expressed in government budgets. The politics and processes involved in raising public moneys and in determining public spending programs.

See also P.Sc. 406, 408, 409, 452, and 456 listed under American Government, and 446 listed under Political Theory and Public Law.

Graduate courses open to qualified seniors are P.Sc. 531, 532, 533, 534, 535, 536, 538, 539. See also P.Sc. 509 listed under American Government and 526 listed under International Relations.

Political Theory and Public Law

P.Sc. 248-3. Introduction to the Legal Process. Basic legal concepts and processes with emphasis on the American system. Special attention to the political functions of law. Recommended as preparation for P.Sc. 447, 448, 449.

P.Sc. 300-3. Varieties of Political Analysis. A survey of the genesis and evolution of the discipline of political science. Analysis of the various approaches to the study of politics such as historical, institutional, normative, sociological, systemic, quantitative, etc. The environment of political inquiry and theory building.

P.Sc. 440-3. Early Political Thought. Main currents of political thought in their historical setting from antiquity to the 17th century, with a critical evaluation of those elements of continuing worth.

P.Sc. 441-3. Modern Political Thought. Main currents of political thought in their historical setting from the 17th century to the present. P.Sc. 440 is not a prerequisite for P.Sc. 441.

P.Sc. 442-3. Politics and Literature. An examination of broadly political topics as they are presented in important literary works and an analysis of the problems involved in using the literary mode to present political teachings.

P.Sc. 443-3. Jurisprudence. Origins of modern legal institutions and the role of law in society throughout the ages. Comparative study of the Anglo-American and continental European legal systems in their social and ideological settings.

P.Sc. 444-3. Contemporary Culture and Politics. A study of the influences, values, and ramifications of politics in contemporary American culture, as manifested in literature, social and political philosophy, psychological and psychoanalytical writings, radical movements, and general essayists.

P.Sc. 445-3. American Political Thought. Development of American political theories and ideas from colonial period to present.

P.Sc. 446-3. Administrative Law. General nature of administrative law, types of administrative action and enforcement, analysis of rule-making and adjudication, administrative due process, judicial review.

P.Sc. 447-3. Constitutional Law I. Nature and scope of the following American constitutional principles as developed by the U.S. Supreme Court: federalism, jurisdiction of the federal courts, separation of powers, the taxing power, and the commerce power. Case method. Not open to freshmen and sophomores.

P.Sc. 448-3. Constitutional Law II. Continuation of P.Sc. 447, with emphasis on the war power, powers of the President, citizenship, the Bill of Rights, and the Civil War amendments. Case method. Not open to freshmen and sophomores.

P.Sc. 449-3. The Judicial System. Examination of the principal actors in the legal system—police, lawyers, judges, citizens—and the roles they play in the political process. Differential treatment of varying economic groups will be emphasized.

P.Sc. 490-3. Revolution and Political Violence. Study, discussion and evaluation of alternative frameworks for the analysis of revolution and political violence. The theoretical material will be firmly couched in case situations such as Western, class, colonial, urban, international, historical, racial, religious, and intergenerational violence.

P.Sc. 491-3. Scientific Thought and Political Action. The genesis and development of scientific thought. The epistemology of science and its relationship to the political order in the Western world. Patterns of rationality and purpose in political action. The concept of progress in science and politics.

P.Sc. 492-3. Women and the Law. Role of the courts in the development of public policy toward women. Case law will be combined with readings on the political position of women in society and the structure of judicial decision-making.

P.Sc. 494-3. Quantitative Research Methods. Introduction to quantitative research methods used in political science. Basic tools of analysis: data collection, processing, and evaluation, with special attention to survey techniques. Elite and case study analysis. Aggregate, cluster, and content analysis. Use of computers in political research.

P.Sc. 495-3. Predicting Politics. Presentation of the bases for the explanation and prediction of political activity. Similarities and differences between the natural and behavioral sciences are examined and illustrated with examples of research procedures and findings.

P.Sc. 496-3. Research Practicum in Political Prediction. The application of systematic research methods to problems of political science inquiry. Students can define their individual substantive areas of research concern or engage in a common project established by the class in consultation with the instructor.

See also P.Sc. 428 listed under International Relations.

Graduate courses open to qualified seniors are 540, 541, 545, 547, 549, 590, 591, 594. See also P.Sc. 534 listed under Public Administration, and 566 listed under Comparative Politics.

General Courses in Political Science

P.Sc. 499-1 to 3. Independent Study. Subjects are chosen and arrangements are made to suit the needs of each student. Primarily for seniors with good scholastic records. Prer., 15 sem. hours in political science. Written permission of instructor and department chairman is required.

GRADUATE COURSES AND SEMINARS

Note: A course listed below is not necessarily offered every year.

American Government and Politics

P.Sc. 501-3. Seminar: American Politics. Primarily for students who have taken an undergraduate course in American politics. Emphasis is on the preparation of research papers and of literature in the field. Prer., graduate standing or consent of instructor. Everett, Martin.

P.Sc. 502-3. Seminar: Colorado Politics. Research and problems in practical politics with emphasis on politics in Colorado. Prer., P.Sc. 403 or consent of instructor. Martin.

P.Sc. 504-3. Seminar: The Presidency. Intensive examination and preparation of research papers on the historical, functional, and constitutional aspects of the Presidency. Broad attention will be given to the literature on the Presidential system and to analytical comparisons with other executive systems. McBride.

P.Sc. 505-3. Seminar: The U.S. Congress. Comprehensive examination of the literature and selected research topics concerning the United States Congress. McBride.

P.Sc. 509-3. Seminar: Metropolitan Political Systems. Intensive analysis of and research in major aspects of government in metropolitan areas. Null, Winter.

P.Sc. 553-3. Problems in Public Policy Analysis. Intensive examination of selected public policy issues. Government outputs and policy alternatives are emphasized in terms of their contribution to the net social welfare. The approach is more "economic" than "behavioral." Blau.

P.Sc. 554-3. Technology and Defense in U.S. Public Policy. Attempts to relate public goals and goods to alternative defense and technological policies for the U.S. The analytic mode is that of political-economic systems analysis rather than behavioralism. Blau.

P.Sc. 600-3. The Analysis of a Public Institution. The concentrated analysis and evaluation of a single public sector organization in terms of its powers, goals, policies, effectiveness in use of resources, resolution of conflicts, coordination with related institutions, pricing, rationality of operations, and obstacles to its effective operation. Goodnow.

P.Sc. 603-3. Research Seminar: Democratic Theory, Participation, and Industrial Democracy. This seminar will have a two-fold purpose: to introduce students to the literature of direct and industrial democracy and to provide an experience in research (research design, test construction, and interviewing). Greenberg.

P.Sc. 656-3. The Corporate State in American Politics. An examination of the impact of the emergence of the mature, integrated corporation upon American political life and upon the general outlines of government policy. Greenberg.

See also P.Sc. 523 listed under International Relations; 532, 535, and 536 listed under Public Administration; 545 listed under Political Philosophy; and 547 and 549 listed under Law and Politics.

Comparative Politics

P.Sc. 510-3. Seminar: Comparative Politics—Western Europe. Examination of and writing of comprehensive research papers on selected topics of western European political institutions. Focus is on recent developments in executive decision making; the bureaucracy and its control; economic planning and welfare state politics. Safran.

P.Sc. 511-3. Seminar: Political Development. Writing and discussion of research papers on selected aspects of political development within the non-Western world. Focus on the theory of political development and the heuristic value of this conceptual framework for the comparative study of non-Western politics. Everett, Pfaff.

P.Sc. 512-3. Seminar: Politics of the Western Hemisphere. Advanced study of governments and politics of Canada, Latin America, and Western Hemisphere dependencies. Stress on writing and discussion of comprehensive research papers. Research methods and materials in the field. Busey.

P.Sc. 513-3. Seminar: Latin American Politics. Seminar designed to stress intensive study of the political process in Latin America with special emphasis on the variables which affect Latin American political behavior and development. Prer., P.Sc. 413, 477, or consent of instructor. Busey.

P.Sc. 514-3. Seminar: Comparative Political Systems. Discussion of current literature on comparative politics, including theoretical and methodological issues. Oral seminar reports will be given on selected aspects of comparative politics and seminar papers will be required on contemporary issues in the subdiscipline or particular country studies. Busey.

P.Sc. 515-3. Seminar: Political Economy of Marxist Socialist States. Critical examination of variables which affect policy development in countries characterized by a state-owned, planned economy. Countries selected for study, degree to which the seminar focuses on one or more states, and allocation of work between common reading and individual research may vary with each offering. Edelstein.

P.Sc. 516-3. Seminar: Political System of Japan. Discussion of common readings about contemporary Japan, followed by discussion of seminar papers on selected political structures, processes, and/or issues, e.g., political parties, civil rights, political thought and behavior, diplomacy, government and business, politics and education. Research methods and materials. L. Beer.

P.Sc. 517-3. Seminar: Problems in Totalitarian Dictatorship. Comparative problems of totalitarian dictatorship, primarily in Nazi Germany, Fascist Italy, and Soviet Russia. Issues to be treated will include meaning and essential characteristics of totalitarianism, stages of development, role of ideology, and instruments of power. Rozek.

P.Sc. 518-3. Seminar: Southeast Asian Politics. Advanced reading, discussion, and research on a selected topical, traditional, or functional political problem of politics in Southeast Asia. Everett.

P.Sc. 519-3. Seminar: Comparative Politics—Sub-Saharan Africa. Writing and discussion of analytical literature reviews and research papers on various aspects of political change in Sub-Saharan Africa. Stress on comparisons among African political systems as well as with other areas of the world, and on explanation of change. Scarritt, Skurnik.

P.Sc. 560-3. Seminar: Comparative Political Parties and Interest Groups. Critical examination of topics relating to social forces, parties, and interest groups. Analysis of concepts, theories, and case studies with particular emphasis on Western political systems. Party systems in comparison. The role of groups and the determinants of group politics. Everett, Safran.

P.Sc. 561-3. Seminar: Political Systems of China, Japan, and Korea. Discussion of common readings about modern East Asia, followed by seminar reports on characteristics and problems of contemporary politics and diplomacy of China, Japan and Korea. Seminar paper; research approaches. L. Beer.

P.Sc. 566-3. Seminar: Comparative Legal Systems—East Asia and the United States. Aspects and problems of contemporary law, politics, economics, society in China, Japan, Korea, and the United States. Reference to other Asian systems. Indigenous and imported legal concepts and practices. Research approaches. L. Beer.

P.Sc. 569-3. Seminar: Political Anthropology. A general consideration of the nature of political systems, law, and authority from an evolutionary point of view. Different types of stateless societies—egalitarian, rank and stratified— will be examined as well as ancient and modern state systems. Everett.

See also P.Sc. 509 listed under American Government, 538 and 539 listed under Public Administration, and 590 listed under Empirical Theory and Methodology.

Empirical Theory and Methodology

P.Sc. 590-3. Seminar: Conflict Behavior—The Politics of Violence. Theoretical and empirical analyses of conflict behavior with special emphasis on the explanation of political violence. Revolution, international warfare, and urban unrest are studied as forms of political violence.

P.Sc. 591-3. Seminar: Science and Politics. Intensive reading and discussion of the impact of the scientific enterprise on the world of politics. The scientific and the political perspectives; democracy and the technological society; science and the non-Western world; nuclear science and international relations. Pfaff.

P.Sc. 594-3. Seminar: Political Psychology. Role of personality variables in political attitudes, behavior, and system-maintenance and change; human nature as a parameter; political relevance of psychoanalytic, behaviorist, existential, and social psychology; alienation, ethnocentrism, dogmatism, and aggression as political variables. Cummings.

P.Sc. 642-3. Seminar: Systematic Political Theory. Critical and creative analysis of empirical theories relevant to an understanding of social and political man. Cummings, Mewes.

P.Sc. 643-3. The Analysis of Political Systems. Examination of concepts, propositions, and theories employed in the analysis of territorially inclusive political systems—national, subnational, and international. Systems, and functional and political economy, conceptual frameworks and their relationship to personality, cultural, role, group, power, elite, and conflict “theories.” Scarritt.

P.Sc. 646-3. Research Methods in Political Science. Analysis and evaluation of research methods, techniques, and materials in political science. Required of all candidates for the Ph.D. degree. Eckart.

P.Sc. 690-3. Seminar: Formal Study of Power. Approaches to the conceptualization and measurement of power as a social behavior, with applications to community, national, and international power systems. Various structures of political authority are studied with regard to the power relations implicit in each.

See also P.Sc. 549 listed under Law and Politics, and 534 and 537 listed under Public Administration.

International Relations

P.Sc. 521-3. Seminar: International Relations. Review of the salient literature on international relations, and subsequent presentation and critical discussion of analytical studies. Students have wide latitude in substantive and methodological approaches. Emphasis on changing trends, and on efforts to understand the bases for cooperation and conflict. Busey, Coddling, Midlarsky, Skurnik.

P.Sc. 523-3. Seminar: American Foreign Relations. Critical review of select conceptual, prescriptive, and methodological literature: examination of select foreign policy problems; discussion of seminar papers. Accent is on student contribution and participation. Skurnik.

P.Sc. 525-3. Seminar: International Relations—Law and Organization. Seminar devoted to study and research on selected problems concerning international law as a viable legal order and the role of international organization in relations among nations. Coddling.

P.Sc. 526-3. Seminar: Problems of International Organization. Seminar devoted to study of selected problems concerning administration and operation of public international organizations, including the United Nations and its specialized agencies. Decision-making, executive leadership, internal organization, personnel policies, coordination of activities, and financing will be considered. Coddling.

P.Sc. 527-3. Seminar: The Causes of International Violence. Systematic treatment of the causes of war from the perspective of recent findings in international relations. Historical and contemporary examples used in the analysis of warlike behavior. Models of war are applied to other conflict phenomena such as urban violence. Midlarsky.

P.Sc. 528-3. Seminar: International Violence and Political Choice. A course which seeks to explore the relationship between knowledge and action about the problem of international violence. Major sections consider the contributions and perspectives of science, engineering, and ethics. F. Beer.

P.Sc. 574-3. Seminar: Africa in World Affairs. Examines motives, objectives, nature, and methods of intra-African and international behavior of independent African states, through such issues as national sovereignty, African unity, national liberation, and economic development. Special attention to values, decision making, systems, and authority and legitimacy. Skurnik.

See also P.Sc. 580 listed under Public Administration and 590 listed under Empirical Theory and Methodology.

Law and Politics

P.Sc. 542-3. Criminal Justice. Evaluative study of the criminal law system of the United States and of its actual work in comparative perspective. Prer., P. Sc. 443, or consent of instructor. Krystufek.

P.Sc. 547-3. Seminar: American Constitutional Law. Intensive analysis of the most recent doctrinal developments in the key areas of constitutional law. Designed primarily for graduate students who intend to offer American government as a field for examination for an advanced degree. Lorch, Wilson.

P.Sc. 548-3. Seminar: Comparative Human Rights—Asia and the United States. Comparative study of selected human rights and liberties in the law, politics, and society of some Asian countries and the United States. Exploration of highly specific issues as well as comparative theories. Discussions of common readings. Reports and papers. L. Beer.

P.Sc. 549-3. Seminar: Behavioral Study of Public Law. Intensive, critical examination of theoretical and substantive literature dealing with the behavior of the primary actors in the legal system—police, lawyers, judges, and citizens. Emphasis will be on the empirical approach and quantitative methods. Research papers will be required. Stover.

P.Sc. 647-3. Seminar: Selected Constitutional Issues. Intensive analysis of selected constitutional issues: civil rights, civil liberties, procedural due process, administrative law, and welfare law. Primarily for graduate students who intend to offer constitutional law as a field of examination for an advanced degree. Prer., P.Sc. 447-448. Wilson.

See also P.Sc. 566 listed under Comparative Politics.

Political Philosophy

P.Sc. 540-3. Seminar: Topics in the History of Political Thought. Selected topics, such as freedom, justice, equality, and revolution in leading political philosophies from classical and modern political thought. Cummings, Jensen, Mewes, Welch.

P.Sc. 541-3. Seminar: Selected Political Theories. Selected political philosophies or theories in classical or modern political thought. Cummings, Jensen, Mewes, Welch.

P.Sc. 545-3. Seminar: American Political Thought. Intensive research in and presentation of selected topics intended to introduce the mature student to broad context within which political ideas arise. Deals with classical and modern thought. Prer., P.Sc. 440, 441, or consent of instructor. Jensen, Mewes.

P.Sc. 641-3. Seminar: Political Theory. Intensive research in and presentation of selected topics. Introduces the student to broad context within which political ideas arise. Deals with classical and modern thought. Prer., P. Sc. 440, 441, or consent of instructor. Mewes, Jensen.

See also P.Sc. 603 listed under American Government and Politics.

Public Administration

P.Sc. 531-3. Seminar: Public Personnel Administration. Intensive research into the issues of public personnel administration in national, state, and local governments; organization, functions, and policies; loyalty and security; human relations; the role of unions, recruitment and selection; compensation; and related topics. Prer., introductory course in public administration (400 level). Buechner, Lorch, Patterson.

P.Sc. 532-3. Governmental Planning. Application of governmental planning to problems of the nation, the states, cities, and urban counties; organization, procedures, and problems of planning agencies. Emphasis is given to planning in cities. Winter.

P.Sc. 533-3. Seminar: Federal Administration. Examination and presentation of research papers on external demands placed on the federal bureaucracy by Congress, the president, clientele groups, and other administrative agencies, and the mechanisms developed by federal organizations to respond to these pressures in formulating public policies. Costain, Lorch.

P.Sc. 534-3. Administrative Theory. Theories of organization and administration with emphasis on their applicability to requirements of democratic government. Significance for administrative theory of recent developments in the social sciences will be emphasized. Eckart, Goodnow.

P.Sc. 535-3. Seminar: Natural Resources Policy and Administration. Resources in the American economy, consideration of constitutional, political, and geographic factors in development of resources policy; organization procedures, and programs for administration and development of natural resources; selected topics. McBride.

P.Sc. 536-3. Intergovernmental Relations. Investigation and analysis of American federal system, including its constitutional, political, and administrative characteristics. Problems considered include federal-state relations, state-local relations, regionalism, interstate cooperation, and grants-in-aid. Kitsos, McBride.

P.Sc. 537-3. Policies, Decisions, and Public Organizations. An examination of decision-making behavior within public organizations. Investigation of collective or public decision making involving theories of power, goals, and strategies, competition and coalition formation, information processing—all applied to a variety of public organizational contexts. Eckart.

P.Sc. 538-3. Seminar: Comparative Administration. The comparative study of selected aspects of administrative systems including comparisons of structure, function, and capabilities in diverse settings. Goodnow, Lorch.

P.Sc. 539-3. Administrative Problems in Developing Countries. A consideration of public administration in less developed nations. Topics include planning and development strategies, the civil and military services, the maintenance of order, local government, and innovation. Discussion and research papers will emphasize problem definition and resolution. Goodnow.

P.Sc. 580-3. The Political System and Telecommunications. Introduction to roles played by political institutions in the utilization of telecommunications for the common good. Emphasis on American regulatory agencies, such as the Federal Communications Commission, and agencies of international cooperation, such as the International Telecommunication Union. Codding.

P.Sc. 581-3. Telecommunications in America: The Legal Structure. This course will explore, in a context of contemporary issues, the regulatory scheme and legal structure with regard to licensing, interconnection, pay TV, FCC rules, satellite ownership and control, and public representation. Codding.

See also P.Sc. 509 and 600 listed under American Government and 526 listed under International Relations.

General Courses In Political Science

P.Sc. 599-1 to 3. Topics in Political Science. Not a free option; must be approved by the student's adviser. Does not count as a seminar.

P.Sc. 699-1 to 3. Graduate Research Topic. Independent research in a topic of special interest. Arrangements are made to suit the needs of each particular student. Not a free option; must be approved by student's adviser and chairman of the department. Does not count as a seminar.

P.Sc. 700-4. Master's Thesis.

P.Sc. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

PSYCHOLOGY

Psy. 100-3. General Psychology. Three hrs. lect. and one hr. rec. per wk. Students required to participate as subjects for several hours in ongoing research. General one-semester survey of major topics in psychology, including sensory and perceptual processes, human development, personality, frustration and conflict, learning and memory and the biological bases of behavior.

Psy. 205-3. Introduction to Biopsychology. Three hrs. lect. per wk. A broad survey course in the physiological, endocrine, and genetic bases of behavior. Topics to be covered include the biological bases of learning, motivation, emotion, movement, comparative animal behavior, sexual and reproductive activity, instinctual behavior, neurobiology of language and thought,

neurophysiology, and neuroanatomy in relation to behavior. Prer., Psy. 100.

Psy. 206-3. Nutrition and Behavior. A basic introduction to the science of nutrition together with an examination of its relationship to the biochemical and physiological foundations of behavior.

Psy. 209-3. Fundamentals of Psychological Research. *Fall, Spring.* A relatively nonquantitative introduction to the essentials of experimental design and statistical reasoning. No mathematical background is required. Emphasis will be on conceptual understanding and practical application. Partially fulfills the natural science requirement. Prer., Psy. 100.

Psy. 210-4. Statistics and Research Methods in Psychology. *Fall, Spring.* Three hrs. lect. and one 2-hr. lab. per wk. Statistics and research methods intended for those who plan to major in psychology. Prer., Psy. 100. College algebra is recommended.

Psy. 221-3. Human Sexuality. *Fall, Spring.* This course covers in substantive form the interdisciplinary field of human sexuality. Anatomical, physiological, anthropological, sociological, legal, and artistic aspects of the subject are covered. Does not count as psychology credit for majors.

Psy. 230-3. Psychology of Adjustment. A survey of concepts bearing upon the processes of normal psychological adjustment, with emphasis upon using the concepts to understand common human problems in personal growth and relationships with others. Prer., Psy. 100.

Psy. 245-3. Social Psychology of Social Problems. An examination of social psychological aspects of a variety of social issues and problems in contemporary society. Issues will be very diverse, ranging from problems of poverty or minority status to topics such as prejudice, drug use, student protest, and patterns of sexual behavior. Psychological theory and research relevant to these areas will be considered as will be the processes involved in defining social behavior as a "problem." Prer., Psy. 100.

Psy. 264-3. Child and Adolescent Psychology. Principles of development in childhood and adolescence. Not recommended for majors. Majors should take Psy. 468 in the junior or senior year. Prer., Psy. 100.

Psy. 265-2. Child Psychology Practicum. Volunteer work with children in local day-care centers, nursery schools, community youth organizations, etc. Periodic training sessions and discussion group meetings with agency and departmental staff. Prer., Psy. 100; Psy. 264 must be taken concurrently.

Psy. 270-3. Psychology of Contemporary American Women. A survey of psychological theory and research concerning contemporary American women. The course deals with issues including the following: masculine bias in American culture; sex differences in cognitive functioning and personality; psychological conflict for women between career and home; and, finally, specific areas pertaining to women's mental health. Prer., Psy. 100.

Psy. 300-2. Honors Seminar. *Fall.* Discussion of current theoretical issues and participation in research problems in psychology. Open only to juniors and seniors who have been accepted into the psychology department honors program. Consent of the psychology honors director is required.

Psy. 340-3. Social Psychology of the Mexican American. (Ch.St. 340.) Focuses on the relationship between sociocultural factors and the perceptual, cognitive, and motivational development of the Mexican American. Prer., Psy. 100.

Psy. 370-3. Culture, Racism, and Alienation. (Bl.St. 370.) This course investigates the effects of racism on the individual personality of the recipient and donor of practices evolving from participation in a racist culture.

Psy. 400-2. Honors Seminar. *Spring.* Survey and integration of general psychology for seniors majoring in psychology. Open only to juniors and seniors who have been accepted into the psychology department honors program. Consent of the psychology honors director is required.

Psy. 401-1 to 6. Senior Thesis. Prer., 3.0 overall GPA, junior standing. For information, see psychology honors director.

Psy. 403-4. Laboratory Computers in Psychology. *Spring.* Lect. and lab. Programming of real-time computers as control and data collection devices. Studies of applications of real-time computers in various areas in psychology. Prerequisite, one or more courses in computer science, or knowledge of Fortran programming language. Bailey.

Psy. 405-4. Physiological Psychology. *Fall, Spring.* An intensive survey of the morphological, neurochemical, and physiological aspects of behavior. One lab./disc. section per wk. required. Prer., Psy. 100, 3 hours of biology, or consent of instructor.

Psy. 406-3. Important Concepts in Physiological Psychology. *Fall.* Revision of reflex arc doctrine, specific and unspecific control systems, lateral and surround inhibition, centrifugal control of sensory input, autonomous activity, self-stimulation, chemical specificity of neurons, habituation and sensitization, effects of use and disuse on synaptic processes, structural changes produced by experience, and consolidation. Prer., Psy. 405.

Psy. 407/507-3. Neurobehavioral Systems. (EDEE 472/572.) Application of controlled system theory to behavioral and dynamical properties of nervous systems. Examples chosen from sensory, sensorimotor, housekeeping, motivational, and cognitive systems. Prer., Psy. 405 or consent of instructor.

Psy. 409/509-3. Hormones and Behavior. This course represents the application of endocrinological concepts and techniques to the problems of motivation and behavior. Prer., junior standing and at least one year of biology.

Psy. 410-3. Behavioral Genetics. *Fall.* The inheritance of behavioral characteristics. Prer., one course in general psychology. Seniors who have had this course may take Psy. 510.

Psy. 411-2. Behavioral Genetics Laboratory. *Spring.* Demonstrations and experiments in behavioral genetics. Basic behavioral and genetic techniques employed in studying the inheritance of behavior in laboratory animals. Emphasis will be placed upon individual projects. Enrollment limited. Prer., Psy. 410 and consent of instructor.

Psy. 412/512-3. Quantitative Genetics. *Fall.* Survey of the principles of genetics of quantitative characteristics. Topics will include gene frequencies, effects of mutation, migration, and selection; correlations among relatives, heritability, inbreeding, crossbreeding, and selective breeding. Prer., consent of instructor.

Psy. 413/513-3. Drugs and the Nervous System. The physiological basis of drug action on the nervous system and behavior, with emphasis on the use of drugs as analytic tools in the study of behavior. This course is not concerned with the subjective, social, or legal consequences of drug use. Part I: Chemical basis of conduction and transmission in the nervous system. Part II: Pharmacology of sleep, pain, addiction, dependence, appetite, anxiety, learning, memory, and perception. Prer., Psy. 405.

Psy. 414-4. Cognitive Psychology. One lab., three lect. per wk. Introduction to the study of cognitive processes in man: memory, conceptual behavior, and thinking. Emphasis of the course will vary with the instructor. Prer., Psy. 100 and 210 or 211 or 310, or consent of instructor.

Psy. 415-3. Psychology of Motivation. Psychological and physiological factors in the motivation of behavior. Prer., Psy. 100 and 210 or 211 or 310.

Psy. 416-4. Psychology of Perception. One lab. per wk. Prer., Psy. 100 and 210 or 211 or 310, or consent of instructor.

Psy. 418-3. Human Learning and Conceptual Behavior: Quantitative Theory. Introduction to choice behavior, decision theory, learning, memory, and conceptual behavior in the context of elementary quantitative theory. Previous work in psychology is not assumed, but a minimum of mathematical preparation is required (college algebra, some understanding of probability).

Psy. 420-4. Psychology of Learning. *Fall, Spring.* One lab. per wk. Conditions of learning in animals and men as found in experimental literature. Prer., Psy. 100 and 210 or 211 or 310 or consent of instructor.

Psy. 422-3. Introduction to Language Behavior. An introduction to psycholinguistics, covering what the English language is and how its characteristics influence one's ability to produce and understand words and sentences. Attention will be given to language as sound, as a system of rules, as a medium for communicating, and as a biological and developmental process. Prer., Psy. 100 and 210 or 211 or 310.

Psy. 423-3. Psychology of Reading. Introduction to basic research on reading, plus educational implications of the research. Critical examination of underlying concepts, experimental designs, and interpretation of results, on both learning to read and reading comprehension. Prer., Psy. 100 and 210.

Psy. 425-3. Comparative Psychology. Behavior of animals. Similarities and differences between animals. Principles of behavior in a variety of species. Prer., 6 hours of psychology or EPOB 101-102.

Psy. 430-3. Abnormal Psychology. *Fall, Spring.* Borderline disorders as extreme variations of the normal personality. Major functional and organic disorders. Theories of mental disorders and methods of psychotherapy. Not open for credit to those who have credit for Psy. 431. Prer., Psy. 100, or consent of instructor; not open to freshmen or sophomores.

Psy. 431-4. Psychopathology. *Fall, Spring.* One two-hr. rec. per wk. Intensive analysis of the major theories of personality and behavior disorders. Not open for credit to those who have credit for Psy. 430. Prer., Psy. 100 plus 6 hours of psychology. (Open to majors only.)

Psy. 438-3/538-3. Advanced Animal Behavior. This course discusses behavior of representative members of each animal phylum. Emphasis is placed on ontogeny of behavior as well as on phylogeny. Prer., general psychology, general biology. Recommended: Psy. 420. Chiszar.

Psy. 439-2/539-2. Advanced Animal Behavior Laboratory. Students are required to execute three original research projects dealing with any aspect of animal behavior. Prer., general psychology, general biology, Psy. 240, statistics, and consent of instructor. Psy. 438 is a co- or prerequisite. Chiszar.

Psy. 440-3. Social Psychology. *Fall, Spring.* General psychological principles underlying social behavior. An overview and analysis of the major social psychological theories, methods, and topics, including attitudes, conformity, aggression, attraction, social perception, helping behavior, and group relations. Prer., at least 12 hrs. of psychology including Psy. 100 and either 210 or 310.

Psy. 441-3. Experimental Social Psychology. Readings and lectures focused on the formulation of researchable problems. Laboratories focused on empirical techniques for studying the problems. Group or individual research project on problem of the student's choice. Prer., Psy. 100 and 210 or 211 and 212 or 310.

Psy. 442-3. Social Psychology of Deviant Behavior. Primary focus upon theories and findings in the causation of deviant behavior, organized in a systematic coverage of both predisposing and precipitating factors in the social structure, in group processes, and in psychodynamics. Secondary focus upon the social response to deviance. Prer., Psy. 440 or 441, or consent of instructor.

Psy. 443-3. Human Judgment and Social Policy. Two lect., one lab. per wk. A systematic treatment of the problem of human judgment in relation to social policy and its application to social problems. Prer., junior standing and 9 hours of psychology.

Psy. 445-3. Psychology of Personality. *Fall, Spring.* The psychological study of the structure, organization, and development of the person as a whole. Analysis of major theories, methods, and research dealing with personality, including topics such as emotion, motivation, temperament, inner experience, identity and the self, personality change, and the influence of the sociocultural context. Prer., 16 hours of psychology.

Psy. 448-3. Women in Cross-Cultural Perspective. The course will review contemporary theory and research on the psychology of women. The course material will be drawn from the fields of anthropology, social psychology, clinical psychology, and sociology. Prer., Psy. 100 and course in child development. Psychology major or consent of instructor.

Psy. 449-3. Cross-Cultural Psychology. Social factors in the development of personality. Social and cultural variations in mental illness. The psychology of cultural and social change, including revolutions, economic growth, etc. Prer., 12 semester hours of courses from psychology, sociology, and anthropology.

Psy. 450/550-4. Behavior of Zoo Animals. *Summer.* An intensive examination of behavioral research conducted at zoos of the world. Emphasis will be placed on courtship and copulation, offspring development, socialization, intellectual processes, and animal communication. Classes and labs will be held at the Denver Zoo. Prer., EPOB 101-102, Psy. 100 and 210.

Psy. 451-3. History of Psychology. *Fall, Spring.* Outline of development of psychological theories since the Greek philosophers. The story of experimental psychology and its problems. Schools of psychological thinking. Readings of original sources in English and English translations. Prer., 16 hours of psychology.

Psy. 466-3. Psychology of the Exceptional Child. Psychology of retarded, handicapped, and superior children. The relation of special traits to their educational and social needs. Prer., Psych. 100 and junior standing.

Psy. 468-3. Developmental Psychology. An overview of major theories concerning the development of knowledge in human children. Emphasis is on the contrast between empiricist, nativist and constructivist viewpoints, as applied to the same content areas (e.g., perception, cognition, social development). Open only to juniors and seniors. Prer., Psy. 100.

Psy. 469-4. Research Methods in Developmental Psychology. *Fall, Spring.* Two lect., one lab. per wk. Methods of investigating developmental problems and of conducting research with children. Prer., Psy. 100 and 210, or 211-212, or 310 and 468, and consent of instructor.

Psy. 471-3. Survey of Clinical Psychology. Theories and practices relating to problems of ability and maladjustment. Diagnostic procedures and treatment methods with children and adults. Prer., Psy. 100 and 431, or consent of instructor.

Psy. 472-3. Community Psychology and Mental Health. This course will focus on issues in the organization, financing and delivery of mental health services within the community, innovative techniques for the provision of mental health-related services, the role of community factors in the production of emotional disorder, and the technologies of community change. Prer., Psy. 430 or 431, or consent of instructor.

Psy. 481-3. Individual Differences. Biological and cultural factors responsible for differences in personality, intelligence; physical traits between individuals such as age, sex, hereditary variation, socioeconomic variables; cultural differences due to geographical and historical factors. Prer., Psy. 210 or 211-212 or 310 or consent of instructor.

Psy. 485-4. Principles of Psychological Testing. Lect. and lab. A psychological and statistical analysis of the principles underlying construction and use of tests of ability and personality. Prer., Psy. 210 or 211-212 or 310.

Psy. 487-3. Personality Assessment. Systematic methods for assessing personality. Application of a variety of psychological and measurement theories to personality appraisal. Prer., Psy. 485 or consent of instructor.

Psy. 499-1 to 3. Independent Study. *Fall, Spring.* Prer., junior standing, consent of instructor, consent of the psychology director of undergraduate studies.

Note: 500-level courses are available to undergraduate and graduate students. Undergraduate students must obtain approval of instructor.

Psy. 503-2 to 4. Seminar: Laboratory Use of Computers. *Fall, Spring.* Theory and practice of computation in psychological research. Fall: introduces programming language, emphasizing basic skills; no prerequisites. Spring: control of experimental devices and collection of data in psychological research; prer., fall section or knowledge of Fortran. Bailey, Polson.

Psy. 505-2. Seminar: Physiological Psychology. Special topics concerning the biological bases of behavior.

Psy. 510-3. Concepts in Behavioral Genetics. Each term selected topics will be examined in greater detail than is possible in the comprehensive undergraduate course in behavioral genetics. (Psy. 410). Topics covered may include the inheritance of behavioral characteristics from the perspectives of pharmacogenetics, transmission genetics, biochemical genetics, and evolutionary genetics. Course may be repeated. Prer., Psy. 410.

Psy. 515-3. Biological Bases of Learning and Memory. *Fall.* Intensive examination of theories, critical experiments, and methods of experimentation that have led to current conceptualizations of memory processes and their underlying mechanisms. Prer., graduate standing.

Psy. 525-2. Seminar: Animal Behavior. Theories and methods of experimentation in the field of animal behavior are critically examined. Observations on live animals in structured environments are conducted with emphasis on innate behavior patterns. Prer., consent of instructor.

Psy. 530-3. Proseminar: Developmental Psychology—Theory and Issues. *Fall.* In-depth survey of issues in theoretical approaches to

developmental psychology. Open to graduate students and senior undergraduate psychology majors with consent of instructor.

Psy. 532-3. Proseminar: Developmental Psychology—Developmental Psychobiology. *Fall.* An intensive survey of topics concerned with experimental and physiological influences on behavioral development, primarily in the vertebrate animals. Emphasis is on methodology, theoretico-conceptual strategies, and empirical details. Students are expected to lead at least one seminar discussion on a topic of their choice during the second half of the semester.

Psy. 533-3. Proseminar: Developmental Psychology—Perceptual Development. *Spring.* The development of human perception and information processing is considered from physiological and behavioral perspectives. Open to graduate students and senior undergraduate psychology majors with consent of instructor.

Psy. 534-3. Proseminar: Developmental Psychology—Cognitive Development. *Spring.* Theoretically oriented survey of major approaches to cognitive development, with primary emphasis on Piaget's theory. Open to graduate students and senior undergraduate psychology majors with consent of instructor.

Psy. 535-3. Seminar: Socialization. *Fall.* Environmental influences on normative behavioral development and the development of individual differences in behavior. Open to graduate students and senior undergraduate psychology majors with consent of instructor.

Psy. 550-3. Behavior Modification: Theory and Practice. Designed to acquaint the student broadly both with the theoretical background of behavior modification and the clinical application of learning principles in modifying behavior. Various techniques and models of behavior modification will be presented with attention given to the criticisms and limitations of each.

Psy. 560-2, 561-2, 562-2. Proseminar: Social and Personality Psychology. Three intensive, integrative reviews of theory and research in social-personality psychology. Topics to be covered will be selected from the following: attitude and behavior change, social and group structure and processes, human judgment and social policy, personality theory and research, socialization. May be taken for 2, 4, or 6 hours credit. See *Schedule of Courses* for further information. Prer., Psy. 440 and 445, or consent of the instructor.

Psy. 563-2, 564-2, 565-2. Proseminar: Social and Personality Psychology. Three intensive, integrative reviews of theory and research in social-personality psychology. Topics to be covered will be selected from the following: attitude and behavior change, social and group structure and processes, human judgment and social policy, personality theory and research, socialization. May be taken for 2, 4, or 6 hours credit. See *Schedule of Courses* for further information. Prer., Psy. 440 and 445, or consent of the instructor.

Psy. 573-3. Neural Modeling. General introduction to neural modeling for graduate students in brain research. Conceptual and computational models in psychology, introduction to computer techniques in neural modeling. Prer., consent of instructor.

Psy. 587-4. General Statistics. A survey of probability and statistics in psychology.

Psy. 588-4. General Statistics. A continuation of Psy. 587.

Psy. 590-3. Proseminar: Quantitative Psychology. *Fall.* General introduction to mathematical psychology, with emphasis on learning theory and choice process.

Psy. 591-3. Proseminar: Quantitative Psychology. *Fall.* Introduction to measurement, scaling, and test theory.

Psy. 592-3. Proseminar: Quantitative Psychology. *Spring.* Introduction to mathematical approaches in information processing and memory.

Psy. 593-3. Proseminar: Quantitative Psychology. *Spring.* Introduction to the use of computer simulation in psychological theorizing.

Psy. 599-0 to 3. Independent Study.

Note: 600-level courses are available to graduate students only.

Psy. 601-0 to 3. Research in Behavioral Genetics. Individual research projects.

Psy. 602-2. Research Problems.

Psy. 603-2. Research Practicum.

Psy. 608-3. Mammalian Neuroanatomy. Topic covers the structure of the mammalian CNS with respect to functional organization and emphasis on synaptology. Course includes description of neuroanatomical and neurohistological techniques and an introduction to CNS ultrastructure with demonstrations of electron micrographs. Prer., consent of instructor.

Psy. 610-2. Seminar: Behavioral Genetics. Intensive study of selected topics in behavioral genetics. Emphasis will be on recent research, and attention will be given to both human and animal studies. Prer., consent of instructor.

Psy. 620-2. Seminar: Learning. A detailed study of one or more important topics in the psychology of learning. Content of seminar varies from semester to semester.

Psy. 621-2. Seminar: Experimental Psychology. An advanced seminar dealing with different specialized topics, at the discretion of the instructor, in different years. The topics chosen are within the broad range of experimental psychology.

Psy. 622-2. Seminar: Psycholinguistics. *Spring.* An analysis of theoretical and experimental contributions by psychologists and linguists to the areas of first-language acquisition and grammatical correlates of verbal behavior. The role of language in association formation, thought, perception, and second-language learning are also considered. Crothers.

Psy. 623-3. Advanced Comparative and Developmental Psychology. A critical survey of animal behavior with special emphasis on biological and developmental aspects of living organisms and on phylogenetic comparisons. Miles, Gollin.

Psy. 634-3, 636-3. Proseminar: Advanced Experimental Psychology. *Fall.* An advanced and intensive survey of topics in experimental psychology. General areas are conditioning and learning, and cognitive psychology. May be taken for 3 or 6 hrs. credit.

Psy. 637-3, 639-3. Proseminar: Advanced Experimental Psychology. *Spring.* An advanced and intensive survey of topics in experimental psychology. General areas will include sensation and perception, and history and theory. May be taken for 3 or 6 hrs. credit.

Psy. 642-3. Attitude Assessment. Study of measurement methods and their psychological and mathematical bases, with special emphasis on the measurement of attitudes.

Psy. 645-2. Social Psychological Theories and Issues From Historical and Philosophical Perspectives. *Spring.* An examination of current social psychological theory and issues in terms of historical and philosophical perspectives. The emphasis will be more on basic concepts than upon chronology. Prer., two years of graduate work in psychology or equivalent.

Psy. 648-3. Advanced Personality Theory. Consideration of foundation issues in the construction of theories of the person; appraisal of the structure and content of representative theories of personality; analysis of the implications for theory of various current areas of personality research.

Psy. 652-2. History and Theory. An advanced seminar, briefly surveying the chronological development of psychology with emphasis on theories. The seminar also provides an opportunity for intensive examination of a few selected topics, which differ from year to year. Wertheimer.

Psy. 653-2. Seminar: Personality and Social Psychology.

Psy. 656-2. Seminar: Group Processes.

Psy. 659-2. Research Problems in Community Mental Health. *Spring.* A systematic examination of research activities and issues relevant to the field of community psychology and mental health for the purpose of developing familiarity with substantive and methodological problems facing the field.

Psy. 661-2. Current Issues in Perceptual Development. The first half of the semester will include background lecture on perception, physiology, and philosophical questions of how man knows his world. The second half of the course will focus on current research in the development of perception and information processing capacities. Prer., consent of instructor. Olson.

Psy. 662-2. Issues in Developmental Psychology. *Spring.* Emphasis is on analysis of theoretical issues and research strategies. Gollin.

Psy. 663-2. Cross-Cultural Research. *Fall.* Survey of cross-cultural research in human social development.

Psy. 664-3. Cognitive Development. Investigation of various theoretical approaches to the child's acquisition of knowledge, with a strong emphasis on Piaget's theory. Prer., graduate standing, some background in cognitive development or consent of instructor. Barclay.

Psy. 665-2. Early Experience. *Spring.* A comparative analysis of the effects of early experience upon later behavior. General topics include imprinting, the effects of early handling, institutionalization, nutritional deprivation, perceptual deprivation, maternal and social deprivation.

Psy. 666-3. Language Acquisition. *Fall.* Examination of the psychological mechanisms that underlie the child's acquisition of his native language. Generative and associative models will be compared, with an emphasis on the former. Prer., graduate standing in psychology or consent of instructor. Bates.

Psy. 670-2. Seminar: Clinical Psychology. Selected topics in the area of clinical psychology.

Psy. 671-2. Practicum in Clinical Psychology. Direct clinical experience for Ph.D. candidates in clinical psychology only.

Psy. 672-2. Seminar: Hypnosis.

Psy. 674-2. Basic Issues and Practices in Community Mental Health. A survey of the factors at work in the United States that have culminated in the community mental health movement and of the current factors to be considered in future developments in the field.

Psy. 675-3. Approaches to Psychotherapy. *Summer.* An examination of the major current theories and methods of psychotherapy including client-centered, psychoanalysis, neo-Freudian, and various learning theory applications. This course is intended primarily for graduate students in departments other than psychology. Raimy, Weatherley.

Psy. 677-3. Clinical Study of the Individual. A focus upon the ideographic study of the attitudes, values, and personality characteristics of individuals using data obtained from personal interviews. The theory and practice of various interviewing approaches are also covered. Ph.D. candidates in clinical psychology only.

Psy. 678-3. Advanced Psychopathology. An intensive survey of the major theories, research findings, and behavioral characteristics associated with deviant reaction patterns.

Psy. 682-2. Seminar: Computer-assisted Instruction. A graduate level course in the theory and practice of computer-assisted teaching, with emphasis on current practice and utilization of available systems. Students will be expected to program course materials on the available systems. Bailey.

Psy. 683-2. Practicum in Interview Survey I.

Psy. 684-2. Practicum in Interview Survey II.

Psy. 685-3. Personality Measurement. Theory and practice primarily in the area of individual intelligence testing. Intensive field work and report writing. Lipetz, Ossorio.

Psy. 687-3. Principles of Experimental Design. Lectures and discussion pertaining to the logic of psychological experiments. Problems of design and analysis, including factorial, Latin Square, blocking, confounding, and other principles, are covered.

Psy. 690-2. Mathematical Theories in Psychology. Seminar on topics in mathematical theories of psychology. Specific topics vary depending on interests of students and instructors.

Psy. 691-3. Multivariate Analysis. Scientific concepts, matrix theory, and computer techniques of multivariate analyses for psychological research. Topics include cluster and factor analysis, multiple regression, and discriminant functions. Emphasis on research technology rather than mathematical theory.

Psy. 692-3. Seminar: Psychotherapy. Selected topics in the field of psychotherapy including content consideration and pertinent research. Topics change from semester to semester. Raimy.

Psy. 699-1 to 3. Teaching of Psychology. A consideration of problems, techniques, and subject matter related to the teaching of psychology. Prer., consent of instructor.

Psy. 700-4 to 6. Master's Thesis.

Psy. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

RELIGIOUS STUDIES

R.St. 162-3. Religious Dimension in Human Experience. A critical study of religion as individual experience and social phenomena;

varieties of religious language (symbol, myth, ritual, scripture, etc.); and varieties of religious experience, Asian and western.

R.St. 195-3. Women in Religion. An examination of attitudes toward women in the historic religions including the Judeo-Christian tradition, Hinduism, Buddhism, and the so-called primitive religions.

R.St. 196-3. Jesus and the New Testament.

R.St. 250-3. Science and the Sacred. An exploration of relations between religion and the sciences, with special attention to religious myth and scientific paradigm, as well as to current issues of religious significance in the sciences.

R.St. 260-3. World Religions: Western. An introduction to the literature, beliefs, practices, and institutions of Zoroastrianism, Judaism, Christianity, and Islam, in historical perspective.

R.St. 262-3. World Religions: Eastern. An introduction to the literature, beliefs, practices, and institutions of Hinduism, Buddhism, Taoism, Shintoism, and Confucianism, in historical perspective.

R.St. 264-3. Traditional African Religions. Traditional African philosophy and religion examined from the point of view of their functions in African society and also from the view of their important challenges to contemporary thought structures in American life.

R.St. 266-3. Mythic Visions of America: American Indian, Mestizo, African, and European. An examination of a wide variety of images and myths about America as a religious space and time.

R.St. 270-3. American Indian Religions. An examination of the history and structure of three American Indian religions: Aztec, Amazonian, and Sioux.

R.St. 299-variable credit. Independent Study.

R.St. 300. The Christian Tradition. An exploration of the evolution of Christian theology, myth, ethics, ritual, and social institutions.

R.St. 303-3. Founders and Prophets. A comparative and critical study of the lives, times, impact, teaching, and intent of selected religious figures of major importance, and the transmission, collection and elaboration of tradition concerning them.

R.St. 305-3. Zoroastrianism. An exploration of the myths, theology, rituals, ethics, and social institutions of Zoroastrianism, in historical perspective.

R.St. 310-3. Judaism. An exploration of the Jewish experience and its expression in myth, theology, ritual, ethics, and social institutions, in historical perspective.

R.St. 320-3. Hinduism. An in-depth study of the literature, beliefs, practices, theology, and institutions of Hinduism, in historical perspective. Prer., R.St. 262 or consent of instructor.

R.St. 330-3. Indian Buddhism. An in-depth study of the literature, beliefs, practices, theology, and institutions of Theravada and Mahayana Buddhism, in historical perspective. Prer., R.St. 262 or consent of instructor.

R.St. 340-3. Japanese Religions. A study of the literature, beliefs, practices, and institutions of Shintoism, the major sects of Japanese Buddhism, and selected "new religions" of modern day Japan.

R.St. 350-3. Religion and the Arts (in the West). A cross-cultural, in-depth study of the religious dimension in art and the role of the arts in religion. Prer., R.St. 162 or consent of instructor.

R.St. 351-3. Religion and the Arts (in the East). A cross-cultural, in-depth study of the religious dimension in art and the role of the arts in religion. Prer., R.St. 162 or consent of instructor.

R.St. 360-3. Islam. Introduction to the Islamic experience and its historical expressions in theology, myth, ritual, ethics, and social institutions.

R.St. 380-3. Tibetan Buddhism.

R.St. 385-3. Chinese Religion. (Chin. 385.) A study of Chinese Buddhism, religious Taoism, popular religion, and the religious aspects of Confucianism. Prer., R.St. 262 or consent of instructor.

R.St. 390-3. Ethical Dimensions in World Religions. An examination of the relation of religion to individual and social action. Prer., R.St. 260 or 262, or consent of instructor.

R.St. 400-3. Topics in New Testament. In-depth study of a selected book, passage, theme, or topic pertaining to the New Testament.

R.St. 410-3. Biblical Judaism. A study of the development of Jewish religious thought and institutions in the Biblical period,

with special emphasis on the literature of the Bible as a source for the study of religious experience. Prer., R.St. 260 or 310 or consent of instructor.

R.St. 415-3. Topics in Jewish Thought. Intensive study of a selected topic in Jewish theology, philosophy, or mysticism in the post-Biblical period. Prer., R.St. 260 or 310 or consent of instructor.

R.St. 420-3. Hindu Vedanta. A comparative study of the philosophies/theologies and spiritual practicums of the major schools of Vedanta. Primary attention will be given to Shankara, Ramanuja, and Madhva, in relation to the major Upanishads and to non-Vedanta schools of Hindu thought.

R.St. 440-3. Japanese Buddhist Scriptures. In-depth study of 40 Buddhist scriptures in translation belonging to the main schools of thought, and ranging from the 9th to the 20th century, from popular Buddhism to Zen. Strict analysis of the terms, trends, and contexts.

R.St. 450-3. Indigenous American Religions. An examination of the history and structure of three American Indian religions: Aztec, Amazonian, and Sioux.

R.St. 462-3. Topics in Christian Theology. An advanced study of a specific topic in Biblical, historical, or systematic theology. Prer., R.St. 400 or consent of instructor.

R.St. 465-3. Koine and New Testament. (Gk. 465.)

R.St. 480-3. Zen. An enquiry into the history and meaning of one of the most powerful traditions of China and Japan, based on the interpretation of primary sources and leading into an appreciation of its influence on Chinese and Japanese cultures.

R.St. 485-3. Taoism. (Chin. 485, Phil. 485.) Prer., R.St. 262 or 385, or Phil. 310.

R.St. 489-3. Sufism. An in-depth study of the origins and aims of Islamic mysticism, with a concentration on the thought and practice of Al-Ghazali and Rumi. Prer., R.St. 260 or consent of instructor.

R.St. 490-3. Methodologies of Religious Studies. A systematic exploration of the development of religious studies as a discipline, with close attention to the contributions of history, sociology, psychology, and phenomenology.

R.St. 495-3. Senior Seminar on Religion. Interdisciplinary inquiry into the nature and function of religion in human experience. Prer., senior major standing.

R.St. 499-variable credit. Independent Study.

SOCIOLOGY

Soc. 100-3. An Introduction to the Social System. See Econ. 100.

Soc. 119-3. Deviance. Devoted to a consideration of the processes of social differentiation which confirm a conventional normality within certain sectors of the population while simultaneously producing and maintaining deviant forms against which conventional normality assumes its moral meaning and significance. Templeton.

Soc. 126-3. Asian-American Ethnic Communities. An examination of the experience of Asian Americans from a sociological perspective. Emphasis will be on an analysis of Asian American ethnic communities and their histories, social institutions, activities, and social problems. Endo.

Soc. 127-3. The Contemporary Mexican American. (Ch.St. 127.) The heritage of the Mexican American: political, social, economic, and cultural; prejudice and discrimination in the United States; race, racism, and minorities; the hyphenated Americans; a study of rural, urban, suburban, and migrant Mexican Americans in the United States.

Soc. 128-3. Race and Minority Problems. Race and racism; facts and myths about great populations, including psychological, social, and cultural sources of bias and discrimination. Adams, Pinto.

Soc. 136-3. Sociology of the American Indian. The course will be an exploration of the position of the American Indian in contemporary life. Early governmental relations with Indian tribes will be discussed as an antecedent to modern reservations and the Bureau of Indian Affairs. Contemporary life on reservations and in urban areas will be analyzed in terms of acculturation, assimilation, and cultural pluralism.

Soc. 191-3. Contemporary Social Issues. Introductory consideration of some 30 current social controversies, such as democracy,

capitalism, race and ethnic groups, marriage, the family, crime, international tensions, and world order, designed to improve the student's ability to understand current debate and to formulate opinions for himself. Higman, Hanson.

Soc. 192-3. Contemporary Social Issues. Continuation of Soc. 191. Higman, Hunter.

Soc. 193-3. Social Issues in Health and Medicine. A discussion of current moral and policy issues facing society in health and medicine. Topics will vary somewhat from semester to semester covering such topics as alcohol and drug abuse, organ transplants and substitutes, genetic engineering, contraception and abortion, fetal research, occupational safety, and health, death and euthanasia.

Soc. 199-variable credit. Independent Study in Sociology. Consent of instructor is required.

Soc. 211-3. Introduction to Sociology I.¹ General survey of the field of sociology. Sociology as a science; man and culture; social groups; social institutions; social interaction; social change.

Soc. 212-3. Introduction to Sociology II. Continuation of Soc. 211-3. Prer., Soc. 211 or consent of instructor.

Soc. 213-3. Magic, Mysticism, and Power: A Cross-Cultural Analysis. An examination of different cultural instances and conceptions of magic, mysticism, and power. Subject cultures include Chicano, Scandinavian, German, African, Italian, and ancient religions.

Soc. 220-3. Introduction to Demography and Human Ecology. The relationship between human populations and social organization. Special emphasis on fundamental demographic processes as affected by spatial and temporal characteristics of human populations.

Soc. 221-3. Elementary Population Studies. Elements of demography, natality, mortality, international and internal migration, population growth, population policy. Cuzzort.

Soc. 222-3. Human Ecology. Ecological organization and processes in urban, rural, and regional areas.

Soc. 228-3. Black Social Movements. See Bl.St. 220.

Soc. 229-3. Black Social and Political Thought. See Bl.St. 221.

Soc. 239-3. Mass Society. Social theory is applied in an analysis of structural features of modern society, entertaining the consequences of technology, bureaucracy, urban life, and massive communications systems, including theories of community, social disorganization, alienation, popular cultural solutions to problems of individual identity, and individual adaptations to mass societal conditions.

Soc. 246-3. Introduction to Social Psychology. A survey of the following varieties of social psychology: psychoanalysis, symbolic interactionism, culture and personality, structural-functionalism, and psychological social psychology. Topics to be treated on the introductory level.

Soc. 248-3. Social Movements. The social bases and development features of modern social and political movements. Downton, Pinto.

Soc. 250-3. Social Problems and Social Change. Deals with major theories of social change, change in major social institutions, and current social problems: distribution of power in society, unemployment, poverty, racism and sexism, the changing role of the family, sexual norms and behavior, drugs, and psychophysical methods of awareness.

Soc. 255-3. Analysis of Modern Society. An examination of various sociological views of modern society including those of Lundberg, Richardson, Mills, Riesman, Goffman, Sorokin, Cohen, and others. Cuzzort.

Soc. 263-3. Social Construction of Reality: Sociology of Knowledge. The initial perspective will be that the foundations of knowledge are largely grounded in social determinants. Exploration of the parameters of this social process as well as evaluation of different social perspectives. The works of A. Maslow, C. Castaneda, and I. Shah will be considered.

Soc. 269-3. The Sociology of Popular Culture and Popular Taste. The topics of popular culture and popular taste are examined in light of their impact on persons and social life. The content of popular culture is examined to shed light upon changing folkways, mores, and styles of life. Wanderer.

- Soc. 275-3. Sociology of Natural and Social Environments.** A sociological interpretation of the increasingly traumatic interaction of ecological and social systems in the Rocky Mountain West, where natural environments are progressively impacted by recreational and energy resource development. Wehr.
- Soc. 280-3. Sociology Through Literature.** This course will attempt to integrate literature and sociology. The materials will be drawn from late 19th and 20th century American novels and short stories. Centering around the themes of class, ideology, and class consciousness, special emphasis will be given to the analysis of Black and Chicano literature. Gimenez.
- Soc. 307-3. Introduction to Radical Sociology.** Intellectual foundations of contemporary radicalism; a critical analysis of contemporary American institutions; strategies for social change; alternative forms of social organization. Hanson.
- Soc. 311-3. Sociological Perspectives: A Critical Analysis.** Critical analysis and application of sociological perspectives and paradigms as they are related to such topics and issues as uniformity and diversity, social stability and change, and consensus and conflict. Current theoretical and methodological issues and developments in sociology. The sociological imagination. Cheng, Downton, Mercer, Rivera, Wehr.
- Soc. 313-3. La Chicana.** (Ch.St. 413.) Background and traditional roles of La Chicana within a bilingual, bicultural life style. Analysis of the sociopsychological development of La Chicana within culturally ascribed roles and the imposition of a foreign dominant society. The role characteristics and behavior patterns related to the different roles will be studied in their individual context and in comparison to female role assignments in other cultural groups.
- Soc. 315-3. History of Sociological Thought I.** Major social theorists from early times to date including such writers as Aristotle, Plato, Machiavelli, Comte, and Spencer. Adams.
- Soc. 316-3. History of Sociological Thought II.** Continuation of Soc. 315. Prer., Soc. 315. Adams, Mercer.
- Soc. 317-3. Statistics.** Quantitative techniques used in analyzing social phenomena. Prer., Math. 107, its equivalent, or consent of instructor. Pearson, Wanderer.
- Soc. 320-4. Research Methods for Barrio Studies.** Methodology for barrio studies, including methodological techniques (sampling, questionnaire construction, interviewing procedures, coding, etc.) and elementary statistics. How to conduct a survey in a Chicano population. Rivera.
- Soc. 325-3. Nonviolent Persons and Movements.** The study of nonviolent persons in the context of their historical and social settings. Downton.
- Soc. 329-3. America's Black Revolution.** The relation of the events of the reconstruction period to the theory and fact of the black revolution, 1940 to the present. Nilon.
- Soc. 331-3. The Sociology of Language.** The record in languages of society and culture. The uses of language in social and cultural processes and involvements. The conveyance of meaning treated as the prime topic of sociological inquiry. Studies of conversations and of social facts put into words. Kjolseth.
- Soc. 332-3. Applied Sociology of Language.** This course is a continuation of Soc. 331 and deals with problems such as language planning and standardization, language maintenance and shift, problems of education and development which are language related, second-language learning, and selection and development of standard language varieties in third world countries and in underdeveloped areas of modern industrial states. Emphasis will be upon the application of sociolinguistic concepts and theories to both macro and micro sociological problems. Field work projects will be encouraged. Kjolseth.
- Soc. 337-3. Population and Society.** This course will examine population, its structure and processes and its relationships to selected areas of the social structure; and population control and its political, social, and economic implications. Malthusian, neo-Malthusian, and Marxist perspectives will be examined. Gimenez.
- Soc. 342-3. Sociology and Perspectives on Alienation.** The course is offered to create the opportunity for the comparison of historical and contemporary conceptions of alienation in sociology, with other perspectives (crucially the religious, the psychoanalytic, and the artistic) in an attempt to arrive at an evaluation of the cogency of the concept in the sociological task of understanding and explaining the historical and contemporary situation of man.
- Soc. 346-3. Self and Consciousness.** An exploration of inner space, drawing upon the relevant literature of East and West and revolving around the basic issues of living in this complex society. Downton, Pinto.
- Soc. 350-3. Film and Society.** Explores movies as a tool of social science. Three components: the text (focuses on a cultural history of American movies); the lectures (a general interpretation of the need for art in any community); and the films (which will be used to elaborate on the text and lectures). There is a \$10 film fee.
- Soc. 353-4. Field Experience in Sociology.** Provides systematic supervision and training in field settings including data collection, interviewing, and participant observation. Rivera, Wanderer.
- Soc. 360-3. Social Relations.** The course has two aims: first, to improve the student's abilities to observe, analyze, and understand his own behavior and that of others in everyday interpersonal situations; and second, to improve his ability to see the small group as a social system. The student is expected to demonstrate his abilities by effective participation in his group as well as in periodic written analyses. Problems for analysis are drawn from events in the group. The class is designed as a self-analytic training group. Rivera.
- Soc. 362-3. Transitional Societies.** Examination of the problems of growth-generation and growth-control in technologically underdeveloped and overdeveloped societies. Focus on China, India, Tanzania, Cuba, and the United States. Wehr.
- Soc. 371-3. Logic for Social Scientists I.** Elementary structural reasoning. The use of propositions, sets, graphs and the like to study how properties of individuals and relations between them define group structures of importance in social science, e.g., networks of association and hierarchies of influence. McPhee.
- Soc. 372-3. Logic for Social Scientists II.** Elementary dynamic reasoning. The use of conditional propositions and the like to develop a sequential logic of processes of importance in social science, e.g., the flow of communications and the functioning of organizations. Soc. 371 or elementary logic or set theory is helpful, but not required. McPhee.
- Soc. 384-3. Environment and Behavior.** Focuses on the influence of both natural and man-made environments upon human behavior and social organization. Consideration is given both micro-environments and their influence on individuals as well as the impact of macro-environments on the organization of society.
- Soc. 394-3. Environment and Recreation I.** Behavioral issues in the use of natural environments such as forest and mountain preserves for human recreation. Field research of a social-psychological nature. Nielsen, McPhee.
- Soc. 395-3. Environment and Recreation II.** Policy issues in the use of natural environments such as forest and mountain preserves for human recreation. Field observation of political and sociological arrangements. McPhee.
- Soc. 400-3. Awareness Workshop.** A mind-games exploration of inner space and social relationships. Downton.
- Soc. 402-3. Senior Honors Seminar.** Topics within the field of sociology. Prer., consent of instructor. Pearson.
- Soc. 403/562-3. Third World Social Theory.** The purpose of the course is to introduce the student to Third World social theory. Our focus will be the ideas that have emerged to explain the social reality of oppressed peoples. Thus, the course will focus upon the following theorists: Fanon, Memmi, Freire, Che Guevara, and Mao Tse-Tung. Rivera.
- Soc. 404-3. Social History of Women.** Comparative sociological analysis of women's roles in a macrohistorical survey beginning with hunting and gathering bands of prehistory, moving through the empires of antiquity and the civilizations of Greco-Roman, Byzantine, Moslem and Western European societies, up to the 20th century. Boulding.
- Soc. 405-3. Intergroup Relations.** (Comm. 429.) A study of intergroup (race) relations at the small-group level. Includes analysis of a group that has been stratified into a majority number of white students and fixed number of minority students. Rivera.
- Soc. 406-3. Sex Role and Sex Stratification.** Causes and consequences of sex role differentiation at the individual, group, and societal levels. Extent of empirically established sex differences. Review of biological, psychological, and sociological explanations for sex role differences; emphasis on the socialization processes. Nielsen.

Soc. 408-3. Selected Topics on Asian Americans. An intensive examination of a particular topic or issue concerning Asian Americans to be selected by the instructor. Examples of topics include the Japanese American evacuation during World War II, Asian American social movements, community institutions and organizations, and directed research in a particular area. Endo.

Soc. 410-3. Twentieth-Century Social Theory. A review of the major sociological theories of the 20th century. The course will consider briefly the major works of such pre-World War II writers as Emile Durkheim and Max Weber. It will then concentrate on the post war work of Garfinkle, Duncan, Goffman, and others. Cuzzort.

Soc. 412/512-3. Applied Formal Sociology. Computer simulations of various social systems, ranging from a relatively simple process of negotiation to the complex of processes that characterize a modern city. Bartos.

Soc. 414-3. Chicano Movement: Theory and Major Events. The course has a twofold purpose: (1) to review the literature on social movements as a theoretical orientation, and (2) to review the major contributing events to the status of the Chicano Movement to date. Rivera.

Soc. 415-3. Research Methods in Black Studies I. See Bl.St. 450.

Soc. 416-3. Research Practicum in Black Studies II. See Bl.St. 451.

Soc. 417-3. Research Methods. Design of social research. Application of statistical techniques and procedures to social phenomena. Prer., Soc. 317 or consent of instructor. Bartos, Nielsen, Pearson, Wanderer.

Soc. 418-3. Statistics of Social Relations. Statistical and probabilistic methods relevant to social processes, for example, time series analysis and stochastic processes; and methods relevant to social structure, for example, random nets, path analysis, and segregation measures. Topics selected for their particular utility in handling sociological problems. Prer., Soc. 317 or consent of instructor. McPhee.

Soc. 419-3. Social Disorganization. Major problems of social maladjustment from standpoint of the processes underlying social and individual disorganization, such as alcoholism, suicide, illegitimacy, and family disorganization. Templeton, Wanderer.

Soc. 420-6. Research Methods and Field Experience. Comprised of two components: (1) survey research, statistics, and computer programming (students will be required to design a research project, collect and analyze data, and report findings), and (2) intensive interviewing and participant observation (students will be required to conceptualize a field work project which includes qualitative analysis of some ongoing social setting). Prer., Soc. 211-212 or permission of instructor.

Soc. 423-3. Chicano Talk. (Ch. St. 423.) An analysis of the social artistic, expressive, and linguistic characteristics of the several varieties of Spanish found in the repertoire of Chicano communities; Pachuco, Calo, Tex-Mex, Manito, Pinto, etc., as well as of phenomena such as code-switching. Kjolseth.

Soc. 425/525-3. Theories and Problems of Development. Course will be related to policy problems facing less developed nations. Theories (institutional vs. instructional, economic vs. political and sociological, similarities of stages), case studies and cross-national empirical research will be included.

Soc. 426-3. Urban Sociology. The city in terms of its social structure, residential and institutional patternings, processes of interaction, demographic processes, and patterns of growth and change. Adams, Endo, Hunter, Wanderer.

Soc. 428/558-3. Sociology of the Future. A systematic analysis of future societies. Emphasis on examining a variety of possible social arrangements, and on assessing economic and political consequences of each, with computer simulation as an optional method. Bartos.

Soc. 429/585-3. Population Issues in Nonindustrial Countries. Examination of the antecedents and consequences of demographic trends in the non-industrial nations of the world, particularly as those trends pertain to economic development, health, and social change.

Soc. 430-3. Social Organization. The social order among primitive peoples and in ancient high civilizations of the Mediterranean, the Orient, and the New World.

Soc. 431-3. Social Organization. Social structures of empires and feudal societies. Development of the social organization of great contemporary populations. Adams, Bynder.

Soc. 432/539-3. Education in Multilingual Communities. Considers role of language in education and mechanisms of social stratification, i.e., inequality, particularly in communities where children enter school with differing mother tongues. Sociology of bilingual education: politics, pedagogy, and development. Field research encouraged.

Soc. 433-3. Communities. Review and appraisal of community studies. Adams, Mercer.

Soc. 435-3. Sociology of Health and Illness. This course will analyze sociological theories of illness causation and differentiate them from the epidemiological and medical models. It will examine the relationship between belief systems and illness causation. The course will also examine the ways in which socioeconomic status and social stress are related to disease. Deviant illness and the social role of the sick person will also be discussed. Finally, the course will examine how American society handles the ultimate outcome of illness; death. Bynder.

Soc. 436-3. Ideas in Society. Mannheim's *Sociology of the Mind*. Experimental and historical studies of collective representations. Sociological epistemologies.

Soc. 437-3. Sociology of Health Institutions. This course will analyze health institutions in the general context of theories of social institutions and their relationships. It will examine how people learn health institutional roles, how they carry them out and the pattern of their relationships. The organizational context of health institutions will be discussed, particularly the hospital. Finally, patterns and problems in the restructuring of health institutions will be analyzed and various alternatives discussed. Bynder.

Soc. 438-3. Practicum in Sociolinguistics. Approaches through language to the study of society and culture. The examination and appraisal of languages and of language productions as records and expressions of social facts. Field projects and documentary and laboratory investigations of language related to social and cultural formations. Sociological treatments of texts, accounts, and conversations.

Soc. 439/536-3. Practicum in Ethnography. Ethnographic investigations of contemporary settings. The ethnographic search for formal social features and the deviation of theoretical constructs from ethnographic accounts. Ethnography related to formal and experimental analysis and the testing and appraisal of ethnographic methods and findings. Ethnography informed by such outlooks and approaches as hermeneutics, phenomenology, and ethnomethodology.

Soc. 440-3. Sociology of Adolescence. Adolescence in primitive, traditional, and modern society, with special emphasis on the contemporary United States. The possible existence of a "youth culture" is investigated. The relationship between social climates and individual academic orientations, dating patterns, etc., is analyzed. Pinto.

Soc. 441-5. Group Structures and Behavior. Collective behavior, personality, group, and culture. The problems of publics, crowds, social movements, and human relations of a changing dynamic nature. Higman.

Soc. 443/543-3. Technology and Modernization. A description and analysis of changing social structures and social relationships as a response to technological innovation and change. Emphasis also given to the role of technology in the development of selected countries outside the United States.

Soc. 444-3. Social Stratification. Status, social mobility, and class in selected societies; elites and leadership problems. Adams, Endo, Pearson.

Soc. 445-3. Public Opinion and Popular Culture. Studies of voting, opinion formation, mass communications, and popular taste. Democratic theory and the logic of collective action in modern mass societies. McPhee, Wanderer.

Soc. 446-3. Persons in Society. The self in society—socialization, presentation of self and identity, social types, and roles and careers in historical situations. Persons in theories of social organization and action. Hanson.

Soc. 448-3. Research in Radical Sociology. An attempt to apply Paulo Freire's pedagogical principles in a university setting. Teams of student researchers will conduct in-depth investigations of two or

three problems selected by the class, after consideration of possible radical topics such as those introduced in Soc. 307. Prer., Soc. 307 or graduate status and permission of the instructor. Hanson, Mayer.

Soc. 449-3. Social Control. Informal and formal regulative processes in social behavior, with reference to techniques and processes of social control, such as propaganda, the political order, and other institutions. Hanson, Hunter, Pearson.

Soc. 450-3. Social Problems: Advanced Analysis. Advanced sociological analysis of persistent social problems, such as poverty, discrimination, and social and political alienation; and of problems of the life cycle, such as those associated with adolescence, marriage and parenthood, and old age. Emphasis upon the application of sociological theory to the analysis of these problems and to the development of techniques and programs for intervention and control. Open only to senior sociology majors or by consent of instructor. Mercer.

Soc. 451-3. Social Institutions. Organized system of practices and social roles developed about values. Machinery evolved to regulate the practices and behavior—family, church, government, economy, recreation, education. Adams.

Soc. 452-3. Collective Behavior. Social, cultural, and psychological factors affecting behavior in crisis situations. Data from small groups research as well as from other psychological and sociological traditions are explored to develop a theory of perception and response to threatening stimuli. Different types of social deprivation and resultant mass movements are investigated. Downton, Pinto.

Soc. 453-3 or 5. Social Change. The process of change in Western society and its effects on the individual, the family, and economic and political institutions. Attention is given to extremist response to tensions produced by rapid social change in America. An historical analysis of the causes of Western development serves as a context in which to study the factors aiding and impeding the modernization of the emerging nations. Boulding, Hunter, Pinto.

Soc. 455-3 or 5. Sociology of the Family. The family as a social institution. Historical development and contemporary cross-cultural analysis with emphasis on the contemporary American family. Boulding, Mercer.

Soc. 456/556-3. Family and Society. It is the aim of this course to examine, from a sociological and historical perspective, the relationship between family structure and economic structure. Contemporary attempts at changing the family will be studied in the context of the economic, political, legal, and ideological basis of the family. Gimenez.

Soc. 457-3. Historical American Social Movements. An examination of historical social movements in America; Know-nothingism, Labor, Abolitionism, Populist-Progressive movements are included. Consideration is given to the role of violence in these movements and its historical consequences. Pinto.

Soc. 458-3. Contemporary American Social Movements. An examination of contemporary social movements and the bases of cleavage and conflict in contemporary America. Radical Right and New Left, civil rights, and student activism are studied in the light of contemporary social facts and their historical roots. Prer., Soc. 457. Pinto.

Soc. 459/559-3. Sociology of Global Systems. General systems analysis applied to global social systems, with emphasis on non-governmental systems and transnational networks. Work with international data bank in developing system descriptors and alternative models of world society. Field work on Boulder as a community of transnational actors. Boulding.

Soc. 460-3. The Chicano Community and Community Organization. Examination of the origin of the terms "community" and "barrio." A comparative analysis of the internal barrio structure and the larger society-community organization and community development—positive and negative role models/leaders—methods and techniques of community organization as related to La Raza. The emphasis will be placed on decentralizing of services, institutional change, innovative approaches, etc. Rivera.

Soc. 461-3. Sociology of Religion. Social origin of religion. Religious factor in culture. Significance of religion as social control in contemporary society. Religion as an institution and its relation to other institutions. Adams, Boulding, Pinto.

Soc. 462-3. The New Chicano Movement. (Ch.St. 462.) The conservative and liberal attitudes and developments, both social and political, of the Mexican American. Rivera.

Soc. 465-3. Religion in American Society. Social, cultural, and historical foundations of American religious belief and the organization of the church. Relation of religious belief to other institutions, e.g., economy, politics. Analysis of contemporary social movements in the United States which are either explicitly religious or have a strong religious quality.

Soc. 466-3. Social Psychology. A basic course in social psychology viewed from a sociological perspective. Nielsen.

Soc. 467-3. Sociology of Education. Analysis of the school as a social organization. Among the topics considered are power and control in the school; classroom organization and procedures and their relation to learning and personality development in children; roles of educators; and reciprocal relations of school and community. Mercer.

Soc. 468/568-3. Sociology of Science. Science as a social institution; social factors in the development of science; the social organization of science; social processes in scientific discovery. The place of science in modern society and the social responsibilities of science. Bynder.

Soc. 469-3. The Art of Leadership. An exploration of the nature of leadership and mythology, symbolic aspects of leadership, and the nature of charisma. Downton.

Soc. 471-3. Political Sociology. Analysis of the political order by means of specific sociological theory and method to relate power to social contexts, structural forms, and behavioral patterns. Downton, Higman, Pinto.

Soc. 472/572-5. War. Evolution of war through animal, primitive, historical, and modern times from the points of view of drives, techniques, functions, and theories of war. Causes and control of war today. Higman.

Soc. 473/573-3. Formal Theories of Conflict. The logic of bargaining, negotiation, conflict, and war. Formulations such as those of Richardson, Boulding, and the game theorists. Empirical research examples drawn from the fields of small groups, politics, and international relations. Bartos, Mayer.

Soc. 475-3. Sociological Analysis of Revolution. A comparative analysis of major revolutions with emphasis on causation, revolutionary process, and long-term consequences. Attention is given to social stratification, political organization, economic processes, ideological systems, and international relations. Mayer.

Soc. 476/582-3. Conflict Management in Social and International Systems. A review of the more promising theoretical and technical approaches to facilitating nonviolent and creative outcomes from social conflict. Assuming the potential creativity of the conflict process, the course formulates a set of propositions for creative management applicable at different levels of conflict. Primary attention is given to neutral third-party intervention, negotiation and bargaining, and techniques of self-limiting nonviolent confrontation such as Gandhian satyagraha and nonviolent resistance to foreign occupation. Wehr.

Soc. 478/578-3. Sociology of Work Organization. A sociological description and analysis of the organization of work in contemporary industrial society. Focal points include the social inputs to work, the allocation of work, work and the non-work world, and the future organization of work.

Soc. 479-3. Large-Scale Organization. Analysis of sociological theories of bureaucracy and inquiry into bureaucratic developments in governmental, industrial, military, and welfare institutions. Bynder, Hunter.

Soc. 480/580-3. Poverty and Health. Analysis of the interrelationships between poverty and health status especially in the United States. A critical examination of social institutions affecting accessibility and utilization of health services for the poor and non-poor with particular emphasis on research issues and on strategies for intervention.

Soc. 481/581-3. Family Planning and Population Control: Social and Policy Issues. Effects of social factors on the development and implementation of population policies in various societies. Values and assumptions underlying such concepts as "free choice on family planning," "birth control," and "population control." Impact of various population policies on societal goals and also on the autonomy of the individuals and families comprising the society.

- Soc. 482-3 or 5. Sociology of Peacemaking.** An analysis of the enabling institutions of war and of emerging forces countering them, such as transnational networks, nonviolent national defense strategies, and such collective behavior as peace movements. Wehr.
- Soc. 483/583-3. Advanced Population Studies I.** Sociological causes and consequences of different levels of fertility, mortality, and population growth. Course emphasizes methods, theory, and policy.
- Soc. 484/584-3. Advanced Population Studies II.** Sociological causes and consequences of migration, assimilation, urbanization, and population distribution. Study of population planning and forecasting models and demographic components of environmental impact statements.
- Soc. 485-3. Research on Asian American Communities.** *Fall.* A basic and intensive introduction to techniques of data gathering and analysis done in conjunction with participation in on-going research projects on Asian American communities. Prer., consent of instructor. Endo.
- Soc. 486-3. Sociology of Aging.** The role of the aged in today's society; relationships of the aged to his family and community; problems in retirement and leisure; the economics and politics of aging; problems in the health of the aged; and prospects for the aged in tomorrow's society. Bynder.
- Soc. 487-3. Research on Asian American Communities.** *Spring.* A basic and intensive introduction to techniques of data gathering and analysis done in conjunction with participation in on-going research projects on Asian American communities. Prer., consent of instructor. Endo.
- Soc. 488-3. Society and Medicine.** Sociocultural factors in health and illness. The doctor-patient relationship. Medical education as a social process. The hospital as a social institution. Social organization of medical services. Sociology of mental illness. Bynder.
- Soc. 489-4. Sociology of Mental Health.** History of mental health in America. Mental illnesses and social class. Communication and value systems bearing on mental health. The mental hospital as a small society. The "therapeutic community" and other new developments in social therapy. The structure of mental health services in America. Prer., Soc. 111 or consent of instructor. Pearson.
- Soc. 490-3. Senior Seminar.** A seminar provided for senior sociology majors (only) in which important concepts, issues, and problems in sociology are considered. Considerable responsibility is placed upon the student to participate in the determination of the topics and materials in the course. Adams.
- Soc. 491/591-3. Statistics Through Computers.** Introduction to basic statistical concepts and methods such as correlational and regression analysis. The student will learn how to use a computer in applying these methods to specific research problems. Bartos.
- Soc. 492/552-3. Cooperatives and Communes.** Field studies and historical and contemporary readings on cooperative communities, consumer and worker-owned businesses, communal farms, extended urban families, spiritual retreats, therapeutic communities, etc. Boulding, McPhee, Pinto.
- Soc. 493-3. Social Issues in Health and Medicine.** A discussion of current issues of concern to society in health and medicine. The following topics will be discussed in terms of their impact on society and on the individual: alcoholism, abortion, organ transplants, drug abuse, genetic engineering, health care delivery systems. Bynder.
- Soc. 495-4. Criminology.** Nature and causes of crime as a social phenomenon. The processes of making laws, breaking laws, and reaction toward the breaking of laws. Cultural significance of the processes of determining the reactions of the community to offenders of the law. Templeton.
- Soc. 496-3 to 5. Juvenile Delinquency.** Factors involved in delinquent behavior. Problems of adjustment of delinquents, and factors in treatment and in post-treatment adjustment. Elliott, Templeton.
- Soc. 497-3 or 4. Treatment of Offenders.** Four hours credit if field experience is elected. Principles of treatment of offenders; application of social science principles to treatment of offenders; attitude formation and change; group dynamics; interviewing; guidance and counseling; social re-education. Prer., Soc. 495 or 496, or consent of instructor. Templeton.
- Soc. 499-variable credit. Independent Study in Sociology.** Consent of instructor is required.
- Soc. 501-variable credit. Guided Readings in Sociology.** Prer., consent of a staff member.
- Soc. 504-variable credit. Seminar: Sociology of Sex Roles.** Advanced and detailed analysis of sex roles in present and past societies. Sex stratification—its causes, consequences, and measurement. Theoretical perspectives on sex role differentiation and stratification by various social and biological scientists. Emphasis on empirical studies of sex differences in socialization, personality, institutions, and culture. Nielsen.
- Soc. 505, 506-variable credit. Proseminar: Sociology.** Systematic review of theory, method, and subject matter in sociology. Higman, Mercer, Wanderer.
- Soc. 507-variable credit. Seminar: Research Methods I.** Problems and procedures of research design and data processing in social research. Topics covered include role of theory in research, concept formation, design of proof and hypothesis testing, schedule construction, sampling, interviewing, scaling techniques, analysis procedure, and report preparation. Pearson.
- Soc. 508-variable credit. Seminar: Research Methods II.** A second-semester seminar devoted to practical applications of research methods and statistical techniques that provides the student with experience in a wide variety of research settings. Prer., Soc. 507. Wanderer.
- Soc. 509-variable credit. Research Practicum.** Practical experience in application of principles of research design and data processing to a social research problem selected by the instructor. Hanson, Wanderer.
- Soc. 510-variable credit. Seminar: Assessment Research.** The seminar will be concerned with methods of assessing the effectiveness of action programs conducted in various institutional sectors of the community. Basic principles of research design, measurement, and administration in the behavioral sciences will be applied to the situations likely to be encountered when social research is conducted in an action setting. Extensive case material will be utilized.
- Soc. 513-variable credit. Structural Models and Causal Inferences.** Course focuses on the formalization of verbal theories into mathematical models. The estimation of linear and nonlinear recursive and nonrecursive structural models of social theories will be emphasized. Bartos.
- Soc. 514-3. Seminar: Intergroup Relations.** An analysis of intergroup relations (race relations) in self-analytic small groups. Emphasis on phases of group development, subgroup formation, roles, conflict and conflict resolution and an application of methodologies to study racial behavior in groups. Rivera.
- Soc. 515-variable credit. Seminar: Social Theory.** Adams, Hanson, Higman, Mercer.
- Soc. 516-variable credit. Seminar: Social Theory.** Adams, Hanson, Higman, Mercer.
- Soc. 518-3. Seminar: Secondary Analysis.** A research oriented seminar stressing the utilization of social data already collected in the test or generation of sociological theory. Prer., statistics and two semesters of methods. Wanderer.
- Soc. 519-variable credit. Seminar: Deviant Behavior.** Examination of current theory and research on deviant behavior with emphasis on the relationship between deviance and patterns of social exclusion. Templeton.
- Soc. 523-3. Models of Social Processes I.** Logical models of individual and small-group behavior, such as learning, attitude formation, social interaction, and the organization of groups. Uses logic, finite algebras, and probability. McPhee.
- Soc. 524-3. Formal Theories of Population and Stratification.** Considers mathematical theories of population growth, fertility, social hierarchy, and occupational mobility. Attention is given to stationary population models, birth and death processes, marriage models, algebraic dominance structures, and Markovian mobility models. Mayer.
- Soc. 526-variable credit. Seminar: Urban Sociology.** Intensive examination of the social and cultural organization of the urban complex. History, contemporary growth, and future of the city are major perspectives; cross-cultural aspects of urban development also are emphasized. Endo.

Soc. 527-3. Models of Social Structure. Social structure as represented by networks of interrelated components. Application of the mathematical theory of finite graphs to the study of such networks.

Soc. 528-3. Models of Social Processes II. Mathematical models of large-scale social processes, including population, stratification, organization, and political and ecological systems. Uses differential equations, linear algebra, and probability. Mayer, McPhee.

Soc. 529-3. Models of Social Processes III. Computer models simulating complex human behavior, as in thinking, problem solving, social interaction, and organizational behavior. Required programming, with emphasis on learning simulation languages. McPhee.

Soc. 530-3. Experiments in Simulation and Gaming. Actual experience in exploring one or more computer simulation models and/or participation as a player in one or more social theory teaching games forms the basis for developing individual or small-group projects to construct new or modified simulation and gaming models. Bartos, Hanson.

Soc. 531-variable credit. Seminar: Societies and Cultures. Studies and theories of social and cultural organizations of large populations. Historical and experimental analyses of culture. Attention directed especially to treatment of knowledge as culture. Rose.

Soc. 532-variable credit. Seminar: Sociology of Ideas. Social existential bases of human mental products; critical analysis of theories and methods employed in the field.

Soc. 534-variable credit. Community Adaptation to Environmental Hazards. Sociological analysis of community planning for an adaptation to environmental hazards such as storms, earthquakes, atmospheric and water pollution. Cross-cultural comparisons. Consideration of selected theoretical and research issues.

Soc. 535-variable credit. Practicum in Sociolinguistics. Approaches through language to the study of society and culture. The examination and appraisal of languages and of language production as records and expressions of social facts. Field projects and documentary and laboratory investigations of language related to social and cultural formations. Sociological treatments of texts, accounts, and conversations. Open to advanced undergraduates with consent of the instructor.

Soc. 538-3. Natural Hazards Research. Methods of assessing natural hazards and human adjustment to hazard. Appraisal of alternative social responses and of public policies.

Soc. 540-3. Seminar: Small Group Processes. Empirical and theoretical analysis of basic forms of social interaction, including such processes as attraction, conformity, cooperation, competition, social exchange, etc. Emphasis on, but not limited to, small groups research. Some attention to relevant methodological issues. Nielsen.

Soc. 546-variable credit. Research for Social Change and Policy Planning. The course will explore a framework for the design and translation of research into legislation and social policy, in the context of current and earlier work in advocacy and public interest research, policy research, and environmental planning. Auger.

Soc. 547-3. Seminar: Social Psychology of Sex Differences. Examination of social psychological theories of sex differences in personality and behavior. The relation between these theories and sex stratification is stressed. Psychobiological and learning theories are considered in detail, and role-oriented vs. personality-oriented theories are contrasted. Empirical research on sex differences, stereotypes, and social interaction between sexes are examined. Nielsen.

Soc. 553-3. Field Experience in Sociology. Required of all Ph.D. candidates in sociology who do not present Soc. 687 and Soc. 688. Provides systematic, supervised field experience in approved social settings, generally in an urban community. Each student will plan his field program with the professor in charge. Discussion and evaluation seminars will meet weekly.

Soc. 554-3. Field Experience in Sociology. Continuation of Soc. 553.

Soc. 555-variable credit. Seminar: The Family. Recent trends in research and theory with emphasis on the American family. Mercer.

Soc. 561-variable credit. Seminar: Sociology of Religion. Comparative analysis of religion as a social institution. Templeton.

Soc. 563-variable credit. Seminar: Sociology of the Chicano. A sociological perspective on Chicanos which explores the social science literature written by Anglos and Chicanos. The literature is critically evaluated and current Chicano thought is considered as an alternative to Anglo social science writings on the subject. Rivera.

Soc. 565-variable credit. Language and Knowledge. A practicum for student-conducted field projects involving all the sequential steps from collection of original data through its analysis and evaluation. Perspectives from the sociology of knowledge and science are united with those from the sociology of language. Kjolseth.

Soc. 567-3. Seminar: Sociology of Education. Analysis of selected topics in education from a sociological perspective. Mercer.

Soc. 569-3. The Politics of Social Research. Starts with the assumption that all social research is executed in a political environment. Its primary task then is to identify, describe, and discuss the significance of those parameters which define that environment. Prer., Soc. 507, its equivalent, or permission of the instructor. King.

Soc. 574-variable credit. Multidisciplinary Approaches to Peace. Approaches to conflict resolution and peace with special emphasis on the international system, drawing on the following behaviorally oriented disciplines: economics, political science, sociology, philosophy, psychology, history, communications, and geography. Boulding.

Soc. 575-variable credit. Seminar: Revolutionary Change. Examination of the distinctive properties of revolution, the structural determinants of revolution, revolutionary leadership, revolutionary organization and ideology, structural and psychological aspects of violence, the functions of violence, revolutionary strategies, restoration in the post-revolutionary setting. Downton.

Soc. 576-5. Modern Marxist Social Theory. An exposition and analysis of recent Marxist social thought. Consideration is given to modern Marxist theories of class structure, political economy, alienation, culture, and the state. The work of Althusser, Dobb, Gramsci, Lukacs, Mandel, and Marcuse are considered. Mayer.

Soc. 577-variable credit. Seminar: Sociological Analysis of Organizations. Analysis of theoretical and research issues in the study of organizations of all types. Systematic review of literature. Research paper required.

Soc. 586-variable credit. Seminar: Comparative Race and Ethnic Relations. A rigorous examination of macrolevel theory in race-ethnic relations and its applicability both to race-ethnic relations case studies drawn from a number of societies and to the general topics of ethnic communities, protest and change, assimilation, prejudice-discrimination, and contemporary social policies. Endo.

Soc. 587-3. Seminar: Sociology of Aging. An in-depth review of the theoretical and conceptual foundations of the sociology of aging, as well as a detailed review of the relevant literature. Development and presentation of student projects. Bynder.

Soc. 588-variable credit. Seminar: Social Research in Health and Medicine. Social and cultural aspects of public health and mental illness. Bynder.

Soc. 589-variable credit. Seminar: Sociology of Mental Health. Research and methods in sociological study of mental health organizations and professions as well as the community setting of mental health problems. Opportunity for guided research work in mental institutions and agencies. Adams, Bynder.

Soc. 590-variable credit. Seminar: Correctional Institutions. Nature and history of punishment; punishment vs. treatment of offenders; detention facilities, jails, reformatories, prisons; dynamics of institutional living, inmate society; organization and administration; personnel; classification; custody and discipline; programs and activities.

Soc. 593-3. Normative Models. Analysis of theories that prescribe proper (rational) behavior. Theory of games, ranging from two-person zero-sum games to n-person meta-games. Application to resolution of social conflicts. Bartos.

Soc. 594-variable credit. Seminar: Law of Delinquency and Corrections. Analysis of legal procedures encountered by juvenile and adult offenders, and the effect of these procedures upon rehabilitation goals.

Soc. 595-variable credit. Seminar: Criminology. Theories of causation of crime as a social phenomenon; theories of punishment and disposition of cases.

Soc. 599-variable credit. Seminar: Prevention and Control of Delinquency and Crime. Policies and programs that have been proposed or tried for prevention and control of delinquency and crime and theories underlying such programs. Examination and evaluation of specific programs. Principles involved in prevention and control.

Soc. 603-variable credit. Guided Research in Sociology. Consent of a staff member required.

Soc. 608-3. Seminar: Ideology and Class Structure. Aim is to study in depth the concepts of class structure, class consciousness, consciousness and ideology as developed within classic and modern Marxist theory. Gimenez.

Soc. 609-3. Research Practicum in Mathematical Sociology I. Individual research projects on current topics of interest to mathematical sociology students and faculty. Bartos, Hanson, Mayer, and McPhee.

Soc. 610-3. Research Practicum in Mathematical Sociology II. Individual research projects on current topics of interest to mathematical sociology students and faculty. Bartos, Hanson, Mayer, and McPhee.

Soc. 611-3. Advanced Statistical Analysis. Principles of multivariate statistical analysis such as path analysis and factor analysis. Application to sets of available data through various computer programs. Bartos.

Soc. 615-variable credit. Seminar: Social Theory. Adams, Hanson, Higman, Mercer.

Soc. 616-3. Seminar: Theory Construction. Analysis of the components of alternative explanatory paradigms in use in social science precedes the development of individual projects designed to integrate a body of findings in a particular content area into a middle range theory. Adams, Hanson, Higman, Mercer.

Soc. 621-variable credit. Seminar: Demography and Ecology. Demographic analyses of selected populations; studies of geographical distributions of populations. Special emphasis on the relationship between demographic structures and the social utilization of selected areas.

Soc. 626-3. Environmental and Social Planning. Focuses on qualitative and quantitative techniques for environmental and social planning. A conceptual framework is explored for the purpose of integrating common elements in different areas of planning. The process of planning with policy formulation is examined in both governmental and corporate settings, with emphasis on planning for social change and innovation. Prer., Soc. 507, 508, or permission of instructor. Auger, Hunter.

Soc. 640-variable credit. Seminar: Social Psychology. Sociological approaches in the study of the self, role theory, persons in situations, identifications, socialization, and other characteristics of persons in society. Studies of group processes bearing upon personality processes. Nielsen.

Soc. 651-variable credit. Seminar: Social Institutions. A review of studies of sociological organization involved in the great institutional activities of man. Interest will be concentrated on particular institutions such as politics, economics, religion, education, and the interrelations between these institutions. Adams.

Soc. 663-3. Advanced Theory and Methods. Synthesis of sociological theory and research with basic statistical methods. Application of matrix algebra and computer technology to theory construction and interpretation of correlational studies. Bartos.

Soc. 667-3. Comparative Methodology. Comparative and critical review of basic research methods and strategies used by sociologists, including survey, experimentation, field observation, and historical methods. Emphasis is on the total research process and how the various stages (problem formulation, design, sampling, measurement, and analysis) fit together. Nielsen.

Soc. 687-3. Field Experience in the Sociology of Medicine. Provides systematic, supervised contact with practitioners and programs in five broad areas of health and medical activity: medical and para-medical education and training; medical care; psychiatric care; public health, and voluntary health organizations. Bynder.

Soc. 688-3. Field Experience in the Sociology of Medicine. Continuation of Soc. 687. Bynder.

Soc. 689-variable credit. Seminar in Joint Problems of Psychiatry and Sociology. Research approaches in psychiatry and

clinical psychology are compared with sociological research in the fields of sociology of medicine and mental health. Emphasis on theoretical outlooks of the several disciplines and on criticism that may be made by psychiatrists and psychologists of sociological approaches to mental health. One of several psychiatrists or clinical psychologists will be invited to participate in this program in cooperation with members of the sociology staff. Adams, Pearson.

Soc. 700-4. Master's Thesis.

Soc. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

SPANISH AND PORTUGUESE

Spanish

Span. 101-5. Beginning Spanish. *Fall, Spring.*

Span. 102-5. Beginning Spanish. *Fall, Spring.* Prer., Span. 101 or placement.

Span. 105-5. Beginning Spanish Review. *Fall, Spring.* Prer., two years high school Spanish or equivalent placement. A review of Spanish for students with two years high school Spanish who are not ready to continue in Span. 211. Not a third-semester course. Not open to students with credit in Span. 102.

Span. 199-1 to 3. Independent Study.

Span. 211-3. Second-Year Spanish. *Fall, Spring.* Prer., Span. 102 or 105 or placement.

Span. 212-3. Second-Year Spanish. *Fall, Spring.* Prer., Span. 211 or placement.

Span. 301-3. Pronunciation, Diction, and Conversation. *Fall.* Prer., Span. 212, 211 (with grade A or B), or equivalent.

Span. 302-3. Conversation and Oral Composition. Prer., Span. 301 or equivalent.

Span. 303-3. Professional Spanish for Business I. *Fall.* Prer., Span. 301, 302.

Span. 304-3. Professional Spanish for Business II. *Spring.* Prer., Span. 303.

Span. 305-3. Spanish Linguistics. *Fall.* Prer., Span. 212, 211 (with grade A or B) or equivalent.

Span. 315-3. Romance Literature in English Translation I. (Fr. 315, Ital. 315, Port. 315.) *Fall.* An interdepartmental course treating the major literary figures of Spanish, French, Italian, and Portuguese literature from the Middle Ages through the 18th century. (Does not count toward Spanish major.)

Span. 316-3. Romance Literature in English Translation II. (Fr. 316, Ital. 316, Port. 316.) *Spring.* An interdepartmental course treating the major literary figures of Spanish, French, Italian, and Portuguese literature of the 19th and 20th centuries. (Does not count toward Spanish major.)

Span. 331-3. Twentieth-Century Spanish Literature. *Fall, Spring.* Prer., Span. 212 or equivalent.

Span. 332-3. Nineteenth-Century Spanish Literature. *Fall, Spring.* Prer., Span. 212 or equivalent.

Span. 333-3. Spanish Literature: Middle Ages Through Golden Age. *Fall.* Prer., 3 hours literature at 300 level.

Span. 334-3. Twentieth-Century Spanish-American Novel and Essay. *Fall, Spring.* Prer., Span. 212 or equivalent.

Span. 335-3. Spanish-American Novel and Essay to 20th Century. *Fall, Spring.* Prer., Span. 212 or equivalent.

Span. 336-3. Spanish-American Poetry and Short Story. *Spring.* Prer., 3 hours literature at 300 level.

Span. 400/500-3. Mexican American Culture of the Southwest. *Spring.* (Ch.St. 400.) (Does not count toward Spanish major.)

Span. 401/501-2. Advanced Rhetoric and Composition I. *Fall.* Prer., Span. 302.

Span. 402/502-2. Advanced Rhetoric and Composition II. *Spring.* Prer., Span. 401.

Span. 403-1. Conversation Laboratory. *Fall.* Open only to students registered concurrently in Span. 401. Advanced conversation practice course. Prer., Span. 302.

Span. 404-1. Conversation Laboratory. *Spring.* Open only to students registered concurrently in Span. 402. Advanced conversation practice course. Prer., Span. 403.

Span. 405/505-3. Structure of Modern Spanish. *Spring.*

Span. 406-3. Problems of Business Translation in Spanish I. *Fall.* Prer., Span. 304 or equivalent.
Span. 407-3. Problems of Business Translation in Spanish II. *Spring.* Prer., Span. 406 or equivalent.
Span. 408/508-3. Spanish in Multilingual Societies. *Spring.* Prer., Span. 305 or consultation.

All 400-level literature courses have as a prerequisite 6 credits of literature at a lower level.

Span. 411/511-3. Women in Spanish Literature. *Fall.*
Span. 412/512-3. Women in Spanish American Literature. *Spring.*
Span. 415/515-3. Masterpieces of Spanish Literature. *Fall.*
Span. 416/516-3. Masterpieces of Spanish-American Literature. *Spring.*
Span. 420/520-3. Hispanic Culture. (Ch.St. 420.)
Span. 421/521-3. Mexican American Folklore of the Southwest. (Ch.St. 411.)
Span. 422/522-3. Mexican Literature.
Span. 425/525-3. Literature of Argentina, Uruguay, and Paraguay.
Span. 430/530-3. Generation of 1898.
Span. 431/531-3. Spanish-American Literature: Independence Through Romanticism.
Span. 440/540-3. Romanticism in Spain.
Span. 441/541-3. Modernism.
Span. 450/550-3. Nineteenth-Century Spanish Novel.
Span. 451/551-3. Contemporary Spanish-American Novel.
Span. 452/552-3. Golden Age Drama.
Span. 453/553-3. Golden Age Prose.
Span. 462/562-3. Don Quixote.
Span. 464/564-3. International Literary Relations. (C.Lit. 464/564.) *Fall.*
Span. 491-3. Spanish Theatre Workshop. *Fall.*
Span. 492-3. Spanish Theatre Workshop. *Spring.*
Span. 493-1 to 4. Languages Internship for Professions. *Fall, Spring.* Enrollment only with instructor's consent.
Span. 495/595-3. Methods of Teaching Spanish. *Fall, Spring.*
Span. 499/599-1 to 3. Independent Study.
Span. 532-3. Spanish Literature Since the Spanish Civil War. (Denver Campus only.)
Span. 540-3. Romanticism in Spain.
Span. 556-2. Spanish-American Theatre.
Span. 559-2. Twentieth-Century Spanish Drama.
Span. 591-3. Testing Foreign and Second Language Skills.
Span. 593-3. Computer Applications in the Humanities. (Engl. 591.)
Span. 594-3. Teaching Culture in the Foreign/Second Language Classroom.
Span. 595-3. Methods of Teaching Spanish.
Span. 596-2. Educational Media in the Foreign Language Classroom.
Span. 597-2. College Foreign Language Teaching. Open only to teaching assistants/instructors.
Span. 605-3. Spanish Phonology.
Span. 606-3. Spanish Syntax.
Span. 610-3. History of the Spanish Language.
Span. 611-3. Seminar in Hispanic Literature I.
Span. 612-3. Seminar in Hispanic Literature II.
Span. 614-3. Spanish Literature of the Middle Ages.
Span. 617-3. Seminar: Literary Criticism.
Span. 631-2. Nineteenth-Century Novel in Spain.
Span. 632-2. Spanish Drama Before Lope de Vega.
Span. 633-3. Golden Age Drama.
Span. 635-3. The Spanish-American Novel and Short Story to World War II.
Span. 636-3. The Spanish-American Novel and Short Story from World War II to the Present.
Span. 637-2. Spanish-American Literature of the Colonial and Independence Periods.
Span. 644-2. Spanish Mysticism.

Span. 645-2. Spanish Literature of the 18th Century.
Span. 650-3. Spanish-American Poetry From Modernism to the Present.
Span. 651-3. Nineteenth-Century Drama in Spain.
Span. 652-2. Romances.
Span. 653-3. Seminar: Spanish Peninsular Poetry.
Span. 654-3. Picaresque Novel.
Span. 655-3. Spanish Contemporary Novel.
Span. 657-2. Spanish Essay.
Span. 663-2. Spanish-American Essay.
Span. 674-2. Cervantes.
Span. 677-2. Unamuno and Ortega y Gasset: Two Epochs in Contemporary Spanish Thought.
Span. 691-3. Seminar: Hispanic Linguistics.
Span. 695-3. Seminar: Language and Language Learning.
Span. 699-1 to 3. Independent Study.
Span. 700-4. Master's Thesis.
Span. 705-3. Spanish Historical Grammar.
Span. 712-2. Seminar: Major Figures of Spanish-American Literature.
Span. 713-2. Seminar: Major Figures in Spanish Peninsular Literature.
Span. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Portuguese

Port. 101-5. Beginning Portuguese. *Fall.*
Port. 102-5. Beginning Portuguese. *Spring.* Prer., Port. 101.
Port. 211-3. Second-Year Portuguese Reading and Conversation. *Fall.* Prer., Port. 102 or its equivalent in proficiency.
Port. 212-3. Second-Year Portuguese Reading and Conversation. *Spring.* Prer., Port. 211 or its equivalent in proficiency.
Port. 311-3. Main Currents of Portuguese Literature and Civilization. *Fall.* Prer., Port. 212 or consultation.
Port. 312-3. Main Currents of Brazilian Literature and Civilization. *Spring.* Prer., Port. 212 or consultation.
Port. 315-3. Romance Literature in English Translation I. (Fr. 315, Ital. 315, Span. 315.) *Fall.* An interdepartmental course treating the major literary figures of Spanish, French, Italian, and Portuguese literature from the Middle Ages through the 18th century.
Port. 316-3. Romance Literature in English Translation II. (Fr. 316, Ital. 316, Span. 316.) *Spring.* An interdepartmental course treating the major literary figures of Spanish, French, Italian, and Portuguese literature of the 19th and 20th centuries.
Port. 403/503-3. Introduction to Luso-Brazilian Civilization. *Fall.* Intensive language and composition. Prer., two years of any other romance language.
Port. 404/504-3. Introduction to Luso-Brazilian Civilization. *Spring.* Intensive language and composition. Prer., Port. 403 or equivalent.
Port. 411/511-3. Survey of Brazilian Literature I. *Fall.* Prer., Port. 212 or consultation.
Port. 412/512-3. Survey of Brazilian Literature II. *Spring.* Prer., Port. 212 or consultation.
Port. 415/515-3. Survey of Portuguese Literature I. *Fall.* Prer., Port. 212 or consultation.
Port. 416/516-3. Survey of Portuguese Literature II. *Spring.* Prer., Port. 212 or consultation.
Port. 451/551-3. Contemporary Brazilian Prose Fiction I. *Fall.* Prer., Port. 212 or consultation.
Port. 452/552-3. Contemporary Brazilian Prose Fiction II. *Spring.* Prer., Port. 212 or consultation.
Port. 499-1 to 3. Independent Study.
Port. 599-1 to 3. Independent Study.

THEATRE AND DANCE

General Theatre and Dance

Th.Dn. 601-3. Introduction to Graduate Work in Theatre and Dance. Required of all departmental graduate students.

Theatre

- Thtr. 111-3. Introduction to Drama.** (Engl. 130.) Reading and analysis of plays.
- Thtr. 270-3. Introduction to Theatre.** (Engl. 230.) Survey of theatre forms past and present, the development of the physical theatre, and staging techniques throughout the ages; readings, lectures, demonstrations.
- Thtr. 273-3. Acting I.** Theory and practice to enable the student to develop his techniques and to utilize these techniques in acting. Emphasis is placed on developing an awareness of the use of the voice and body as a means of expression.
- Thtr. 276-3. Stagecraft.** Theory and practice. An introduction to stagecraft, including basic mechanical drawing, mechanics, lighting, and their application to the scenic arts.
- Thtr. 321-1 to 3. Practicum in Costuming.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 322-1 to 3. Practicum in Technical Theatre.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 323-1 to 3. Practicum in Theatre Management.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 324-1 to 3. Practicum in Acting.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 325-1 to 3. Practicum in Playwriting.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 326-1 to 3. Practicum in Directing.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits.
- Thtr. 327-1 to 3. Practicum in Theatrical Make-up.** Practical production projects within the designated area of theatre. Repeatable to a maximum of 8 credits. Not offered every year. See *Schedule of Courses*.
- Thtr. 373-3. Acting II.** Theory and practice to enable the student to develop his techniques and to utilize these techniques in acting. Formal and informal performance of scenes throughout the semester. Prer., instructor consent.
- Thtr. 376-3. Advanced Stagecraft.** Theory and practice. A continuation of beginning stagecraft with emphasis on special problems in stage rigging and the building of three-dimensional forms. Prer., Thtr. 276.
- Thtr. 377-3. Introduction to Costuming.** A brief outline of costume history as well as theory and practice in the design and construction of costumes for the stage.
- Thtr. 389-variable credit. Problems in Theatre.** Study in problem areas in the field of theatre. Work that is basically investigative in character. Prer., consent of supervising instructor.
- Thtr. 399-1 to 3. Independent Study.** Prer., written consent of instructor.
- Thtr. 421-1 to 3. Advanced Practicum in Costuming.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 422-1 to 3. Advanced Practicum in Technical Theatre.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 423-1 to 3. Advanced Practicum in Theatre Management.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 424-1 to 3. Advanced Practicum in Acting.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 425-1 to 3. Advanced Practicum in Playwriting.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 426-1 to 3. Advanced Practicum in Directing.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Theatre majors may repeat course to a maximum of 16 credits.
- Thtr. 427-1 to 3. Advanced Practicum in Make-up.** Advanced projects in production within the designated area of the theatre under close supervision of senior faculty. Not offered every year. See *Schedule of Courses*.
- Thtr. 432-2 to 4. Directing the Theatre Program.** Philosophy, principles, and practical applications; methods of directing theatre programs, junior high school through college.
- Thtr. 471-3. History of the Theatre I.** Study of theatres, methods of presentation, actors, and acting from primitive times to 1700, with some readings of plays to illustrate the points covered.
- Thtr. 472-3. The Theatre of Asia.** Survey of Asian theatre history, methods, content, and social function, with a special focus on India, China, and Japan. Prer., 6 hours of theatre or Asian studies.
- Thtr. 473-3. Acting III.** Research, analysis preparation, and performance of roles in period and modern drama, emphasizing theories and techniques of historical and presentational styles. Prer., Thtr. 373.
- Thtr. 474-3. Directing.** Theory and practice. Prer., Thtr. 373 or consent of instructor.
- Thtr. 475-3. Playwriting: The Short Form.** (Engl. 408.) Plays, radio, and television scripts. Prer., any course in drama or consent of instructor.
- Thtr. 476-3. Scene Design.** Prer., Thtr. 276 or consent of instructor.
- Thtr. 477/577-3. Costume Design and Construction.** Study and application of the principles of design as applied to stage costume with special emphasis on the drafting of patterns leading to construction of authentic, workable costumes. Prer., Thtr. 377.
- Thtr. 478-3. Drama Theory.** Examination of critical and theoretical ideas from Aristotle to the present day.
- Thtr. 481-3. History of the Theatre II.** Continuation of Thtr. 471. From 1700.
- Thtr. 482-3. History of Costume I.** A detailed study of the history of costume from the Egyptian and Asian civilizations to the European Renaissance, including fabrics, accessories of dress, and ornaments; influence of cultural factors; study of available collections.
- Thtr. 483-3 to 12. Touring Theatre Acting.** Participation in Colorado Caravan Touring Theatre program. Prer., consent of instructor.
- Thtr. 485-3. Playwriting: The Long Form.** (Engl. 409.) Full-length plays, etc. Prer., consent of instructor.
- Thtr. 486-3. Stage Lighting Design.** The study and practice of lighting and design with emphasis on the principles of electricity, optics, color theory, instrumentation, and their aesthetic application to the stage.
- Thtr. 487/587-3. History of Costume II.** Continuation of Thtr. 482. A detailed study of the history of costume from the Renaissance to contemporary times, including fabrics, accessories of dress, and ornaments; study of a selected group of regional costumes.
- Thtr. 489/589-1 to 4. Problems in Theatre.** Opportunity for students to explore, upon consultation with the instructor, areas in theatre which the normal sequence of offerings will not allow. Prer., consent of instructor.
- Thtr. 490-3. Methods of Teaching Theatre.** *Fall.* Curriculum, materials, methods, evaluation, and related aspects of instruction. Secondary level. Prer., 18 hours of theatre courses or consent of instructor.
- Thtr. 499-1 to 3. Independent Study.** Prer., written consent of instructor.
- Thtr. 572-3. Problems in Asian Theatre.** Survey of Asian theatre history, method, content, and social function with a special focus on India, China, and Japan. Prer., 6 hours of theatre or Asian studies. (Same as Thtr. 472 plus graduate paper.)
- Thtr. 573-3. Acting III.** Research, analysis preparation, and performance of roles in period and modern drama, emphasizing theories and techniques of historical and presentational styles. Prer., consent of instructor.
- Thtr. 574-3. Directing: Theory and Practice.** Advanced study of theory and practice of play direction; observation of plays in the University Theatre; direction of a one-act play and presentation before an invited audience under supervision of instructor. Prer., consent of instructor.

Thtr. 576-3. Scene Design. (Same as Thtr. 476 plus graduate project).

Thtr. 578-3. Seminar: Drama. Discussion and research in drama. Prer., consent of instructor.

Thtr. 579-1 to 2. Theatre Practice. Participation in University Theatre productions. Credit hours to be arranged by director of the theatre.

Thtr. 585-3. Problems in Playwriting. (Same as Thtr. 485 plus graduate paper.)

Thtr. 586-3. Stage Lighting Design. (Same as Thtr. 486 plus graduate paper.)

Thtr. 587-3. History of Costuming II. (Same as Thtr. 487 plus graduate project).

Thtr. 589-1 to 4. Problems in Theatre. Opportunity for students to explore, upon consultation with the instructor, areas in theatre which the normal sequence of offerings will not allow. Prer., consent of instructor.

Thtr. 599-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 603-3. Seminar: Theatre Aesthetics. Shared research into the relation of oriental and occidental aesthetics to theatre as an art form. Prer., undergraduate theatre major plus one course in aesthetics or consent of instructor.

Thtr. 670-2. Graduate Survey of Dramatic Literature. A reading survey of plays from the Greeks to the present day.

Thtr. 671-3. Seminar: Theatre History. Advanced study and research in depth in specialized areas of world theatre history.

Thtr. 672-3. Seminar: Asian Theatre. In-depth study and research on major theatre forms in Asian countries, with a specific focus on dramas and theatres of India, China, and Japan.

Thtr. 674-3. Directing the Long Play. Experience (theory and practice) in directing a long play. Play selection, study, casting, rehearsals, and performance in consultation with an instructor. Prer., consent of instructor.

Thtr. 678-3. Seminar in Contemporary Theatre. Research and study of the contemporary theatre, its impulses, achievements, and trends. Such areas as scholarship, theory and criticism, playwriting, production arrangements, staging methods, and social effect or importance may be considered.

Thtr. 679-3. Problems in Developmental Theatre. Opportunity for students to explore, upon consultation with instructor, areas in theatre and dance which the normal sequence of offerings will not allow. Prer., consent of instructor.

Thtr. 680-3. Developmental Theatre. The objectives and techniques of a developmental theatre program and its theoretical foundations. Prer., consent of instructor.

Thtr. 681-3. Scriptwriting for Developmental Theatre. Need analysis, material gathering, and creation of scripts for developmental theatre situations, with particular attention to age levels and social contexts. Prer., Thtr. 680 and enrollment in developmental theatre program.

Thtr. 684-2. Producing the Shakespearean Play. Special problems in presentation of Shakespeare's plays in the Elizabethan public-outdoor playhouse; nature and architectural derivation of the playhouse.

Thtr. 689-variable credit. Problems in Developmental Theatre. Opportunity for students to explore, upon consultation with the instructor, areas in developmental theatre which the normal sequence of offerings will not allow. Prer., consent of instructor.

Thtr. 699-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 700-1 to 4. Master's Thesis.

Thtr. 799-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 800-0 to 8. (16 to 24 maximum). Doctor's Thesis.

Interpretation

Intp. 250-3. Introduction to the Art of Oral Interpretation. Study and performance of the narrative and dramatic modes of literature.

Intp. 350-3. Oral Interpretation of Literature: Poetry. Exploration of poetry through analysis and performance.

Intp. 352-3. Voice. Intense concentration upon the understanding, training, and effective use of the vocal instrument.

Intp. 399-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 450/550-3. Advanced Oral Interpretation. Exploration of prose forms; theory and analysis of fiction and nonfiction. Development and presentation of individual and group programs.

Intp. 451/551-3. Advanced Oral Interpretation. Theory and analysis of poetry. Development and presentation of individual and group programs.

Intp. 452/552-3. Dramatic Interpretation: Tragedy. Theory of tragedy as basis for analysis, scripting, and performance of tragedies. Relation of Zeitgeists to dramatic styles. Focus upon selected periods and playwrights.

Intp. 453/553-3. Dramatic Interpretation: Comedy. Theory of comedy as a basis for analysis, scripting, and performance of comedies. Relation of Zeitgeists to dramatic styles. Focus upon selected periods and playwrights.

Intp. 479/579-1 to 4. Interpretation Practice. Project in interpretation under supervision of senior faculty.

Intp. 489/589-1 to 3. Problems in Interpretation. Opportunity for students to explore, upon consultation with the instructor, areas in interpretation which the normal sequence of offerings will not allow. Prer., consent of instructor.

Intp. 499-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 598-1 to 3. Recital-Interpretation.

Intp. 599-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 650-3. Background Studies for Oral Interpretation. History and aesthetics of oral interpretation from the Greeks to the present.

Intp. 651-1. Recital. Open only to students completing graduate degrees in the Department of Theatre and Dance at the University of Colorado. Preparation for the final recital.

Intp. 679-1 to 3. Problems in Interpretation. Opportunity for students to explore, upon consultation with the instructor, areas in interpretation which the normal sequence of offerings will not allow. Prer., consent of instructor.

Intp. 699-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 700-1 to 4. Master's Thesis.

Intp. 799-1 to 3. Independent Study. Prer., written consent of instructor.

Dance

Dnce. 183-2. Dance Techniques: Ballet. Open to dance majors and by consent of instructor.

Dnce. 184-2. Dance Techniques: Ballet. Open to dance majors and by consent of instructor.

Dnce. 185-2. Dance Techniques: Ballet. Open to dance majors and by consent of instructor. May be repeated to a maximum credit of 6 hours.

Dnce. 186-2. Dance Techniques: Ballet. Open to dance majors and by consent of instructor. May be repeated to a maximum credit of 6 hours.

Dnce. 193-2. Dance Techniques: Modern Dance. Fall. Open to dance majors and by consent of instructor.

Dnce. 194-2. Dance Techniques: Modern Dance. Spring. Open to dance majors and by consent of instructor.

Dnce. 195-2. Dance Techniques: Modern Dance. Fall. Open to dance majors and by consent of instructor. May be repeated to a maximum credit of 6 hours.

Dnce. 196-2. Dance Techniques: Modern Dance. Spring. Open to dance majors and by consent of instructor. May be repeated to a maximum credit of 6 hours.

Dnce. 197-1. Dance Techniques: Recreational Dance Forms. Open to dance, physical education, and recreation majors, and by consent of instructor.

Dnce. 200-3. Mexican History Through Dance.

Dnce. 214-2. Dance Improvisation. An opportunity for the student to explore movement problems resulting in an awareness of the self alone and in a group in various environments. An experience to sense dance improvisation as an authentic life experience and art form.

Dnce. 290-3. Beginning Dance Composition. An understanding of the basic elements of dance composition through beginning studies, evolved from readings, discussion, and improvisation.

Dnce. 314-3. Movement Analysis Practicum. Theories of movement. Analysis of contemporary dance techniques. Individual application; use of video tape. Prer., basic understanding of anatomy.

Dnce. 318-2. Readings in Mexican Dance Folklore.

Dnce. 320-3. Introduction to Dance Therapy. The use of movement experience as an adjunctive therapeutic technique in psychotherapy.

Dnce. 390-3. Intermediate Dance Composition. An opportunity for the student to increase knowledge and understanding of the elements of dance composition as they relate to group forms, theme, and development, and different performing spaces. Prer., Dnce. 290 or consent of instructor.

Dnce. 392-3. Musical Accompaniment for Dance. Reading and discussion of beginning music theory; selection of music for the dance concert. Experience in playing percussion accompaniment for modern dance technique and improvisation.

Dnce. 399-1 to 3. Independent study. Prer., written consent of instructor.

Dnce. 413/513-3. Children's Dance. Creative dance for primary school children. Observation and teaching in the primary grades.

Dnce. 415-3. Methods of Teaching. Exploration and evaluation of dance for the secondary school student. The understanding of the value of creative movement exploration for the development of the individual. Clarification of the role of the teacher and the role of the student in secondary school. Methods, materials, and activities used to contribute to the student's original expression. Prer., Dnce. 214, 290, 392, 314, and basic understanding of anatomy.

Dnce. 479-1 to 3. Dance Practicum. Project in dance under supervision of senior faculty.

Dnce. 490/590-3. Advanced Dance Composition. An in-depth approach to composition with an emphasis on personal invention, solo and group forms; increasing technical range; styles based on historical art forms; exploration of the evaluative process. An awareness of the cerebral, emotional and physiological centers culminating in performance experience. Prer., Dnce. 290, 390, or consent of instructor.

Dnce. 491/591-3. History and Philosophy of Dance. The history and philosophy of dance from primitive times to 1900.

Dnce. 493/593-2. Performance Events. A theoretical study and practical exploration of contemporary modes of performance ranging from the traditional dance concert and lecture demonstration format to the more experimental forms such as happenings, rituals, activities, body works, theatre pieces, environmental and mixed media events. Prer., upper classmen only.

Dnce. 494/594-3. History of Dance in the 20th Century. *Spring.*

Dnce. 495-2 to 4. Dance Repertory. Learning and performing dances from the repertory of current faculty members, artists-in-residence, and upon occasion from the repertory of historic modern dancers. Prer., admission through auditions.

Dnce. 497-2. Beginning Dance Notation. Not offered every year. Check current *Schedule of Courses*. Fundamentals of Labanotation; permits the beginner to record individual steps and arm patterns used in human movement.

Dnce. 499-1 to 3. Independent Study.

Dnce. 579-1 to 3. Dance Practice.

Dnce. 589-2. Problems in Dance.

Dnce. 594-3. History of Dance in the 20th Century. Development of modern dance from Isadora Duncan to the present through lectures, discussions, critical reviews, and films. (Same as Dnce. 494 plus graduate paper.)

Dnce. 595-2 to 4. Dance Repertory. Same as Dnce. 495 except graduate students will be required to keep a log of learning process involved in repertory to document and analyze each work in terms of stylistic differences, musical/sound accompaniment and trends.

Dnce. 597-2. Intermediate Dance Notation. Not offered each year. Check current *Schedule of Courses*. Prer., Dnce. 497 or consent of instructor.

Dnce. 598-1 to 3. Studio Concert. Prer., consent of instructor.

Dnce. 599-1 to 3. Independent Study. Prer., written consent of instructor.

Dnce. 600-3. Seminar: Dance. Intensive study of selected topics related to the art of dance, dance criticism, research in dance and dance in relationship to the other arts (performing and visual) with an emphasis on the avant-garde.

Dnce. 610-2. Problems in Dance Administration and Curriculum. Current problems in the administration of dance programs at the secondary and college levels. Curriculum development and trends in curriculum construction.

Dnce. 615-2. Problems in Organization and Administration of Performing Groups. Not offered each year. Check current *Schedule of Courses*.

Dnce. 620-2 to 4. Choreography. Advanced compositions choreographed and presented for public performance and criticism.

Dnce. 624-2. Readings in Dance. A survey of dance literature.

Dnce. 699-3. Independent Study. Prer., written consent of instructor.

Dnce. 700-4. Master's Thesis.

Non-Major Dance Courses

Not offered each year. Check current *Schedule of Courses*.

Dnce. 132-1. Beginning Ballet.

Dnce. 133-1. Intermediate Ballet.

Dnce. 134-1. Advanced Ballet.

Dnce. 135-1. International Folk Dance.

Dnce. 136-1. Intermediate International Folk Dance.

Dnce. 137-1. Advanced International Folk Dance.

Dnce. 138-1. International Folk Dance.

Dnce. 139-1. Jazz Dance.

Dnce. 140-1. International Folk Dance.

Dnce. 142-1. Beginning Modern Dance.

Dnce. 143-1. Intermediate Modern Dance.

Dnce. 144-1. Advanced Modern Dance.

WOMEN STUDIES

W.S. 200-3. Introduction to Women Studies. The nature and function of women in society will be examined from an interdisciplinary perspective focusing on the varied and shared aspects of the feminine experience. The course will examine topics such as the psychology and physiology of women; sex roles and socialization; marriage and the family, women in art, myth, and religion; the history of women; women and the law; and the women's movement.

W.S. 300-3. Women Studies Practicum. Students will work in a service agency on a project research basis to integrate the theory of women studies with the practical experience to be gained in working with women through agencies. Students will be required to implement and complete the project, and will be expected to provide a written evaluation of the project at the completion of the course.

W.S. 400-3. Senior Seminar. Advanced interdisciplinary course, organized around a specific topic, problem, or issue relating to women in culture and society (such as women and work, women and development, the women's movement). Course will alternately be offered as a research or reading seminar. Prer., W.S. 200.

W.S. 402-3. Senior Research Seminar. Course is an advanced research seminar. Research will have a regional focus in order to make use of available resources and to contribute to our knowledge of women in Colorado and the Rocky Mountain west.

W.S. 499-variable credit. Independent Study. This course provides students with an opportunity to do interdisciplinary independent work in the area of women studies. For more information, contact the Women Studies Office, x. 8923.

College of Business and Administration and Graduate School of Business Administration

Courses open to both undergraduate and graduate students are designated by slashes (e.g., Acct. 424/524).

ACCOUNTING

Acct. 200-3. Introduction to Financial Accounting. The preparation and interpretation of the principal financial statements of the business enterprise, with emphasis on asset and liability valuation problems and the determination of net income. Prer., sophomore standing.

Acct. 202-3. Introduction to Managerial Accounting. The analysis of cost behavior and the role of accounting in the planning and control of business enterprises, with emphasis on management decision-making uses of accounting information. *Note:* Accounting majors must take this course. Prer., Acct. 200.

Acct. 322-3. Intermediate Financial Accounting I. Intensive analysis of problems and theory of financial statements of condition and net income, and other published financial statements of business organizations. Consideration of the role of professional accounting organizations in establishing generally accepted accounting principles. Prer., Acct. 202.

Acct. 323-3. Intermediate Financial Accounting II. Continuation of Acct. 322. Prer., Acct. 322.

Acct. 332-3. Cost Accounting. Cost analysis of the manufacturing, marketing, and administrative functions of business organizations, primarily for purposes of control and decision making. Prer., Acct. 202.

Acct. 424/524-3. Advanced Financial Accounting. Advanced financial accounting theory and practice with emphasis on accounting for partnerships, business combinations, and consolidations. Prer., Acct. 323 or 612.

Acct. 425/525-3. Financial Accounting Issues and Cases. In-depth analysis of contemporary accounting issues and problems, the development of accounting thought and principles, and critical review of generally accepted accounting principles. Prer., Acct. 322 and 323 or 612.

Acct. 433/533-3. Managerial Accounting Problems and Cases. Critical analysis of advanced topics in managerial accounting. Considerable use of cases and current readings. Prer., Acct. 332.

Acct. 441/541-3. Income Tax Accounting. Provisions and procedures of federal income tax laws and requirements affecting individuals and business organizations, including the management problems of tax planning and compliance. Prer., Acct. 202 or B.Ad. 501.

Acct. 442/542-3. Advanced Income Tax Accounting. Continuation of Acct. 441, with special emphasis on the income tax problems of partnerships, corporations, and estates and trusts. Consideration is also given to federal estate and gift taxes. Prer., Acct. 441 or 541.

Acct. 454/554-3. Accounting Systems and Data Processing. The design and analysis of management information systems, automated data processing methods with special emphasis on computers, computer programming, and the role of accounting in the management process. Prer., 9 sem. hrs. of accounting.

Acct. 462/562-3. Auditing. Generally accepted auditing standards and the philosophy supporting them; auditing techniques available to the independent public accountant. Pertinent publications of the AICPA reviewed. Prer., Acct. 323.

Acct. 480/580-3. Accounting for Government and Nonprofit Organizations. Planning and control of government and nonprofit organizations. Includes program budgets, responsibility accounting, and fund accounting. Prer., Acct. 202.

Acct. 612-3. Financial Accounting Practice and Procedures. Designed to be a graduate-level treatment of substantially the same material covered in Acct. 322 and 323. Should not be taken by students who have taken Acct. 322 and 323 or their equivalent. Restricted to graduate students. Prer., B.Ad. 501 or equivalent.

Acct. 626-3. Seminar: Managerial Accounting. In-depth exploration of the broad professional field of managerial accounting, especially as related to organizational decision making, planning, and

control. Development and current problems of the managerial accounting function analyzed. Prer., Acct. 332, 628 or consent of instructor.

Acct. 627-3. Seminar: Income Determination. Critical analysis of problems and theory of measurement and reporting of periodic net income of business organizations. Net income models, research efforts, and role of professional accounting organizations. Current issues and problems given special attention. Prer., Acct. 628.

Acct. 628-3. Seminar: Accounting Theory. Nature and origin of accounting theory and the development of postulates, principles, and practices. Methodology appropriate to development and evaluation of accounting theory, with special emphasis on accepted research standards and procedures. Prer., Acct. 323 or 612; Acct. 332.

Acct. 635-3. Current Issues in Professional Accounting. In-depth analysis of current issues in the accounting profession, including ethics, development and validity of standards, and regulation. Prer., Acct. 628.

Acct. 642-3. Research Problems in Income Tax Accounting. A study of the methodology used in tax research and in tax planning, together with a study of some aspects of tax administration and tax practice, and of some aspects of the current law and proposals for its revision. Prer., Acct. 441 or 551 or consent of instructor.

Acct. 652-3. Controllership. Functions of the modern corporate controller. Topics and problems demonstrating the integrative nature of the controller's role are investigated. Prer., Acct. 322, 332, and 454 or 554 or equivalent.

Acct. 662-3. Advanced Auditing Theory. Development of auditing as a profession, including evolution of standards and audit reports. Historical and contemporary literature in the field reviewed. Prer., Acct. 462 or 562.

Acct. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Acct. 700-4 to 6. Master's Thesis.

Acct. 730-3. Doctoral Seminar: Accounting. Examination and evaluation of current theories, issues, and problems relating to accounting. Primary emphasis on accounting theory and research. Open only to doctoral students. Prer., Acct. 626, 627, and 628 or equivalent.

Acct. 800-0. Doctor's Thesis.

BUSINESS ADMINISTRATION

B.Ad. 100-3. Introduction to Business. Nature of business enterprise; role of business in our society; problems confronting business management. Career opportunities in business. Business students are advised to take this course during freshman year. Open only to freshmen and sophomores.

B.Ad. 195-3. President's Leadership Class. The President's Leadership Class, for preselected students, provides a forum of interchange between these students and social, civic, and political leaders of the community through a series of weekly lectures, on-site seminars, and recitations.

B.Ad. 200-3. Business Information and the Computer. A study of business information. Includes computer programming, computer systems, and their uses in an administrative environment. Prer., Math. 107 and Math. 108 or equivalent. Students should enroll in B.Ad. 200 and Q.M. 201 in consecutive semesters.

B. Ad. 295-2. President's Leadership Class. The President's Leadership Class, for preselected students, offers real world experiences in the form of second-semester internships. Preceded by first-semester planning units and activities dealing with adventure, inquiry, creativity, and community service.

B.Ad. 410-3. Business and Government. Study of government regulation of the business system. Topics include regulation of business concentration and of the markets for labor, money, other resources, and final products. Prer., Econ. 201 and 202. Completion of P.Sc. 110 is recommended before taking this course.

B.Ad. 411-3. Business and Society. An examination of inter-relationships between business, society, and the environment.

Topics will include perspectives on the socio-economic-business system, current public policy issues, and social responsibilities and ethics. Prer., Econ. 201 and 202. Completion of P.Sc. 110 and Soc. 211 is recommended before taking this course.

B.Ad. 440-3. International Business Seminar. Examines the international business environment as it affects company policy and procedures. Integrates all the functions undertaken in international operations through depth analysis and comprehensive case studies. Prer., any two of the following: Econ. 441, Fin. 440, Mk. 490, Tr.Mg. 458.

B.Ad. 450-3. Cases and Concepts in Business Policy. Emphasis is on integrating the economic, market, social-political, technological, and competition components of the external environment with the internal characteristics of the firm; and deriving through analysis the appropriate interaction between the firm and its environment to facilitate accomplishment of the firm's objectives. Priority for enrollment will be given to business seniors in their final semester prior to graduation. Prer., Fin. 305, Mk. 300, Pr.Mg. 300, Or.Mg. 330, and Q.M. 201.

B.Ad. 451-3. Management Game and Cases in Business Policy. Computerized management simulation is used as a means of giving the student practical, simulated experience in developing and analyzing business problems and building a framework for decision making, policy formulation, and plans of action. Priority for enrollment will be given to business seniors in their final semester prior to graduation. Prer., Fin. 305, Mk. 300, Pr.Mg. 300, Or.Mg. 330, and Q.M. 201.

B.Ad. 452-3. Small Business Strategy, Policy, and Entrepreneurship. Emphasis is on planning, organizing, and operating small business firms. The role of the entrepreneur is examined in the conception, organization, and development of firms. Extensive use is made of small business cases. Priority for enrollment will be given to business seniors in their final semester prior to graduation. Prer., Fin. 305, Mk. 300, Pr.Mg. 300, Or.Mg. 330, and Q.M. 201.

B.Ad. 470-3. Small Business—Management and Operation. Analysis of managerial problems of the small businessman. Case studies, outside speakers, and individual reports on local small business enterprises supplement class discussions. Student must have an understanding of elementary accounting, finance, and business law, or have experience in small business operation. Prer., senior standing.

B.Ad. 490-3. Honors Seminar: Business I. Social responsibilities of the business executive, business ethics, business-government relations, business in literature. Open to seniors who have completed at least 30 semester hours of business courses, have obtained not less than a 3.3 grade-point average over those hours, and have received consent of instructor. Does not carry graduate credit.

B.Ad. 495-variable credit. Topics in Business. Experimental course offered irregularly for purpose of presenting new subject matter in a particular business field. Prerequisites will vary, depending upon topics covered.

B.Ad. 499-variable credit. Independent Study. With the consent of instructor under whose direction study is undertaken. Intended only for exceptionally well-qualified business seniors.

The following graduate fundamentals courses (B.Ad. 500 to 507) do not carry graduate business degree credit, nor may they be used to satisfy requirements for the bachelor's degree in business. They are open only to graduate students admitted on a regular or provisional status. Qualified nonbusiness senior undergraduates who intend to pursue graduate study in business and special students who will be applying for graduate admission during the term in which they are enrolled for the course may be admitted with the written approval of the Office of Graduate Studies.

B.Ad. 500-1. Sources of Information and Research Methods. The objective of this course is to provide the M.B.A. student with the basic research techniques needed to locate, use, and evaluate secondary resource materials. The approach will be to emphasize techniques rather than actual titles.

B.Ad. 501-3. Fundamentals of Accounting. Provides basic understanding of accounting essential for graduate study of business.

B.Ad. 502-3. Fundamentals of Business Statistics. Provides basic understanding of business statistics essential for graduate study of business.

B.Ad. 503-3. Fundamentals of Marketing. Provides basic understanding of marketing essential for graduate study of business.

B.Ad. 504-3. Fundamentals of Management and Organization. Provides basic understanding of organization theory, personnel management, labor relations, and organizational behavior essential for graduate study in business.

B.Ad. 505-3. Fundamentals of Finance. Provides basic understanding of financial institutions and business finance essential for graduate study of business. Prer., B.Ad. 501.

B.Ad. 506-3. Legal Environment of Business. Provides understanding of the private and public law essential for graduate study in business.

B.Ad. 507-3. Fundamentals of Management Science. A survey of the analytical methods of management science operations research as applied to decision problems in business. A major objective of the course is to develop an understanding of the power and the limitations of mathematical-statistical models and to develop skills in problem formulation. Prer., B.Ad. 502 or equivalent.

B.Ad. 540-3. Seminar: International Business. Examines the international business environment as it affects company policy and procedures. Integrates all the functions undertaken in international operations through in-depth analysis and comprehensive case studies. Prer., any two of the following: Econ. 441, Fin. 440 or 540, Mk. 490 or 590, and Or.Mg. 458 or 558.

B.Ad. 570-3. Small Business—Management and Operation. Analysis of managerial problems of the small businessman. Case studies, outside speakers, and individual reports on local small business enterprises supplement class discussions. Student must have an understanding of elementary accounting, finance, and business law, or have experience in small business operation. Prer., graduate standing.

B.Ad. 595-variable credit. Topics in Business. Experimental course offered irregularly for purpose of presenting new subject matter in a particular business field. Prerequisites will vary, depending upon topics covered.

The following graduate courses are open only to admitted graduate students. Any other students enrolling in these courses must have the written approval of the Office of Graduate Studies. Students should have completed all of the fundamental requirements or be currently registered for them before enrolling in any of the 600-level graduate courses.

B.Ad. 610-3. Business, Government, and Society. The interaction and interdependence of business and its executives with societal, governmental, and economic environments, including analytic elements such as the forecasting and analysis of business conditions. Explores the firm's and its executives' social and ethical responsibilities to various internal and external publics. Considers the relationship between business and government and the control and regulation of business. Considers the problems and opportunities of operating in the international environment. Prer., by course work or waiver, to have completed at least half (12 hours) of the B.Ad. 500 series of fundamentals.

B.Ad. 615-3. Business and Economic Analysis. A presentation of the concepts, tools, and methods of economic analysis relevant to a broad cross section of decisions within the business firm. Particular attention will be given to market demands and the interrelationships between price policy, costs, and production. Prer., B.Ad. 502 and Introduction to Microeconomics.

B.Ad. 620-3. Administrative Controls. Nature and techniques of control in modern managerial context. Intensive case analysis to study theory and application of control methods. Prer., B.Ad. 501, 502, and 505.

B.Ad. 630-3. Business Research. Nature, scope, and importance of business research and research methodology. Emphasizes sources of information, methods of presentation, methods of analysis, and interpretation of statistical data. Involves individual investigation

and report writing on problems of current business interest. Prer., B.Ad. 502 or equivalent.

B.Ad. 640-3. Organizational Behavior. Application of behavioral science concepts and research to management of organizations. Prer., B.Ad. 504.

B.Ad. 650-3. Business Policy. Emphasizes problem analysis and decision making at integrative-management level. Devoted to internal policy making. Emphasis on integrated use of research, analysis, and control in policy decisions. This course *must* be taken in the candidate's final term of the program. B.Ad. 500-level fundamentals, by course completion or waiver, are firm prerequisites.

B.Ad. 660-3. Business Conditions. Analysis of the American economy; its development and present condition. The state of the economy and the underlying factors affecting the economy will be analyzed. Prer., 9 semester hours of economics.

B.Ad. 670-2. Advanced Problems in Small Business Operation. Advanced course. Research studies of conditions that make for success or failure by localities. Prer., B.Ad. 470 or 570.

B.Ad. 695-variable credit. Graduate Seminar: Business. Experimental seminar offered irregularly to provide opportunity for investigation of new frontiers in business knowledge. Prerequisites will vary, depending upon the topic to be covered.

B.Ad. 699-variable credit. Independent Study. With the consent of instructor under whose direction study is undertaken.

B.Ad. 755-3. Doctoral Seminar: Administrative Policy I. Examination and evaluation of current theories, issues, and problems involved in the formulation, administration, and appraisal of administrative policies. Includes both study of relevant literature and examination of administrative policies in operation in business enterprises. Open to doctoral candidates only. Prer., B.Ad. 650.

B.Ad. 756-3. Doctoral Seminar: Administrative Policy II. Continuation of B.Ad. 755. Prer., B.Ad. 755.

B.Ad. 757-3. Directed Study and Research in Current Policy Issues. For D.B.A. candidates with primary interest in administrative policy. Directed intensive study of important policy issues, both on an individual basis and in small groups. Reading and research. Prer., B.Ad. 755 and B.Ad. 756 completed or taken concurrently.

B.Ad. 790-3. Doctoral Seminar: Dissertation Research. A seminar designed to assist the doctoral student in integrating his courses and fields of study in order to be able to apply knowledge and skills to problems in business. Special attention will be given to the development of thesis topics.

B.Ad. 800-16 to 24. Doctor's Thesis.

BUSINESS EDUCATION

Courses numbered 500 and above generally are offered only during summer sessions.

B.Ed. 230-3. Principles of Business Education. History, objectives, and problems of education for business, particularly at the secondary school level; construction and organization of curriculum; relationship to other factors influential in the educational experience; trends.

B.Ed. 410/510-3. Methods in Business Education: Typewriting and Shorthand. Methods and materials in teaching typewriting, shorthand, and clerical practice. Prer., B.Ed. 230.

B.Ed. 411/511-3. Methods in Business Education: General and Basic Business and Bookkeeping. Methods and materials in teaching introductory general business and economic education courses at the 9th- and 10th-grade level and advanced basic business, economics, and bookkeeping at the 11th- or 12th-grade level. Prer., B.Ed. 230.

B.Ed. 414/514-2. Methods and Materials for Teaching Data Processing. Philosophy of data processing programs in the secondary and postsecondary curriculums. Methods, materials, and techniques of handling and utilizing data; methods in and development of computer programming; application of systems and peripheral equipment. Designed for beginning teachers in data processing.

B.Ed. 610-2. Improvement of Instruction in Shorthand and Typewriting. For experienced teachers of shorthand and typewriting. Findings of educational psychologists concerning

motor skills and their application in teaching of shorthand and typewriting; materials and methods of instruction; study of recent research.

B.Ed. 611-2. Improvement of Instruction in Bookkeeping. For experienced teachers. Materials and methods of teaching. Recent research and literature in the field.

B.Ed. 612-2. Improvement of Instruction in Secretarial, Office, and Clerical Practice. For experienced teachers. Methods and procedures in advanced secretarial and clerical practice; selection of materials and equipment; establishment of standards of productivity; individual teaching problems.

B.Ed. 620-2. Organization, Administration, and Supervision of Business Education. Administrative problems of supervisor of business education, department head, and teacher as to organization, curriculum, budgets, equipment, personnel, and community relations. It is recommended that B.Ed. 630 precede this course or be taken concurrently.

B.Ed. 630-2. Foundations of Business Education. Philosophy and objectives of business education; problems of curriculum and curriculum evaluation; contribution of business education to general education; business and economic history and trends.

B.Ed. 631-2. Problems in Business Education. General problems of current importance to the business teacher in high school or college.

B.Ed. 640-2. Research in Business Education. Methods of research in business education; analysis of research studies in the field; planning of a research project.

B.Ed. 641-2. Seminar: Business Education. Basic business understanding necessary in an economic society; how this may be included in the high school curriculum in business education; resource materials.

B.Ed. 660-4. Workshop in Business Education. Problems of current interest to teachers of business economics and the adaptation of business economic content to general business and other business classes. Development of background knowledge necessary for business economic teaching. Preparation of materials appropriate for classroom use.

B.Ed. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

B.Ed. 700-4 to 6. Master's Thesis.

BUSINESS LAW

B.Law 300-3. Business Law. To understand the legal significance of business transactions as part of the decision-making process in business. Coverage of text and statutes includes law and its enforcement and integration of the Uniform Commercial Code with the law of Contracts, Bailments, Warehousemen and Carriers, Documents of Title, Sales of Goods, and Commercial Paper. Prer., junior standing.

B.Law 412/512-3. Business Law. Property security transactions (UCC9), suretyship and guaranty, bankruptcy, agency, partnerships, and corporations (UCC8). Prer., B.Law 300 or B.Ad. 506.

FINANCE

Fin. 305-3. Basic Finance. Includes a study of the monetary system and other institutions comprising the money and capital markets. Also includes a study of the financial manager's role in business. The investment of capital in assets and financing the asset requirements of business firms. Prer., Econ. 201 and 202; Acct. 200.

Fin. 321-3. Personal Finance. Problems of personal financial management; use of credit, personal budgets, insurance, small investments in securities, buying a home, creating an estate, providing for old age, and making a will. Intended for nonbusiness students. No credit given toward business degree requirements.

Fin. 333-3. Investments. Study of the basic problems concerning development and implementing of a personal investment program. Includes analysis of investment risks, alternative investment media, designing and executing an investment program. No credit given toward business degree for finance majors. Prer., Fin. 305. Students may not receive credit for both Fin. 333 and 433.

Fin. 355-3. Financial Markets. Discusses major operating characteristics and problems of money and capital markets, both national and international. Emphasizes the sources and availability of money and capital for financing business and the market structure for the employment of savings. No credit given toward business degree for finance majors. Students may not receive credit for both Fin. 355 and 455. Prer., Fin. 305.

Fin. 401-3. Business Finance I. Basic principles and practices governing management of capital in the business firm constitute the core of this course. Determinants of capital requirements, methods of obtaining capital, problems of internal financial management, and methods of financial analysis. Financing the business corporation given primary emphasis. Prer., Fin. 305, Acct. 202 (formerly Acct. 214).

Fin. 402-3. Business Finance II. Develops analytical and decision-making skills of students, in relation to problems that confront financial management. Areas include planning, control, and financing of current operations and longer term capital commitments; management of income; evaluation of income-producing property; and expansion. Case method of instruction. Prer., Fin. 401.

Fin. 433-3. Investment and Portfolio Management. Discusses investment problems and policies and the methodology for implementing them. Includes portfolio analysis, selection of investment media, and measurement of performance. Prer., Fin. 401 and 455; coreq., Fin. 402. Students may not receive credit for both Fin. 333 and 433.

Fin. 434/534-3. Security Analysis. An application of the theories and methodology for the selection of investment media for implementing an investment portfolio. Prer., Fin. 402 and 433 or Fin. 602 and 633.

Fin. 440/540-3. International Financial Management. Considers international capital movements and balance of payments problems. Problems of international operations as they affect the financial functions. Reviews foreign and international institutions and the foreign exchange process. Considers financial requirements, problems, sources, and policies of firms doing business internationally. Prer., Fin. 305 or B.Ad. 505.

Fin. 453/553-3. Bank Management. An analysis of structure, markets, regulation, and chartering commercial banks. Problems and policies of the internal management of funds, loan practices and procedures, investment behavior, deposit and capital adequacy, liquidity, and solvency. Analytical methodology for these problems is developed. Prer., Fin. 401 or 601 and Pr.Mg. 300 or B.Ad. 504.

Fin. 455-3. Monetary and Fiscal Policy. Analyzes the theoretical and practical problems concerning the use of monetary and fiscal devices for controlling national and international economic relationships. Emphasizes the major theories and analytical models for current monetary and fiscal policies. Prer., Fin. 305. Students may not receive credit for both Fin. 355 and 455.

Fin. 601-3. Problems and Policies in Financial Management I. Emphasizes analysis of financial condition, planning and control of current assets and current liabilities, and long-term financial arrangements. Specific topics include management of working capital, short, intermediate and long-term financing, leasing, valuation, and capital structure policies. Theory and case studies. Prer., B.Ad. 505 or equivalent.

Fin. 602-3. Problems and Policies in Financial Management II. A continuation of Financial Management I. Specific topics include: long-term financing (hybrid securities), marketing securities, capital budgeting, dividend policy, external expansion or acquisitions, and capital structure adjustments. Theory and case studies. Prer., Fin. 601.

Fin. 633-3. Investment Management and Analysis. The theory of investment management and security values; portfolio management including the analysis of investment risks and constraints on investment policies and objectives; the analysis and use of investment information; and the development and application of the tools for determining values. Prer., Fin. 601; coreq., Fin. 602.

Fin. 655-3. Business Fluctuations and Monetary Policy. Theoretical and empirical study of forces governing business fluctuations in the U.S. and the effectiveness of monetary and fiscal policies. Develops the analytical tools essential for understanding

business indicators and the various policy alternatives to attain stated economic goals and objectives. Prer., B.Ad. 505.

Fin. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Fin. 700-4 to 6. Master's Thesis.

Fin. 720-3. Doctoral Seminar: Business Finance. Examination and evaluation of current theories, issues, and problems relating to the financial management of business. Emphasis on both internal and external environment forces affecting managerial policies and decisions. Includes study of relevant literature and of financial policies prevailing in business. Prer., Fin. 602 or equivalent.

Fin. 733-3. Doctoral Seminar: Investments. Advanced study and research in contemporary investment problems, including security markets. Prer., Fin. 633 or equivalent.

Fin. 755-3. Doctoral Seminar: Monetary Theory and Policy. Advanced study and research in selected contemporary monetary theory and credit problems. Prer., Fin. 655 or equivalent.

Fin. 800-16 to 24. Doctor's Thesis.

INFORMATION SYSTEMS

I.S. 215-3. Data Processing. Uses of computers, data systems, file structures and file processing, hardware-software systems, and COBOL programming. Prer., B.Ad. 200.

I.S. 350-3. Database and Information Systems. Advanced concepts in file processing; management control systems, on-line query systems, data base management systems, and further study in file processing languages. Prer., I.S. 215. (Formerly I.S. 345).

I.S. 355-3. Computerware. Contrasting systems for data processing applications; equipment selection and systems configuration with emphasis on economic consideration in an uncertain economic and technological environment. Prer., I.S. 215.

I.S. 465/565-3. Systems Analysis and Design. Basic system analysis tools; defining logical system requirements; steps in analysis; preliminary investigation, general feasibility study, general system proposal; detailed analysis; specification of input/output methods and formats; physical design (of files, programs, and procedures); system life cycle management. Prer., I.S. 350, Q.M. 330.

I.S. 645-3. Information Systems and Management. Information processing, the analysis and design of information systems, management query systems, and data base design and management. Prer., familiarity with FORTRAN or some other computer programming language.

I.S. 650-3. Database Management Systems. Theory of data structures; implementations of database models. Comparative analysis of available systems and in-depth applications in conventional and innovative circumstances, especially in development of information for operations and control of administrative functions. Prer., I.S. 645 or equivalent.

I.S. 665-3. Advanced Systems Analysis and Design. Advanced studies in the auditing of information flows, information processing and administrative use of information, the selection of information systems strategies and the management of ADP operations. Prer., I.S. 650 or equivalent.

I.S. 680-3. Selected Topics in Information Science. This course will vary from semester to semester, treating topics such as advanced concepts and research in information sciences, digital simulation and simulation languages, and other topics. May be repeated when topic changes. Prer., specified each semester.

INSURANCE

Ins. 484/584-3. Principles of Insurance. Fundamental principles of insurance and their application in life, disability, property, and liability insurance. Provides the basic knowledge for intelligent solution of personal and business insurance problems as well as for further specialized study of insurance. Prer., Fin. 305 or B.Ad. 505.

Ins. 487/587-3. Risk Control in the Corporate Enterprise. A systematic approach to risk control in industrial and commercial enterprises. Concerns the interworkings of human behavior, natural phenomena, and chance involved in situations of risk and the great variety of combinations of preventive measures, insurance provisions, and loss absorption arrangements. Prer., Ins. 484 or 584.

MANAGEMENT SCIENCE

Mg.Sc. 601-3. Deterministic Models. Linear programming and its application, network analysis, including scheduling models, dynamic programming, integer programming, nonlinear programming. Prer., B.Ad. 507.

Mg.Sc. 602-3. Stochastic Models. Probability theory, queueing theory, inventory theory, Markov decision processes, simulation, decision analysis. Prer., B.Ad. 502 and B.Ad. 507.

Mg.Sc. 675-3. Seminar: Management Science. Application of operations research methods to problems of business and industry, with emphasis on the functional fields of marketing, financial management, and production. Prer., Mg.Sc. 601 and Mg.Sc. 602. One of the prerequisite courses may be taken as a corequisite.

Mg.Sc. 685-3. Selected Topics in Decision Science. This course will vary from semester to semester, treating topics such as algorithmic developments in mathematical programming, decision analysis, stochastic processes, and other topics. May be repeated if topic changes. Prer., to be specified each semester.

Mg.Sc. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Mg.Sc. 700-4 to 6. Master's Thesis.

Mg.Sc. 800-16 to 24. Doctor's Thesis.

MARKETING

Mk. 300 or B.Ad. 503 or an equivalent course in basic marketing is a prerequisite for all other marketing courses except Mk. 310.

Mk. 300-3. Principles of Marketing. Analytical survey of problems encountered in distributing goods and services. Takes a marketing-management approach in attacking problems related to product planning, channels of distribution, pricing, advertising, and selling. Emphasizes role of consumer and the social responsibility of marketer.

Mk. 310-3. Salesmanship. Principles and methods of personal salesmanship with attention to development and demonstration of effective sales presentation techniques.

Mk. 320-3. Consumer Behavior. Survey of contributions of behavioral sciences to understanding and prediction of consumer behavior. Contributions of research techniques in social sciences to understanding of consumer purchasing and decision-making processes. Survey of consumer purchasing behavior, brand loyalty, and product cycles. Prer., Mk. 300.

Mk. 330-3. Marketing Research. Fundamental techniques. Practical experience in research methodology: planning an investigation, questionnaires, sampling, interpretation of results, report preparation. Research techniques for product analysis, motivation research, sales and distribution-costs analyses, and for advertising research. Student will incur project expenses. Prer., Mk. 300 and Q.M. 201. Not available in summer session.

Mk. 340-3. Marketing Institutions and Retailing. A study of the macroeconomic foundations of marketing intermediaries, middlemen, and institutional alignments. Emphasis placed on development and change of institutional structures and functions and roles played by participants in moving goods to ultimate consumer, focusing on retailing functions and strategies. Prer., Mk. 300.

Mk. 350-3. Principles of Advertising. Analysis of principles and practices in advertising from executive's viewpoint. Considers whether a firm should advertise; product and market analysis as planning phase of advertising program; media; survey of creation and production of advertisements; advertising budgets, copy testing, and organization. Prer., Mk. 300.

Mk. 430-3. Research Design and Experimental Methods in Marketing. Advanced course in marketing research. Stresses design of marketing research projects and application of statistical techniques. Collection, analysis, and interpretation of marketing information. Techniques of experimental design and application as basis for decision-making in marketing. Design and management of a planned marketing information system. Prer., Mk. 330.

Mk. 450/550-3. Advertising Management. Advertising problems from management point of view. Stimulating primary and selective demand; selection of media; building promotional programs; adver-

tising appropriations and campaigns; evaluations of results; agency relations. Prer., Mk. 350.

Mk. 460/560-3. Industrial Marketing. Activities involved in marketing of industrial goods. Analysis of market structures; habits and motives of purchasers; types of industrial products; pricing problems; distribution channels. Problems in selling to agencies of government. Oriented to engineers and others entering the fields of industrial selling or marketing. Prer., Mk. 300.

Mk. 470/570-3. Sales Management. Problems involved in managing a sales force. Includes sales organization, operating a sales force (recruiting, selection, training, compensation, supervision, stimulation), sales planning (forecasting, budgeting, territories), sales analysis and control. Prer., Mk. 300 or B.Ad. 503.

Mk. 475/575-3. Pricing and Price Policies. Appraisal of price theory and limitations in actual business situations. Detailed study of impact of demand, costs, and prices upon revenues and profits through extensive use of actual case materials. Legal aspects of pricing decisions studied intensively. Prer., Mk. 300.

Mk. 480-3. Marketing Policies and Strategies. Detailed consideration of process of formulating and implementing marketing policies. Major emphasis on markets, distribution channels, and product analysis. Problem approach utilized to develop student's analytical ability and to integrate all major areas of marketing. Prer., Mk. 300.

Mk. 485/585-3. Physical Distribution Management. Investigation and analysis of logistics of distribution systems for firms engaged in manufacturing and marketing. Component parts of each system are studied and analytical tools are presented for selecting alternatives which will attain distribution goals of the firm. Prer., Mk. 300.

Mk. 490/590-3. International Marketing. Studies managerial marketing policies and practices of firms marketing their products and services in foreign countries. An analytical survey of institutions, functions, policies, and practices in international marketing. Relates marketing activities to the market structure and marketing environment. Prer., Mk. 300 or consent of instructor.

Mk. 600-3. Marketing Management. An in-depth inquiry into marketing decision making. Emphasis is placed on strategic planning and analytical procedures for marketing decisions. The course integrates all areas of marketing management and relates marketing activities to the other functional areas of the firm. Prer., Mk. 300 or B.Ad. 503.

Mk. 605-3. M.B.A. Seminar: Marketing. Comprehensive survey of current problems and issues in marketing from the perspective of firm. Analysis of firm's process of adjustment to market changes. (Required of all M.B.A. students with an area of emphasis in marketing.) Prer., Mk. 600.

Mk. 610-3. Seminar: Marketing. *Summer.* Intensive analytical study of certain aspects of marketing principles, institutions, policies, and operations. Prer., Mk. 300 or B.Ad. 503.

Mk. 620-3. Seminar: Consumer Behavior. A study of the nature and determinants of consumer buying behavior. In-depth investigation of contributions of behavioral sciences (especially psychology, sociology, cultural anthropology) towards understanding consumer behavior. Influence of demographic factors, motivation, personality, culture, and purchasing behavior. Prer., Mk. 420 or 520 or consent of instructor.

Mk. 630-3. Quantitative Methods in Marketing. Fundamental techniques and applications of quantitative market analysis. Includes study of market and sales potentials; sales forecasts; analysis of sales volume; distribution costs; and application of operations research, linear programming, and other techniques to the solution of certain marketing problems. Prer., Mk. 300 or B.Ad. 503 and Q.M. 201 or B.Ad. 502.

Mk. 640-3. Seminar: Channel Policy and Structure. Analytical study and evaluation of structure and evolution of marketing channels. Relationship of channel policy to business policies is stressed. Cost and effectiveness of alternative distribution policies and practices are considered, and the relationship of channel policy to physical distribution is studied. Prer., 6 semester hours of marketing courses.

Mk. 650-3. Seminar: Promotional Strategy. Principles, concepts, and problems involved in development and management of advertising, personal selling, and sales promotion program in an individual firm. Qualitative market analysis, social, ethical, and

economic evaluation of the role of promotional activities in American economy. Prer., Mk. 350.

Mk. 660-3. Marketing Field Problem. Participants functioning as a research group are presented with opportunity of analyzing and making recommendations regarding a practical marketing problem presented by a cooperating business firm. Special emphasis placed upon developing effective methodology for problem-solving processes in marketing. Prer., Mk. 600.

Mk. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Mk. 700-4 to 6. Master's Thesis.

Mk. 710-3. Doctoral Seminar: Marketing Management. Consideration of current problems and issues in marketing from the perspective of the individual firm. Analysis of the adjustment process of the firm in meeting changes in the market and marketing environment. New developments in techniques and procedures analyzed and evaluated. Prer., Mk. 600.

Mk. 720-3. Doctoral Seminar: Marketing Theory. Investigation of development and current state of theoretical and conceptual aspects of marketing principles, institutions, and processes. Course develops an understanding of functioning, measurement, and efficiency of total distribution process. Frontiers of marketing thought will be analyzed and evaluated. Prer., Mk. 710.

Mk. 800-16 to 24. Doctor's Thesis.

MINERALS LAND MANAGEMENT

M.L.Mg. 485/585-3. Minerals Landman Administration. A thorough examination of the range of administrative duties performed by the minerals landman. Leasing, property rights, easements, participating interests, taxation, and pay-out schedules are included. Emphasis on the governmental agencies and private interests that are dealt with in acquiring land for exploration and development. Prer., completion of 75 semester hours of work toward the major, including all lower division requirements.

M.L.Mg. 495/595-3. Oil-Gas and Mineral Law. A review and examination of the legal relationships associated with mineral rights and properties. Topics include mineral rights; regulations governing federal, state, and private lands; and the rights and duties of owners and developers. Procedural requirements, instruments, title examinations, and environmental statements. Prer., completion of 75 semester hours of work toward the major, including all lower division requirements.

OFFICE ADMINISTRATION

O.Ad. 110-2. Typewriting I. Speed and accuracy in operation of typewriter by the touch system; application of the skill to business materials such as business letters, tabulations, manuscripts.

O.Ad. 111-2. Typewriting II. Development of typewriting skill to vocational competency, application of skill to complex business materials and needs. Emphasis on productivity in typing materials such as letters, office forms, statistical tables, legal forms, multi-copy documents. Prer., O.Ad. 111 or equivalent.

O.Ad. 210-3. Stenography I. Fundamentals of Gregg shorthand; dictation and transcription. Coreq., O.Ad. 110 or typing proficiency.

O.Ad. 211-3. Stenography II. Dictation and transcription; vocabulary building. Prer., O.Ad. 210 or equivalent; coreq., O.Ad. 110 or typing proficiency.

O.Ad. 300-1. Office Machines I. Operation of standard office equipment: electronic, rotary and key-driven calculators, adding and listing machines, dictating and duplicating machines.

O.Ad. 301-1. Office Machines II. Work experience in operation of office machines and in office procedures. Coreq., O.Ad. 421.

O.Ad. 420-3. Secretarial Procedures. Refinement of secretarial skills and the procedures for utilization and/or supervision in the modern office. Provides the foundation for solving communication problems in the secretary-executive situation. Prer., O.Ad. 111 and 211 or equivalent.

O.Ad. 421-3. Office Procedures. Situational analysis of office procedures, theories, and techniques, i.e., simulated office situations and case problems. Provides foundation for supervision and solving of information flow problems in the office. Does not give graduate credit. Prer., O.Ad. 111 or equivalent; coreq., O.Ad. 301.

O.Ad. 440/540-3. Principles of Office Management. Analysis of principles and their application in the planning, organizing, and controlling of office activities. Methods of developing office systems; importance as a preliminary step in office automation.

O.Ad. 441/541-2. Problems in Office Management. Analytical problems in office methods and procedures; systems; cost control; automation; layout; standardization; work simplification, including process charts, and other tools of office methods analysis presented through case problems. Prer., basic course in principles of office management.

O.Ad. 640-3. Seminar: Office Management. Analytical study of paperwork engineering in actual office management situations in business organizations. Coordination of student research in office management problems with published research in the field through seminar reports and discussions.

O.Ad. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

ORGANIZATION MANAGEMENT

Or.Mg. 330-3. Introduction to Management and Organization. An introductory study of management fundamentals and organizational behavior. How individuals adapt to organizations; how managers motivate and lead in work situations; how organizations are designed and managed. Students are urged to complete Psych. 100 and Soc. 211 before taking this course.

Or.Mg. 335-3. Managing Individuals and Work Groups. Examines leadership and supervision of individuals and small work groups in organizations. Includes study of motivation, perception, learning, and other characteristics of individuals critical to performance in groups and organizations. Study of group formation and operation, analysis of group member roles, group structure, normal group leadership, and intergroup relationships. Prer., Or.Mg. 330.

Or.Mg. 437-3. Managing Complex Organizations. From the perspective of a general manager, the course explores organizational design and management processes for effective organizational performance. Prer., Or.Mg. 330.

Or.Mg. 602-3. Individual Behavior in Organizations. Analysis of individual differences including issues such as perception, cognition, motivation, human judgment and problem solving, learning, achievement, emotions, value and attitude formation, abilities, alienation, and integrating the personality into organizations. Prer., B.Ad. 640 or equivalent.

Or.Mg. 632-3. Behavior of Task Groups. A study of interpersonal competence in organization. Topics include group formation and development, leadership, power conflict, conformity, cohesiveness, and task effectiveness. Prer., B.Ad. 640 or equivalent.

Or.Mg. 636-3. Behavior in Complex Organizations. Analysis of behavior and structure required for total organizational functioning. Issues discussed include bureaucracy, technological and environmental influences, organizational socialization, structure, goals, adaptation, information, communication, and control systems, lateral relationships, system integration, conflict resolution, change, organizational development, and organizational decision processes. Prer., B.Ad. 640 or equivalent.

Or.Mg. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Or.Mg. 700-4 to 6. Master's Thesis.

Or.Mg. 800-16 to 24. Doctor's Thesis.

PERSONNEL MANAGEMENT

Ps.Mg. 434-3. Labor Relations: Policy and Practice. Analysis of legal, political, social, and managerial aspects of collective bargaining and union-management relations. Prer., Or.Mg. 330 or B.Ad. 504.

Ps.Mg. 438/538-3. Personnel Management: Policy and Practice. Study of development and implementation of personnel systems, including selection, training, motivation, and performance appraisal. Prer., Q.M. 201 and Or.Mg. 330 or B.Ad. 504.

Ps.Mg. 439/539-3. Personnel Management: Legal and Social Issues. A study of legal and social issues related to personnel administration such as equal employment opportunity and affirmative action with emphasis on program implementation and evaluation. Reviews both federal and state laws, guidelines and

procedures, and their administration by governmental regulatory agencies. It is recommended that students take Ps.Mg. 434 and 438 before taking this course. Prer., Or.Mg. 330 or B.Ad. 504.

Ps.Mg. 634-3. Seminar: Labor Relations. Analysis of collective bargaining problems and the implications of trade agreement interpretations. Emphasis on integrating scholarly writings and research findings as a basis for constructive action and for prediction of collective bargaining trends. Prer., Ps.Mg. 434 or 534 and 438 or 538 or equivalent.

Ps.Mg. 638-3. Seminar: Personnel Administration. Issues in personnel administration and applied models of the personnel functions. Applications of learning theory and motivation theory to individuals in organizations; wage-salary administration analysis of human resources in organizations through applied models, survey methods, and other applied behavioral concepts. Prer., Ps.Mg. 538 or B.Ad. 504 and B.Ad. 640.

PRODUCTION AND OPERATIONS MANAGEMENT

Pr.Mg. 300-3. Production and Operations Management. An introduction to the design and analysis of production systems in manufacturing, service, and public organizations. Topics include facility location and layout; job design, safety, and work standards; production and inventory planning and control; quality control; simulation; waiting line analysis; and linear programming. Prer., Acct. 200; coreq., B.Ad. 200.

Pr.Mg. 440/540-3. Planning and Control Systems in Production and Operations Management. Study of the design, implementation, and control of production, inventory and service delivery systems. Topics include computer-based scheduling and control systems; analytic models for design of operating systems; and material requirements planning (MRP). Organization studies include manufacturing, services (including urban services), and government. It is recommended that graduate students take Pr.Mg. 640 in lieu of this course. Prer., Pr.Mg. 300 or B.Ad. 502 and 507.

Pr.Mg. 444/544-3. Work Design and Measurement. Study of the design of jobs in manufacturing, service, and public organizations. Topics include job specialization vs. job enlargement, work measurement, determining job standards, job health and safety, and the impact of automation on job design. Prer., Pr.Mg. 300 and Or.Mg. 330 or B.Ad. 504.

Pr.Mg. 447/547-3. Policy Analysis in Production and Operations Management. Study of production and operations management formulation and analysis. Emphasis is on developing decision-making skills through the use of case analysis, field study in local organizations, and production-oriented simulation games. It is recommended that graduate students take Pr.Mg. 647 in lieu of this course. Prer., Pr.Mg. 440 or 540.

Pr.Mg. 460/560-3. Purchasing and Materials Management. Study of the purchasing function in manufacturing, service, and public organizations. Topics include source selection, make-buy analysis, inventory control; warehousing, material quality standards and specifications, transportation alternatives, bid systems, and legal aspects.

Pr.Mg. 640-3. Logistics, Production, and Inventory Management. Study of the total flow of resources to and through the production process to the ultimate consumer. Topics include integrated production, inventory, and logistics systems in manufacturing, service, and public organizations; demand forecasting; capacity planning; inventory management; material requirements planning (MRP); facility scheduling and control; and physical distribution management. Prer., B.Ad. 502 and B.Ad. 507 or equivalent.

Pr.Mg. 647-3. Policy Analysis in Production and Operating Systems. Advanced study of policy formulation and analysis in manufacturing, service, and public organizations. Emphasis is placed on developing decision-making skills through the use of case analysis, field study in local private and public organizations, and production/operations-oriented simulation exercises. Prer., B.Ad. 502 and B.Ad. 507, or equivalent.

Pr.Mg. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

Pr.Mg. 700-4 to 6. Master's Thesis.

PUBLIC AGENCY ADMINISTRATION

The program will encompass the subject areas of budgeting, personnel management, administration, and quantitative methods. For additional information refer to Public Agency Administration area of emphasis.

QUANTITATIVE METHODS

Q.M. 201-3. Business Statistics. Statistical applications in business. Includes descriptive statistics, time series analysis, index numbers, probability and sampling distributions, statistical inference, simple regression, and decision analysis without sampling. Prer., Math. 107, 108, and B.Ad. 200. Students are encouraged to take Q.M. 201 in the semester following completion of B.Ad. 200.

Q.M. 300-3. Intermediate Statistics. Intermediate treatment of regression and forecasting models in business and research, statistical quality control in manufacturing processes, sampling and analysis of variance, parametric and non-parametric statistical inferences, decision analysis with sampling. Prer., Q.M. 201.

Q.M. 330-3. Operations Research. (Formerly Q.M. 440.) Objectives and models of operations research and their application in a managerial setting. Inventory models and control, simulation, linear programming topics, network models. Prer., Pr.Mg. 300.

Q.M. 430/530-3. Business Forecasting. Analysis of fluctuations in business activity, study of responsible factors, diffusion indices, and other forecasting techniques and models. Construction of models for planning and simulation. Prer., Q.M. 201 or B.Ad. 502.

Q.M. 620-3. Multivariate Analysis. Topics in multivariate data analysis of particular interest to those engaged in business research. Includes techniques such as multivariate discriminate analysis, factor analysis, and multiple regression, and the use of standard multivariate statistical packages such as the SPSS package. Prer., B.Ad. 502.

REAL ESTATE

All courses numbered 400 and above may be limited to Real Estate majors.

R.Es. 300-3. Principles of Real Estate Practice. Activities in the current field of real estate practice. Prer., upper division standing.

R.Es. 401/501-3. Urban Land Analysis. The nature of urban real estate and the market forces affecting its utilization. Prer., R.Es. 300.

R.Es. 430/530-3. Residential and Income Property Appraising. (Formerly Real Estate Appraising). Principles and techniques of estimating the value of land, residences, and income property are studied. Principles and techniques are applied by a field problem in appraising. Prer., R.Es. 300.

R.Es. 433/533-3. Real Estate Investments. Emphasizes problems and methodology for making the real estate investment decision. Includes real estate versus other investments; real estate user and investor requirements; decision models; tax factors and syndication. Prer., R.Es. 300 and Fin. 401 for undergraduates; R.Es. 300 or equivalent and Fin. 401 or 601 for graduate students.

R.Es. 454/554-3. Real Estate Finance. Functions and practices of various real estate financing institutions. Embraces mortgage lending, servicing, and mortgage banking relative to all types and uses of real estate. Prer., R.Es. 300, Fin. 305 or B.Ad. 505.

R.Es. 473/573-3. Legal Aspects of Real Estate Transactions. Business and legal aspects. Estates in land, purchase and sales contracts, conveyances, mortgage and trust deed transactions, property taxes, landlord and tenant, wills and inheritance. Prer., B.Law 300 and R.Es. 300; or B.Ad. 506 and R.Es. 300.

SMALL BUSINESS MANAGEMENT AND ENTREPRENEURSHIP

B.Ad. 470/570-3. Small Business—Management and Operation. Analysis of managerial problems of the small businessman. Case studies, outside speakers, and individual reports on local small business enterprises supplement class discussions. Student must

have an understanding of elementary accounting, finance, and business law, or have experience in small business operation. Prer., senior standing; for 570, graduate standing.

B.Ad. 670-2. Advanced Problems in Small Business Operation. Advanced course. Research studies of conditions that make for success or failure by localities. Prer., B.Ad. 470 or B.Ad. 570.

B.Ad. 699-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

TRANSPORTATION AND TRAFFIC MANAGEMENT

Tr.Mg. 450/550-3. Transportation Operation and Management. Economics of transportation service and rates. History and patterns of regulation. Explanation of various forms in common use in freight and passenger transportation. Introduction to tariffs and their use. Service and management problems of industrial traffic managers. Prer., Econ. 201 and 202 or consent of instructor.

Tr.Mg. 451/551-3. Survey of Transportation Operation and Procedure. Brief analysis of the function of transportation in the economic system. Issues in administration of transportation policy with respect to public regulation. Not open to students who have taken Tr.Mg. 450 or 550. Students may take Tr.Mg. 450 or 550 after this course, but will receive only 2 semester hours credit for Tr.Mg. 450 or 550.

Tr.Mg. 452/552-3. Problems in Traffic Management. Class and commodity rates, demurrage, car mileage, fabrication-in-transit, diversion and reconsignment privileges, tariff interpretation, and rate construction.

Tr.Mg. 456/556-3. Air Transportation. Particular reference to operating costs and methods, passenger and cargo rates, air routes, schedules, safety, regulation, and airport management. Prer., senior standing or graduate standing.

Tr.Mg. 457/557-3. Urban Transportation. Analysis of the two aspects of urban transportation—freight and people. Issues in policy, modes, governmental actions and structure, investment and costs, and effect upon urban environment.

Tr.Mg. 458/558-3. International Transportation. Analysis of international transportation (primarily sea and air) in the world economy. Detailed study of cargo documentation and freight rate patterns. Included are liability patterns, logistics, economics, and national policies of transportation.

Tr.Mg. 650-3. Seminar: Domestic and Urban Transportation: Policy and Practice. The ways in which transportation and transit systems initiate, develop, and support 20th century urbanized society. Particular emphasis is given to the ways in which transport and transit systems have fostered urbanization and the role of transportation and transit systems in the further development of modern society. Prer., graduate standing in College of Business or Engineering, or economics or public administration major.

Tr.Mg. 699-variable credit. Independent Study. With consent of instructor under whose direction the study is undertaken.

School of Education

UNDERGRADUATE TEACHER EDUCATION

T.Ed. 301-3. Economics and the Social Sciences: Foundations of the Curriculum I. (Econ. 311.)

T.Ed. 302-3. Economics and the Social Sciences: Foundations of the Curriculum II. (Econ. 312.)

T.Ed. 309-2. Foundations of American Education: Elementary. A study of American education in its cultural setting; its nature, role and function in society, including political, historical, philosophical, sociological, economic, religious, and other foundation aspects. Concurrent lab experience in the schools required.

T.Ed. 310-2. Educational Psychology for Elementary School. Psychological bases of teaching and learning with applications at the elementary school level.

T.Ed. 311-2. Child Growth and Development. Basic course for elementary school teachers.

T.Ed. 375-1 to 4. School-Based Group Tutorial I. Teaching experience in small groups in an elementary or secondary school setting.

T.Ed. 376-1 to 4. School Based Group Tutorial II. Teaching experience in small groups in an elementary or secondary school setting.

T.Ed. 400-1. Educational Media Laboratory. An introduction to educational media used in elementary and secondary schools, including the production and instructional uses of equipment, materials, sources, and programs.

T.Ed. 401-3. Educational-Social Problems of Mexican/Americans. A study of the educational social problems of the Spanish-speaking in the United States as interpreted through professional literature.

T.Ed. 403-3. Methods and Materials in Bilingual Education. A survey of the current methods and materials being used in bilingual programs.

T.Ed. 410-3. Foundations of American Education. A study of American education in its cultural setting and its nature, role, and function in society, including political, historical, philosophical, sociological, economic, religious, and other foundation aspects. Includes school-based tutorial experience.

T.Ed. 411-3. Educational Psychology and Adolescent Development. A basic course for secondary school teachers dealing with psychological processes of instruction in general, and adolescent growth and development in particular.

T.Ed. 412-3. Principles and Methods of Secondary Education. Emphasis on objectives, functions, modern philosophy, curriculum, discipline, planning, etc. For junior and senior high school levels.

T.Ed. 415-9. Basic Elementary Block. Curriculum, materials, methods, evaluation, and related aspects of instruction for elementary pupils in language arts, mathematics, media, reading, science, social foundations, social studies, and special education.

T.Ed. 420-2. Methods in Elementary Language Arts. Creative writing, spelling, language development, handwriting, listening, choral speaking, questioning, nonverbal communication, creative dramatics, and evaluation of language learning.

T.Ed. 421-2. Methods in Elementary Mathematics. Preparation in the teaching and content of mathematics at the elementary school level. Required of all students in the elementary professional year program. Prerequisite for student teaching.

T.Ed. 422-2. Methods in Elementary Reading. Understanding and acquisition of basic methods in the teaching of reading at the elementary school level. Content includes the understanding and teaching procedures in basic reading programs, language experience, and individualized reading instructions.

T.Ed. 423-2. Methods in Elementary Science. Covers the methods and materials available for teaching science in the elementary school. Part of the required block for the elementary education professional year.

T.Ed. 424-2. Methods in Elementary Social Studies. Familiarization with the elementary social studies curriculum as pertains to elementary public schools. Emphasizes organization (lesson plans and units), new trends, textbooks, new programs and materials, concepts in teaching geography, economics, government, and other social science topics.

T.Ed. 435-2. Kindergarten Education. The kindergarten movement. Characteristics of young children. Curriculum, testing and evaluation. Parent-teacher cooperation.

T.Ed. 441-3. Teaching Reading and Writing in the Content Areas. Presents diagnostic, remedial, and developmental techniques in reading and composition especially adapted to uses in subject matter areas. Primarily for students preparing to teach in the secondary schools.

T.Ed. 442-3. Developing Reading Skills in the Junior and Senior High School. Format variations from content area to content area, materials, equipment, readability of content materials, vocabulary, variations in comprehension, and variations in study procedures.

T.Ed. 443-3. Teaching Reading in Content Areas at the Secondary Level. See Rdg. 502-3.

T.Ed. 444-3. Literature for Adolescents. See Sec.E. 531-3.

T.Ed. 445-3. Advanced Composition for Secondary School English Teachers. See Sec.E. 533-3.

T.Ed. 446-1 to 3. Teaching the Learning Disordered in the Regular Classroom. Individualizing instruction for emotionally disturbed learning disabled children in the regular classroom. Developing and applying competencies in diagnosis, programming, and remediation.

T.Ed. 447-2. Teachers, Materials, and Learning. Provides elementary and preschool teachers and aides with an opportunity to become involved with a range of concrete materials in science, environmental studies, language arts, and music, and to consider the implications of their own learning for their work in school.

T.Ed. 452-3. Methods and Materials in English. Curriculum, materials, methods, evaluation, and related aspects of instruction. Integration of content and methodology. Secondary level.

T.Ed. 453-3. Methods and Materials in Social Studies. Curriculum, materials, methods, evaluation, and related aspects of instruction. Integration of content and methodology. Secondary level.

T.Ed. 454-3. Methods and Materials in Science. Curriculum, materials, methods, evaluation, and related aspects of instruction. Integration of content and methodology. Secondary level.

T.Ed. 455-3. Methods and Materials in Mathematics. Curriculum, materials, methods, evaluation, and related subjects of instruction. Integration of content and methodology. Secondary level.

T.Ed. 456-3. Children's Literature. Reading and evaluation of books for children, children's interests in reading, important authors and illustrators, poetry, folk literature, and trends.

T.Ed. 470-4 or 8. Student Teaching—Elementary School. Kindergarten and grades one through six.

T.Ed. 471-4 or 8. Student Teaching—Secondary School. Student teacher attends a senior or junior high school in Boulder-Denver metropolitan area.

T.Ed. 472-4. Elective Assignment, Secondary. This is the final experience in the secondary professional year. It involves a wide number of possibilities for the students, and arrangements are made on an individual student basis. Prer., admission to secondary professional year.

T.Ed. 473-6. Elective Assignment, Elementary. This is the final experience in the elementary professional year. It involves a wide number of possibilities for the students, and arrangements are made on an individual basis. Prer., admission to elementary professional year.

T.Ed. 475-6. Instructional Assistant Laboratory. A variety of experiences and assignments in the public schools.

T.Ed. 479-1. Senior Seminar: Elementary. Accompanies the student teaching assignment and includes workshops and seminar sessions.

T.Ed. 482-1 to 4. Workshop in Curricular and Instructional Development. Consideration given to current trends in curriculum development and in organization for instruction. Depth study of one or more specific plans for classroom procedure.

T.Ed. 483-0 to 4. Instructional Workshop. Current instructional approaches are considered. Focus is upon classroom applications with in-depth study of selected topics. Advanced-level work but credited toward graduate degrees only as a minor.

T.Ed. 490-1 to 6. Independent Study.

ADMINISTRATION AND SUPERVISION

Ad.S. 500-2. Problems and Trends In Education. A broad overview of current problems in schools and school systems and consideration of practices and policies in U.S. schools for solution of such problems. Evaluates procedures for solving educational problems.

Ad.S. 502-3. Introduction to Educational Administration. Responsibilities of boards of education and administrators; nature of administrative leadership, and introductory consideration of finance and public relations. State, local, and federal relationships in education.

Ad.S. 505-3. The Community College. Origins, functions, organization, and current trends in the junior or community college. For present and prospective teachers and administrators in two-year colleges.

Ad.S. 510-3. School Law. Recent developments including administrative implications of significant court decisions pertaining to school operations generally. For superintendents, principals, school board members, and prospective administrators.

Ad.S. 511-2. School and Community Relations. Principles, practices, materials, and techniques used in public relations in sections of the country. Students may develop materials for own use.

Ad.S. 512-2. Personnel Administration. Personnel problems in the administration of public and private school systems. Policies affecting personnel, rights and responsibilities of teachers, salary schedules, retirement, sick leave, collective negotiations, etc.

Ad.S. 513-3. School Finance. For advanced students and school superintendents. Problems of educational finance; theory, practice, and control; equalization funds, federal-state-local relations in finance, budgeting, salary schedules, retirement, and school bonds.

Ad.S. 514-3. Educational Facilities Planning. *Alternate years.* Determination of school plant needs; relation of educational and architectural services; criteria of adequate school plants, site development, building operation and management; financial problems.

Ad.S. 517-3. Administration and Supervision of the Elementary School. For administrators and teachers. Purposes, practices, and trends in administration and educational leadership.

Ad.S. 518-3. Administration and Supervision of Secondary Schools: Senior and Junior/Middle Schools. Current administrative principles and practices essential to effective organization and management, with emphasis on the educational leadership of the principal.

Ad.S. 520-2. Educational Supervision. Stimulating and guiding the in-service professional growth of teachers. Evaluation of teacher activities in relation to pupil growth. Supervisory procedures and techniques.

Ad.S. 521-3. Group Development and Training. Organizational theory and practice for school leadership personnel with emphasis on group development, group problem identification and solutions, and conflict management skills and processes.

Ad.S. 530-2. Elementary Principalship Intensive. *Offered even summers only.* Two-week in-depth examination of the elementary school principalship. Required for Type D administrative certification, elementary school. Consent of instructor required.

Ad.S. 560-2. Seminar: Supervision. Students work on individual topics and report orally and in writing.

Ad.S. 561-2. Seminar: School Administration. Students develop and analyze case studies using organizational behavior concepts.

Ad.S. 581-1 to 3. Workshop in Educational Administration and Supervision. Designed to meet the unique needs and interests of educational leaders by drawing upon relevant concepts and ideas from educational administration and supervision and testing their application in field-based settings. Not to be applied toward a degree.

Ad.S. 590-1 to 4. Independent Study in Administration and Supervision.

Ad.S. 601-2. Seminar: Educational Leadership. Seminar dealing with processes and patterns of educational leadership in the schools. Graduate students from various specialties interact with faculty members in preparing for leadership roles. May be taken more than one semester for credit with adviser's approval.

Ad.S. 610-2. Theory of Educational Administration. Study of organizational models, theories, and communication patterns; leadership roles and behavior; and organizational change. Attention to recent research in administrative theory.

Ad.S. 620-2. Doctoral Study of Educational Supervision. Stimulating and guiding the in-service professional growth of teachers. Evaluation of teacher activities in relation to pupil growth. Supervisory procedures and techniques.

Ad.S. 624-3. Planning and Administration in Community College. Principles and practices in the application of modern management concepts and administrative tools including data base, student flow information, output measurement, PPBS. Lectures, discussion, simulations, student projects. Prer., instructor consent.

Ad.S. 630-3. Advanced Seminar: School Law. An in-depth examination of the American legal process as it pertains to administration, planning, and delivery of educational programs. Involves self-selected research followed by individual or group presentations.

Ad.S. 662-2. Seminar: Educational Supervision. Students work on individual topics and report orally and in writing.

Ad.S. 670-1. Internship in Administration and Supervision. Supervised on-the-job experience with related reading and study.

Ad.S. 690-1 to 4. Independent Study: Elementary School Administration.

Ad.S. 691-1 to 4. Independent Study: Middle Level School Administration.

Ad.S. 692-1 to 4. Independent Study: Senior High School Administration.

Ad.S. 693-1 to 4. Independent Study: Central Office Administration.

Ad.S. 694-1 to 4. Independent Study: Educational Administration.

Ad.S. 695-1 to 4. Independent Study: Supervision.

Ad.S. 700-4. Master's Thesis.

Ad.S. 701-2. Master of Education Report.

Ad.S. 800-0 to 8. Doctor of Philosophy Dissertation.

Ad.S. 801-0 to 8. Doctor of Education Dissertation.

CURRICULUM

Curr. 501-3. Curriculum for Mexican Americans. Effect of the standard school curriculum on bilingual-bicultural children; strengths and weaknesses. Planning for change in the teacher, curriculum, school, and community.

Curr. 502-2. Intercultural Education for Teachers. Intercultural factors and problems and their influence on the student, the teacher, and the educative process.

Curr. 503-3. Bilingual and Bicultural Education. Includes various components of bilingual education curricula methodology as well as diagnostic and assessment processes with emphasis on the needs of bicultural children. It includes various bilingual education models for non-English speaking children as well as provision for the development of fluency in bilingualism among all children.

Curr. 504-3. Multicultural Education. A study of selected American ethnic-racial groups and their history, culture, and social conflicts planned to help teachers develop an awareness and sensitivity to these groups. Ethnic groups will include Mexican-Americans, Blacks, Native Americans, and others. Students will cover basic units for selected groups and will also complete an independent project or study of their choice.

Curr. 505-3. Testing, Materials, and Methodology in Bilingual/Bicultural Education. A survey of testing instruments used in Spanish-English bilingual/bicultural programs. In-depth investigation of specific methods and materials used in bilingual/bicultural programs.

Curr. 511-3. Elementary School Curriculum. An integrating course dealing with the history, development, problems, and practices of the curriculum of the elementary school.

Curr. 512-3. Junior and Senior High School Curriculum. Principles, trends, problems, and practices in the curriculum of the junior and senior high schools.

Curr. 513-2. Student Activities Curriculum. Principles, problems, and procedures for improvement of extra-class activities, student councils, home rooms in the secondary school, etc.

Curr. 514-3. Curriculum Construction. Methods of constructing and revising curricular programs. Procedures for securing and utilizing data concerning educational needs in curriculum decision-making.

Curr. 515-3. Junior High School/Middle School Education. Stimulation and direction of constructive activities of adolescent boys and girls. Problems of management, curriculum, school life, guidance, and community relations.

Curr. 516-3. Curriculum and Instruction in Higher Education. An examination of current practices and innovations in curriculum and instruction. Techniques of program building and instructional design will be explored and applied to specialized student projects.

Curr. 530-3. Preschool Through College Curriculum for Mexican Americans. An analysis of curriculum programs and the application of principles and innovation for the education of Mexican Americans at all levels of school.

Curr. 531-2. Seminar: Curriculum. Advanced course relating to theory and practice in curriculum-building. Includes both elementary and secondary levels.

Curr. 532-2. Problems in Junior High School/Middle School Education. Case studies and seminar approach to theory and practice on an advanced level.

Curr. 571-1 to 4. Internship in Curriculum Development. Supervised on-the-job experience in curriculum development with related reading, study, and discussion.

Curr. 581-2 to 4. Workshop in Curriculum. Consideration given to current trends in curriculum development and in organization for instruction. Depth study of one or more specific plans for classroom procedure.

Curr. 591-1 to 4. Independent Study in Curriculum Development.

Curr. 592-1 to 4. Independent Study in Junior High School/Middle School Education.

Curr. 593-1 to 4. Readings in Intercultural Curriculum.

Curr. 601-2. Current Developments in Leadership. See Ad.S. 601.

Curr. 602-1 to 4. Practicum in Bilingual-Bicultural Education. Supervised field experiences with bilingual-bicultural programs. Credit to be arranged. Prer., consent of instructor.

Curr. 603-3. Seminar: Bilingual Education. A comparative evaluation of the current research, issues, and trends relevant to bilingual-bicultural education.

Curr. 611-3. Curricular Theories. Intensive study of current theories of public school curriculum related to trends in actual practices in elementary and secondary schools.

Curr. 612-3. Processes and Materials in Curriculum Appraisal. Designed to provide curriculum workers with skills in the process of assessment of curriculum programs and skill in the appraisal of curriculum materials. The course will include work in the theory of evaluation, the methodology of evaluation, and practicum in evaluation of curricula. Prer., one course in curriculum.

Curr. 631-2. Doctoral Seminar: Curriculum. Advanced course relating to theory and practice in curriculum-building. Includes both elementary and secondary levels.

Curr. 632-2. Doctoral Seminar: Junior High School/Middle School Education. For advanced students. Problems, theories, and trends in secondary education. Includes field work and individual projects.

Curr. 671-1 to 4. Internship in Curriculum Development. Supervised on-the-job experience in curriculum development with related reading, study, and discussion.

Curr. 672-3. Testing, Materials, and Methods in Bilingual-Bicultural Education. A survey of testing instruments used in Spanish-English bilingual-bicultural programs. In-depth investigation of specific methods and materials used in bilingual-bicultural program.

Curr. 691-1 to 4. Independent Study in Curriculum Theory.

Curr. 692-1 to 4. Readings in Curriculum.

Curr. 693-1 to 4. Independent Study in Junior High School/Middle School Education.

Curr. 700-4. Master's Thesis.

Curr. 701-2. Master of Education Report.

Curr. 800-0 to 8. Doctor of Philosophy Dissertation.

Curr. 801-0 to 8. Doctor of Education Dissertation.

ELEMENTARY EDUCATION

El.Ed. 500-3. Systematic Analysis of Teaching. Investigation and development of systems for analyzing the teaching-learning process.

El.Ed. 501-3. Contemporary Teaching Tactics. Research, preparation, and participation in current teaching tactics utilized in classes at all levels of instruction (elementary, secondary, and college). Students select, prepare, and present strategies such as valuing, interaction analysis, inquiry, simulations, role playing, questioning techniques, etc., as agreed upon by the class.

El.Ed. 504-3. Curriculum Materials Analysis. See Sec.E. 504.

El.Ed. 510-2. Seminar: Elementary Education. Students work on individual topics and report orally and in writing. Prer., consent of instructor.

El.Ed. 513-3. Preparation and Utilization of Teaching Materials. Course for teachers and supervisors to develop skill in making their own materials, locating sources of materials, and commercially evaluating such materials. Operation and maintenance of equipment in the classroom.

El.Ed. 531-3. Children's Literature. Reading and evaluation of books for children, children's interests in reading, important authors and illustrators, poetry, folk literature, and trends.

El.Ed. 532-3. Advanced Language Arts in Elementary School. Current thought, as determined by research findings, in the various areas of the language arts; oral and written communication, spelling, handwriting, usage, grammar, foreign languages, and bilingual education.

El.Ed. 533-2 or 3. Current Literature for Children. Current books and media material in children's literature. This course is for people who have not had a course in this area within the past five years. Prer., course in children's literature, or consent of instructor.

El.Ed. 534-3. Language Arts for Urban Schools. Adaptation of intact senses for listening, speaking, reading, and writing. Diagnosis for weaknesses in listening, speaking, and coordination and application of dramatic play, oracy procedures, sensory imagery, and creative expression. Preparation of cases, records, and application of differential instruction. (Elective at the undergraduate level.)

El.Ed. 535-3. Advanced Science in Elementary Schools. Emphasis on experimental programs and implementation of these newer programs. Supervision and curriculum development considered.

El.Ed. 536-3. Supervision of Science Curriculum. Workshop for supervisors of science in city school systems; basic content in science fields.

El.Ed. 540-3. Contemporary Mathematics for Elementary Schools. Deals with contemporary mathematical content and teaching techniques. More emphasis is placed on mathematical background for the teacher and experimental projects. Prer., T.Ed. 431 or its equivalent and elementary teaching experience.

El.Ed. 541-3. Elementary Mathematics Curriculum. An in-depth study of curriculum building in mathematics at the elementary school level (K-8). Particular attention will be given to selection of instructional materials, establishment of content, and evaluation of programs.

El.Ed. 545-3. Advanced Social Studies in Elementary School. Review and analysis of current innovations and concept formation in the social studies. Involves student development and implementation of materials for trial in classroom instruction.

El.Ed. 546-3. Elementary Social Studies Curriculum Evaluation. Course examines existing social studies curricula from selected locations within the United States in light of latest materials and programs. Aims at students updating their own programs and revising them in accordance with the latest thought and materials available.

El.Ed. 550-2. Kindergarten Education. The kindergarten movement. Characteristics of young children. Testing and evaluation. Parent-teacher cooperation.

El.Ed. 580-2 to 4. Curriculum Workshop for Elementary School Teachers. Opportunity to work on projects and problems in the school in which the student is employed; conferences, study groups, discussion, and work in curriculum construction. Prer., 18 semester hours in education and teaching experience.

El.Ed. 590-1 to 4. Independent Study in Elementary Education.

El.Ed. 591-1 to 4. Readings in Elementary Education.

El.Ed. 631-2. Seminar: Children's Literature. In-depth study of topics such as the following: development of a literature program, banning books, bibliotherapy, appropriateness of award-winning books, books for minority groups, and trends in children's literature. Prer., course in children's literature.

El.Ed. 640-2. Seminar: Mathematics Education. See Sec. Ed. 640.

El.Ed. 690-1 to 4. Independent Study in Elementary Education.

El.Ed. 691-1 to 4. Readings in Elementary Education.

El.Ed. 700-4. Master's Thesis.

El.Ed. 701-2. Master of Education Report.

El.Ed. 800-0 to 8. Doctor of Philosophy Dissertation.

El.Ed. 801-0 to 8. Doctor of Education Dissertation.

GUIDANCE AND COUNSELING

Note: The master's program in guidance and counseling is designed to start in summer only.

G.C. 501-3. Foundations of Personnel Services. Introduction to the field of guidance and personnel services. Topics include objectives of guidance and counseling, theoretical bases of counseling, roles and functions of counselors, measurement techniques, and ethics.

G.C. 502-3. Laboratory in Personal Appraisal. Taken in conjunction with G.C. 501 this course provides the student with experience designed to stimulate self-appraisal vis-à-vis the field of guidance. Focused field experiences will be employed in addition to group interaction.

G.C. 503-3. Guidance in the Classroom. Methods for promoting group interaction — basic interviewing strategies, management of behavior problems, developing career awareness in subject areas. Positive approaches to working with culturally different students.

G.C. 510-3. Theory and Techniques of Counseling. Theories of counseling and skills needed to facilitate interpersonal relationships. Interviewing techniques and other specific helping relationship skills. Twenty hours of microcounseling in a laboratory required in addition to classroom instruction. Prer., G.C. 501 and 502.

G.C. 511-3. Advanced Theory and Techniques of Counseling. The application of counseling techniques in specific circumstances including group counseling and classroom situations. Emphasis on application approaches such as transactional analysis, Gestalt techniques, and role playing. Twenty hours of participation in an intensive group experience required in addition to classroom instruction. Prer., G.C. 501, 502, and 510

G.C. 512-3. The Student in Higher Education. Consideration of research and theory pertaining to the college student as a learner and the effects of environmental differences on changing behavior of the student.

Note: Prerequisite for enrollment in G.C. 530, G.C. 531, G.C. 532, and/or G.C. 533 is the completion of G.C. 501, G.C. 502, G.C. 510, and either completion or concurrent enrollment in G.C. 511, and instructor consent.

G.C. 530-3. Field Work in Agency Counseling. Directed observational experience in a variety of agency counseling settings, including rehabilitation agencies, employment services, mental health clinics, etc. Helps students familiarize themselves with the techniques used in agencies. Ten hours in field setting in addition to class sessions.

G.C. 531-3. Field Experience in Guidance. Primary emphasis is directed observational experience in various counseling and personnel service settings. The experiences will help students familiarize themselves with the counseling techniques used in these settings. Ten hours in field setting in addition to class sessions.

G.C. 532-3. Field Work in College Student Personnel. Orientation experiences in each of several student personnel services including financial aid, admissions, career development and placement, and veterans advising. Ten hours in field setting in addition to class sessions.

G.C. 533-3. Professional Seminar: Guidance. Provides in-depth attention to a limited number of special interest topics to be determined by the interests of the students and instructor.

G.C. 580-3. Elementary Guidance. Examines the roles and functions of the counselor at the elementary school level. Growth and development stages will be presented as well as appropriate guidance techniques.

G.C. 581-3. Intervention Strategies in Elementary Guidance. Prepares the student to assume the role of a counselor at the elementary level. Consultation, counseling, and coordination strategies will be emphasized as they relate to the elementary school.

G.C. 582-3. Strategies in Agency Settings. Explores the role and function of the counselor in agency settings with emphasis on the underlying historical and theoretical concepts.

G.C. 583-1 to 4. Workshop in Guidance. Workshop is designed to allow specific topics to be explored in depth on a time-limited intensive basis.

G.C. 590-1 to 5. Independent Study.

G.C. 591-1 to 5. Readings in Guidance.

G.C. 601-2. Seminar: Educational Leadership. See Ad.S. 601.

Note: Prerequisite for enrollment in G.C. 610, 611, 612, 613, 614, and 615 is admission to a doctoral program in the School of Education.

G.C. 610-3. Seminar: Human Behavior. Explores the cognitive, affective, and psychomotor aspects of human behavior. It will emphasize both causation and the consequences of various modes of human behavior.

G.C. 611-3. Seminar: Leadership Skills and Human Behavior. An advanced course for doctoral students preparing for teaching, consulting, and leadership roles in counseling and the facilitation of behavior change.

G.C. 612-3. Seminar: College Student Personnel Administration. Research and problems in the organization, administration, and evaluation of student personnel services in institutions of higher education.

G.C. 613-3. Seminar: Counseling Research. In-depth study and analysis of published research in counseling.

G.C. 614-3. Seminar: Advanced Counseling Theory. Comparative evaluation of differing theoretical systems and constructs relevant to counseling application.

G.C. 615-3. Seminar: Guidance. Specific topics will depend on needs and interests of students in any particular class.

G.C. 620-variable credit. Teaching Methodology in Counselor Education. Instruction and practical experience in teaching in counselor education.

G.C. 640-3. Career Development. Provides students with competencies in career development and career counseling. Topics include theories of career development, information systems, decision making, and awareness of self and the world of work.

G.C. 641-3. Measurement and Appraisal. Helps the student gain competence in the basic fundamentals of tests and measurement. Topics include standardization, correlation, reliability, validity, norms, scoring, standard error of measurement, and restriction of range.

G.C. 642-3. Organization Development in Schools. Organization development in theory and practice with special attention to organization development in schools. Requires organization development project for course completion.

Note: Prerequisite for enrollment in G.C. 670, 671, 672, 673, 678, 679, and 680 is instructor consent.

G.C. 670-6. Practicum in Elementary Guidance. Supervised field experience in an elementary school setting.

G.C. 671-6. Practicum in Secondary Guidance. Provides in-depth practical experience in counseling in secondary schools.

G.C. 672-6. Practicum in Agency Counseling. In-depth, supervised practical experience in counseling in agency settings.

G.C. 673-6. Practicum in College Student Personnel. Supervised practice in college student personnel work.

G.C. 678-3. Advanced Practicum in Counseling. Supervised counseling experience, report writing, and case staffing procedures with emphasis on professional staff collaboration.

G.C. 679-1 to 4. Internship in Counseling and Personnel Work. Supervised preprofessional work experience; to be arranged individually.

G.C. 680-1 to 4. Internship in College Student Personnel Work. Supervised experience in college personnel organizations; to be arranged individually.

G.C. 684-3. Readings in Guidance. Focuses on special problems in the development of guidance services. Major activities are directed readings and small group work sessions.

G.C. 685-3. Problems in Counseling, Guidance, and Personnel Services. An examination of current trends and contemporary

problem issues in the professional area of counseling and personnel work. Designed for the practitioner in the field.

G.C. 686-3. Organization and Administration of Guidance and Personnel Services. Advanced professional course dealing with problems of program organization, development, and management; implementation of guidance strategies; and principles of organizational behavior.

G.C. 690-1 to 5. Independent Study.

G.C. 691-1 to 5. Readings in Guidance.

G.C. 700-4. Master's Thesis.

G.C. 701-2. Master of Education Report.

G.C. 800-0 to 8. Doctor of Philosophy Dissertation.

G.C. 801-0 to 8. Doctor of Education Dissertation.

LIBRARY-MEDIA

L.M. 501-3. Introduction to the Library Media Center. First course in program. Its purpose is to give students knowledge, skills, and motivation to integrate people, materials, equipment, and facilities into the school curriculum.

L.M. 503-3. Production of Educational Materials. Design and production of instructional materials for use by school library media specialists and teachers in educational situations. Projected and non-projected materials are produced, including graphics, photography, tape recordings, and overhead transparencies.

L.M. 505-3. Photography in Education. A course utilizing the photographic tools of visual literacy in organized instruction communication. Included are elements of message design, photographic skills, visual message implementation, and evaluation. Photographic systems employed are primarily 35mm still photography and super 8mm motion pictures.

L.M. 507-3. Television in Education. Examines the application of television to problems and goals in education. Stresses ways and means by which television can become a significant part of the educational process at all levels. Provides students an opportunity to produce and evaluate instructional TV programs.

L.M. 508-3. Programmed Learning. Designed to develop an understanding of the theoretical background of programmed instruction. Laboratory time for programming, computer-assisted instruction, and programmed instruction with the computer will be included.

L.M. 512-3. Policies and Procedures for Selection/Evaluation of Materials. Policies, procedures, selection aids, and evaluation criteria needed to develop and maintain a school library media collection are studied.

L.M. 513-3. Materials and Services for Children and Young Adults. Extensive and in-depth examination and evaluation of a broad range of materials and their utilization in instructional development and curriculum design.

L.M. 514-3. School Reference Service. Analysis and evaluation of reference resources and the provision for reference services in a school library media center.

L.M. 516-3. Cataloging Library Media. Terminology, philosophy, and practice in the application of cataloging, classification, and filing pertaining to various types of media.

L.M. 518-3. Administration of Library Media Programs. Administrative problems related to all the common educational media programs are studied. Primary emphasis is placed on the organization and administration of educational media services that support and extend opportunities for teaching and learning in the public schools.

L.M. 520-3. Methodology in Library Media Research. Analysis, evaluation, and interpretation of published library media research with examples of studies using the analytical, historical, descriptive, or experimental method and application of appropriate research methodology to a problem in the library media field.

L.M. 535-3. Information Storage and Retrieval. Examination of the various types of retrieval systems for use in school media programs. Several approaches to information retrieval include: manual information retrieval systems, whole document retrieval systems, and computer-based retrieval systems.

L.M. 540-3. Computer-Assisted Instruction (for Teachers). Examination of and experimentation with various trends in computer-assisted instruction. Design strategies and intrinsic programming techniques are applied within an existing CAI language.

L.M. 570-1 to 4. Internship in Library Media. Provides practical experience in the duties, services, and administration of a library media center. The intern will work cooperatively under the direction of the educational media supervisor of the participating library and faculty adviser.

L.M. 580-3. Educational Media—Theory and Practice for Teachers. The nature and scope of educational media, their nature and use are covered through practical hands-on experiences with audiovisual equipment and materials.

L.M. 582-1 to 3. Workshop in Library Media.

L.M. 590-1 to 4. Independent Study: Library Media. Prer., written consent of instructor.

L.M. 591-1 to 4. Readings in Library Media. Prer., written consent of instructor.

L.M. 601-2. Seminar: Educational Leadership.

L.M. 610-3. Fundamentals of Instructional Development. Provides students with instructional development skills. Several instructional development models are studied. Students will develop instructional development models with curricular content.

L.M. 612-3. Design of Mediated Instruction. Provides students with the skills necessary to analyze instructional problems, select teaching strategies, design mediated programs, and evaluate their effectiveness in teaching and learning.

L.M. 614-3. Educational Media Research and Evaluation. Will survey the basic research done since 1925 in the audiovisual and instructional television fields. Implications of that traditional body of research will be applied toward the more modern ideas of constructive evaluation as a means to continually improve learning systems.

L.M. 630-3. Seminar: Educational Media. Covers the definition and methods of solution of problems in educational media. Emphasis on experimental research in educational media and the use of the library. Required of all doctoral graduate students in Library Media program.

L.M. 670-1 to 4. Internship in Educational Media. Supervised field experiences for the advanced student in highly individualized learning situations with related reading, study, and consultation.

L.M. 690-1 to 4. Independent Study in Educational Media.

L.M. 691-1 to 4. Readings in Instructional Technology. Prer., written consent of instructor.

L.M. 700-4. Master's Thesis.

L.M. 701-2. Master of Education Report.

L.M. 800-0 to 8. Doctor of Philosophy Dissertation.

L.M. 801-0 to 8. Doctor of Education Dissertation.

PSYCHO-EDUCATIONAL STUDIES

Psycho-educational studies is a new program area resulting from the merger of educational and school psychology and special education. Courses previously listed under the E.Psy. and Sp.Ed. designations have been renumbered under P.E.S. *Note:* The master's program in special education starts only at the beginning of the fall semester and requires full-time participation.

P.E.S. 500-3. Advanced Psychological Foundations of Education. A survey of results of psychological inquiry with emphasis on applications to educational practices. Major topics include motivation, behavior, learning, development, and evaluation.

P.E.S. 501-3. Survey of Exceptional Children. Types of physically, mentally, and socially handicapped children; methods of diagnosis; suggested educational adjustments; and teaching techniques.

P.E.S. 502-3. Introduction to the Gifted Student. Assists the teacher in identifying, understanding, and challenging children with unusual abilities.

P.E.S. 503-3. Teaching the Mainstreamed in the Regular Classroom. Individualizing instruction for emotionally disturbed, learning disabled children in the regular classroom. Developing and applying competencies in diagnosis, programming, and remediation.

P.E.S. 504-3. Theories of Educating Emotionally Disturbed Children. An indepth analysis of current models (behavioral, psychodynamic, biophysical, ecological, etc.) used to explain

emotional disturbance. The theoretical foundations and associated intervention techniques for describing and remediating emotional disturbance will be compared and contrasted through an examination of the current literature.

P.E.S. 510-3. Advanced Child Growth and Educational Development. A review of knowledge of human growth and applications of this knowledge. Prer., P.E.S. 500.

P.E.S. 511-3. Human Learning. A review of research methods and results of the study of cognition and memory with implications for instruction and other educational practices. Prer., P.E.S. 500.

P.E.S. 512-3. Analysis of Learner Behavior. A systematic survey of current theory in motivation and learning with emphasis on analysis of classroom behavior. Prer., P.E.S. 500.

P.E.S. 513-3. Children's Thinking. A review of the psychology of thinking with emphasis on developmental changes in modes of thought. Topics include inference, problem solving, conceptual behavior and structures, and creativity. Prer., P.E.S. 500.

P.E.S. 514-3. Psycho-Educational Diagnostics I. Individual appraisal of human abilities; interpretation and application of individual intelligence data in the school setting. Prer., R.E.M. 501 and one previous graduate course in measurement and appraisal.

P.E.S. 515-3. Psycho-Educational Diagnostics II. Personal appraisal of the individual with emphasis upon educational application of projective personality data. Prer., consent of instructor.

P.E.S. 517-3. Individualizing Instruction. See Sec.E. 510.

P.E.S. 519-3. Adolescent Psychology for the Teacher. A review of selected topics in adolescent behavior.

P.E.S. 526-3. Seminar: School Psychology. Selected topics in the field of school psychology including consideration of current practice and literature. Prer., consent of instructor.

P.E.S. 527-3. Research Seminar: Educational Psychology. Intensive review of special topics in the application of psychological science to educational practice. Prer., P.E.S. 500.

P.E.S. 530-3. Education of the Mentally Retarded. Study of characteristics and needs of educable and trainable mentally retarded children.

P.E.S. 531-3. Characteristics of the Emotionally Disturbed. One 2-hr. lab. per wk. Survey of current theory and practice in area of emotional disturbance. Emphasis is on developing a systems model for observation, intervention, management, teaching styles, and educational practices. Observation, field trips, and tutoring required.

P.E.S. 532-3. Introduction to Learning Disabilities. One 2-hr. lab. per wk. Survey of current theory and practice in the area of learning disabilities. Emphasis is on developing a systems model for diagnosis, programming, and remediation. Observation and tutoring required.

P.E.S. 533-3. Evaluation in Special Education. One 2-hr. lab. per wk. Students critique evaluation studies in special education, design and conduct an evaluation study in special education.

P.E.S. 535-3. Methods for the Emotionally Maladjusted Child. One 2-hr. lab. per wk. Developing and applying diagnostic programming, and remedial competencies with learning disordered children (emotionally disturbed/learning disabled). Tutoring required. Prer., consent of instructor.

P.E.S. 536-3. Research in Special Education. One 2-hr. lab. per wk. Students critique research and development studies in special education, design and conduct a research study in special education. Prer., consent of instructor.

P.E.S. 537-3. Diagnostic Testing in Special Education. The administration and interpretation of a wide range of diagnostic tests, including the ITPA. The formulation of appropriate educational prescriptions based on test data.

P.E.S. 538-3. Methods and Materials for the Learning Disabled. Teaching strategies and materials in psychomotor, perception, memory, cognition, language, and academic areas for the learning disabled.

P.E.S. 539-3. Theory on the Education of Psychotic Children. Introduction to psychopathology of children with psychotic characteristics; emphasis on current research of intervention programs and teaching strategies.

P.E.S. 540-2. Seminar: Special Education. Problems approach to issues of learning disorders (emotionally disturbed and/or learning disabled). Prer., consent of instructor.

P.E.S. 569-3. Consulting with Pre-Service Student Teachers. Working with and supervising pre-service education student teachers who are doing case studies with mildly handicapped learners.

P.E.S. 570-1 to 4. P.E.S. 571-1 to 4. Practicum I: The Educationally Handicapped. *Fall, Spring.* Supervised field experiences with learning-disordered children (emotionally disturbed and/or learning disabled). Full time for 8 weeks, minimum 320 clock hours. Prer., consent of instructor.

P.E.S. 574-1 to 4. Practicum in Educational Psychology. Provides the graduate student with a wide variety of practical field experiences to further professional growth.

P.E.S. 575-1 to 4. Practicum in School Psychology. Selected supervised experience for advanced students in school psychology. Prer., consent of instructor.

P.E.S. 576-1 to 4. Internship in School Psychology. Direct field experience for psychology students only.

P.E.S. 580-1 to 4. Workshop in Psycho-Educational Studies. Techniques of managing and facilitating classroom and other related groups.

P.E.S. 590-1 to 4. Readings in Learning Disabilities.

P.E.S. 591-1 to 4. Readings in Special Education.

P.E.S. 593-1 to 4. Readings in Educational Psychology.

P.E.S. 598-1 to 4. Independent Study in Educational Psychology.

P.E.S. 599-1 to 4. Independent Study in Special Education.

P.E.S. 610-3. Seminar: Human Development. Intensive study of selected topics in growth and development, with applications to educational situations. Prer., P.E.S. 510 and consent of instructor.

P.E.S. 611-3. Seminar: Human Learning. Intensive study of selected topics in cognition and memory, with applications to educational situations. Prer., P.E.S. 511 and consent of instructor.

P.E.S. 612-3. Seminar: Learner Behavior. Intensive study of selected topics in the analysis and modification of human behavior in educational situations. Prer., P.E.S. 512 and consent of instructor.

P.E.S. 627-3. Research Seminar: Educational Psychology. Special topics in the application of psychological science to educational practice. Students have an opportunity to present their individual research interests and activities.

P.E.S. 693-1 to 4. Readings in Educational Psychology.

P.E.S. 698-1 to 4. Independent Study.

P.E.S. 700-4. Master's Thesis.

P.E.S. 701-2. Master of Education Report.

P.E.S. 800-0 to 8. Doctor of Philosophy Dissertation.

P.E.S. 801-0 to 8. Doctor of Education Dissertation.

READING

Rdg. 500-3. Improvement of Reading Instruction in the Elementary and Middle School. Comparative analysis of current and emerging philosophies, programs, and instructional practices for teaching reading in the elementary and middle school. Examination and evaluation of basal textbook, individualized, programmed, and hardware reading programs.

Rdg. 501-3. Developing Reading Skills in the Junior and Senior High School. Teaching techniques to improve reading skills and efficiency among junior and senior high school students.

Rdg. 502-3. Teaching Reading in Content Areas at the Secondary Level. Format variations from content area to content area, materials, equipment, readability of content materials, vocabulary, variations in comprehension, and variations in study procedures.

Rdg. 506-3. Teaching Reading at the College Level. Methods, materials, study skills, and levels of comprehension adapted to the college student requiring reading proficiency for academic success. Prer., consent of instructor.

Rdg. 510-3. Diagnostic and Remedial Techniques of Reading. Causes of low reading ability and techniques employed in teaching the poor reader; diagnosis, motivation, and skills.

Rdg. 511-3. Processes Involved in Reading. Concepts needed for understanding and critically evaluating the competencies involved in learning how to read. Examining and dealing with child and adolescent development and linguistic orientation.

Rdg. 530-1 or 2. Reading Conference. Visiting authorities in reading, lectures, demonstrations, discussion groups, films, exhibits, field trips, etc.

Rdg. 534-3. Organization and Management Procedures in Reading. Identifying, selecting, organizing classroom procedures and materials for general and remedial instruction, K-12.

Rdg. 535-3. Reading as a Social Force. An overall survey of mass communication fields (print, radio, film) with special emphasis on social relationships and implications of reading. Library science course.

Rdg. 570-4, 571-4. Reading Clinic Procedures I, II. Supervised diagnosis of reading problems; evaluation instruments; pertinent research; case study approach. Prer., Rdg. 510 or consent of instructor.

Rdg. 590-1 to 5. Independent Study: Reading. Intended only for those who wish to study along lines not followed by courses. Prer., written consent of instructor.

Rdg. 591-1 to 3. Selected Readings. Selected readings for advanced study in a specific area of reading instruction or research in reading.

Rdg. 611-3. Teaching Reading to Multilingual Students. Advanced study involving multilingual backgrounds, transition, and translation of linguistic concepts to include the impact of roots, socioeconomic education profiles, aspirations and conflicts, contemporary concerns, and suggestions for educational change.

Rdg. 612-3. Analyses of Research in Reading. Required of all doctoral candidates. Critical analysis and evaluation of published research studies in reading, principles of internal and external validity, and preparation of critique abstracts.

Rdg. 631-3. Seminar for the Reading Specialist. Primarily for doctoral students. Discussion of problems in the reading process, consulting and supervision, overview of diversified programs, organization and administration, and general trouble-shooting. Prer., consent of instructor.

Rdg. 670-1 to 4. Internship in Reading. Clinical and field experiences; evaluation and construction of materials; clinical and field research; experimentation. Prer., consent of instructor.

Rdg. 671-3. Supervision of Reading Clinic K-12. Planning and supervising clinical procedures and course tutoring functions among college students. Case study preparation and evaluation report writing included.

Rdg. 690-1 to 3. Independent Study. Prer., written consent of instructor.

Rdg. 691-1 to 3. Selected Readings. Selected readings for advanced study in a specific area of reading instruction or research in reading for advanced graduate students.

Rdg. 700-4. Master's Thesis.

Rdg. 701-2. Master of Education Report.

Rdg. 800-0 to 8. Doctor of Philosophy Dissertation.

Rdg. 801-0 to 8. Doctor of Education Dissertation.

RESEARCH AND EVALUATION METHODOLOGY

R.E.M. 500-3. Development of Educational Measures. The construction, interpretation, and evaluation of achievement tests, attitude measures, questionnaires, and sociometric measures. Item analysis, validity, reliability, and norming considerations. Interpretation and use of standardized intelligence and achievement tests.

R.E.M. 501-3. Introduction to Research and Statistics I. First course of a two-semester sequence in research design and analysis, for the consumer of research. Measures of central tendency, variability, percentiles, standard scores, and correlation. Basic concepts in statistical inference. Locating research information, internal and external validity. Design and analysis of experimental research. Critical analysis of published research.

R.E.M. 502-3. Introduction to Research and Statistics II. Design and analysis of correlational and survey research. Critical analysis of published research. Production of a research proposal. Prer., R.E.M. 501.

R.E.M. 570-1 to 5. Practicum in Educational Research and Evaluation I. Supervised practicum in educational research:

problem development, analysis, measurement, evaluation, and related computer experiences with ongoing research projects.

R.E.M. 603-3. Intermediate Statistical Methods. Sampling theory and inferential statistics; advanced applications for the testing of hypotheses regarding central tendency, variability, proportion, correlation, and normality; Chi-square, and the analysis of frequency data; multiple regression and prediction; introduction to the analysis of variance; and related computer programs for statistical analysis. Required of all doctoral candidates. Prer., R.E.M. 502.

R.E.M. 604-3. Experimental Design and Analysis I. Required of all Ph.D. candidates. Experimental and quasi-experimental designs in educational research; selecting an appropriate statistical test; power and statistical power efficiency; randomization and control; multiple comparisons; factorial experiments and interaction with fixed-factor and mixed designs; analysis of covariance; effects of assumption violations; related computer programs for statistical analysis. Prer., R.E.M. 603.

R.E.M. 605-3. Experimental Design and Analysis II. Offered alternate years. Intensive study of advanced experimental design and analysis. Topics to include general linear model; fixed, random, and mixed-effects analysis of variance (ANOVA) models; multiple comparisons techniques; ANOVA robustness; analysis of covariance; nested and hierarchical designs. Prer., R.E.M. 604; some proficiency in matrix algebra and a background in mathematical statistics is desirable.

R.E.M. 611-3. Test Theory and Application. Reliability and validity theory, empirical estimation of reliability and validity; standardization and norming, item analysis, problems in assessing intelligence, achievement, interest, and personality. Prer., R.E.M. 500, 604, or consent of instructor.

R.E.M. 612-3. Educational Evaluation. Study of models and methods for the evaluation of educational programs. Evaluation models proposed by curriculum and instructional researchers are critically examined. Application of methods of measurement and experimentation to evaluation problems is studied. Exemplary evaluation projects are studied in detail. Prer., R.E.M. 500, 502, or consent of instructor.

R.E.M. 630-3. Seminar: Research Methodology. Offered alternate years. Selected topics for advanced study in educational research, statistics, measurement, and evaluation. Prer., R.E.M. 604.

R.E.M. 631-3. Research Seminar for Doctoral Candidates. The development of the thesis prospectus including problem development, hypothesis formulation, literature review, research design, statistical analysis, related measurement, and computer considerations. Prer., R.E.M. 603.

R.E.M. 632-3. Time Series and Multivariate Analysis. Offered alternate years. An introduction to the theory of advanced multivariate statistical techniques and their application in educational research. Topics include the analysis of time-series experiments, multivariate ANOVA, canonical correlation, discriminant function analysis, and multiple regression.

R.E.M. 633-3. Theory of Measurement and Scaling. Offered alternate years. Concentrated study of special problems in the mathematical theory of behavioral measurement and scaling. Topics include generalizability theory, factor analysis applied to test development, unidimensional and multidimensional scaling.

R.E.M. 670-1 to 5. Practicum in Educational Research and Evaluation II. Continuation of R.E.M. 570.

R.E.M. 671-1 to 5. Internship in Educational Research I. Continuation of R.E.M. 670 with an educational agency or research and evaluation project.

R.E.M. 672-1 to 5. Internship in Educational Research II. Continuation of R.E.M. 671.

R.E.M. 691-1 to 5. Readings in Educational Research.

R.E.M. 692-1 to 5. Readings in Educational Measurement.

R.E.M. 693-1 to 5. Readings in Educational Evaluation.

R.E.M. 694-1 to 5. Readings in Educational Statistics.

R.E.M. 699-1 to 4. Independent Study in Educational Research.

R.E.M. 800-0 to 8. Doctor of Philosophy Dissertation.

R.E.M. 801-0 to 8. Doctor of Education Dissertation.

SECONDARY EDUCATION

Sec.E. 501-3. Mirrors and Models. Investigation and development of systems for analyzing the teaching-learning process.

Sec.E. 504-3. Curriculum Materials Analysis. Strategies for critical analyses of social studies curriculum materials will be the focus of this course. Students will learn a variety of analysis systems and will engage in practical applications of these systems.

Sec.E. 510-3. Individualizing Instruction. An individualized course which aids teachers in individualizing programs in their schools.

Sec.E. 511-3. Supervision of Student Teachers. Designed to develop competency in the supervision of student teachers, including attention to various modern and new approaches. For cooperating teachers as well as supervisors.

Sec.E. 512-3. Modern Trends in Teaching. Recent developments and trends in philosophy and techniques of teaching. For experienced teachers and administrators. Prer., course in educational psychology and methods in teaching.

Sec.E. 513-3. Preparation and Utilization of Teaching Materials. See Ed.Ed. 513-3.

Sec.E. 530-3. Teaching Language Arts (5 to 12). Aim and objectives; the language arts skills — reading, writing, speaking, listening; literature for adolescents; English as a second language. For experienced teachers.

Sec.E. 531-3. Literature for Adolescents. Reading and evaluation of books for junior and senior high school pupils. Emphasis on modern literature.

Sec.E. 532-4. Proseminar in Teaching Written Composition. This advanced level course provides opportunities for inquiry into processes of written composition. Special topics: rhetoric, style, language, evaluation, and assessment, invention, grouping techniques, editing techniques, and individual teaching/learning analysis.

Sec.E. 533-3. Advanced Composition for Secondary School English Teachers. Strategies for evaluating and teaching written composition in the secondary schools. Emphasis on structure of prose, invention, motivation, audience, and other rhetorical considerations, as well as on teaching methodologies.

Sec.E. 535-3. Issues and Problems in Science Education. Recent developments in theory, curriculum, methods, and materials in secondary science examined for their contribution to the objectives of science education. Prer., high school science teaching experience or consent of instructor.

Sec.E. 537-3. Environmental Education. Theory and practice of conservation education, including use of resource personnel and the study of curricular and instructional development. Field experiences incorporated. Primarily oriented to elementary and junior high school.

Sec.E. 538-3. Advanced Methods and Strategies for Teaching Secondary Science. Studies of methods, techniques, and strategies for teaching science from middle school through high school. Participation and demonstration required. Consideration of desired competencies expected. Evaluation of outcomes.

Sec.E. 540-3. Curriculum in Secondary Mathematics. Investigation of curriculum projects in secondary school mathematics, program development, history and trends, program and course objectives, and pertinent research.

Sec.E. 541-3. Advanced Methods and Strategies in Secondary Mathematics. In-depth investigation of specific methods and strategies suitable for teaching mathematics from the middle school through senior high school levels. Participants actively involved in the process of instruction by utilizing methods and strategies being considered.

Sec.E. 542-3. Teaching Mathematics to Low Achievers. Problems and characteristics of low achievers: motivation, attitudes, use of materials, what materials are available, programs for low achievers, mathematics laboratory, activity approach to teaching mathematics.

Sec.E. 543-3. Teaching Aids in Mathematics Education. Production and use of manipulative aids, audiovisual aids, and other materials for instruction for teaching mathematics. Open to all persons interested in teaching mathematics at any level.

Sec.E. 545-3. Simulation Games for Education. Alternate years. An introduction to the use of simulation games as they pertain to social studies instruction in the public schools. Introduction to available simulations and attention to various types of game design. Students required to attempt game design for particular social studies courses.

Sec.E. 546-3. Advanced Methods in Social Studies Education. Designed to meet the needs of experienced teachers and of those who will teach in public schools. Recent developments in theory and materials in the social studies examined and present practices analyzed for their contribution to general goals of social studies education. Appropriate for teachers in grades 7-12, but also profitable for elementary teachers with a specialization in social studies.

Sec.E. 560-3. Concepts and Process of Experiential Education. A field experience analyzing and investigating the educational values, dynamics, and significance of action-oriented learning. A 24-day Outward Bound course.

Sec.E. 561-3. Development of Experiential Education Programs. A seminar focusing on organizational development concepts, planning systems relevant to experiential education, and an analysis of existing programs in experiential education.

Sec.E. 562-3. Research and Evaluation of Experiential Education Programs. Covers fundamental statistics, basic research design, standardized instruments, instrument construction, systems analysis, approach to research, and an overview of more advanced techniques such as nonparametric statistics and multivariate analysis appropriate to the evaluation of experiential education programs in schools.

Sec.E. 563-3. Seminar: Experiential Education. Students identify, plan, implement, and evaluate an intensive experiential education experience. They serve as assistants to leaders directing experiential education programs and report their experiences orally and in writing.

Sec.E. 564-3. Experiential Education in a Humanistic Perspective. Open to practicing teachers, college faculty, counselors, and youth workers. Course content emphasizes the humanistic, psychological and philosophical foundations of experiential education, and looks at the practical implications of various positions.

Sec.E. 570-1 to 4. Advanced Practicum in Teaching. This course is not to be used as independent study but is to be used for groups approved in advance by the dean of the School of Education. Prer., consent of instructor.

Sec.E. 571-1 to 6. Internship in Secondary Education.

Sec.E. 580-2 to 5. Curriculum Workshop for Secondary School Teachers. Opportunity to work on projects and problems in the school in which the student is employed; conferences, study groups, discussion, and work in curriculum construction. Prer., 18 semester hours in education and teaching experience.

Sec.E. 590-1 to 4. Independent Study.

Sec.E. 610-2. Seminar: Junior and Senior High School Education. For advanced students. Problems, theories, and trends in secondary education. Includes field work and individual projects.

Sec.E. 611-2. Seminar: Education of Teachers. Alternate years. This seminar is concerned with an in-depth study of the theoretical base for the education of teachers. A critical study of the literature concerned with the education of teachers will be conducted from both historical and contemporary perspectives. Special attention will be paid to the recent research in the field with the intent of promoting better research. Seminar activities will include assigned reading, discussion, projects, research, oral reports, and critical analysis of research proposals.

Sec.E. 612-2. Survey of Major Research in Secondary Education. Survey of landmark and major contemporary research literature of secondary education. Design, data collection, analysis, and conclusions for nonpsychological research. Critiques of methods studies. (Prer., R.E.M. 501 and 502.)

Sec.E. 630-2. Seminar: English Education. Methods, analysis of courses of study, selection of materials, and study of recent research in English. Students present and discuss individual problems. Appropriate for teaching in grades 7-14.

Sec.E. 631-2. Seminar: Literature for Adolescents. In-depth study of topics such as adolescents and their responses to literature, censorship of books, bibliotherapy, development of literature programs appropriate for junior and senior high schools, books for minority groups, trends in literature programs. Prer., a course in literature for the adolescent.

Sec.E. 635-2. Seminar: Science Education. For advanced students in this subject area. Individual topics and research. Prer., Sec.E. 535, 536, and teaching experience.

Sec.E. 640-2. Seminar: Mathematics Education. For advanced students in mathematics education. Recent literature and research in mathematics education; new programs in mathematics. Individual topics and research plans. Prer., T.Ed. 455 or Sec.E. 540 and teaching experience.

Sec.E. 645-3. Seminar: Social Studies Education. Recent literature, problems, trends in social studies education. For experienced teachers in grades 7-12. Required of students working on graduate degrees in social studies education.

Sec.E. 671-3. Internship in Mathematics Education. Supervised experience with public schools and curriculum development in mathematics education. The internship will be in mathematics supervisory work, curriculum development, evaluation activities, and/or research.

Sec.E. 672-1 to 4. Internship in Science Education I. (Formerly Educ. 626.) Supervised experience with public schools and curriculum development agencies. The intern will engage in school science supervisory work, science curriculum development, and evaluation activities and/or research.

Sec.E. 673-1 to 4. Internship in Science Education II. (Formerly Educ. 627.) Continuation of Sec.E. 672.

Sec.E. 690-1 to 4. Independent Study: Secondary Education.

Sec.E. 691-1 to 4. Readings in Secondary Education.

Sec.E. 700-4. Master's Thesis.

Sec.E. 701-2. Master of Education Report.

Sec.E. 800-0 to 8. Doctor of Philosophy Dissertation.

Sec.E. 801-0 to 8. Doctor of Education Dissertation.

SOCIAL FOUNDATIONS

S.Fnd. 500-3. Advanced Social Foundations of Education. An evaluation of the social values and forces in American society that shape or influence the aims, philosophies, methods, content, issues, and problems of the American educational enterprise.

S.Fnd. 501-3. Education in Other Countries. A comparative evaluation of the political, historical, philosophical, sociological, economic, religious, and other foundational aspects of education in selected countries.

S.Fnd. 530-3. Educational Sociology. A sociological appraisal of the school in American society with reference to the status, role, activities, and relationships within the school, and of the school to other social institutions.

S.Fnd. 531-3. History and Philosophy of Early Education. Traces the development of educational theory and practice from ancient times to the 16th century.

S.Fnd. 532-3. Economics of Education. An examination of sources of economic support for education and the impact of education on national economy.

S.Fnd. 533-3. History and Philosophy of Modern Education. Traces the development of educational theory and practice from the 16th century to the present day, including education in the United States.

S.Fnd. 534-3. Contemporary Philosophies of Education. A critical examination of selected contemporary philosophies and their impact upon educational thought and practice.

S.Fnd. 535-3. Seminar: Social Foundations of Education. Special studies in the history and philosophy of education, comparative education, educational sociology, and the broad area of education and society. Prer., consent of instructor.

S.Fnd. 537-3. Images of the Future. A study of the future: implications for global society, for U.S. society, and for education; dealing with several ways of imagining the future, with value dimensions, with schools and curricula of the future, and with future studies and global studies as school subjects.

S.Fnd. 599-1 to 4. Independent Study in Social Foundations.

S.Fnd. 635-3. Seminar: Social Foundations of Education. Special studies in the history and philosophy of education, comparative education, educational sociology, and the broad area of education and society. Prer., consent of instructor.

S.Fnd. 636-3. Research Methodology in Social Foundations of Education. Methodology of research in the areas of social foundations. Emphasis on non-empirical approaches.

S.Fnd. 670-3. Teaching Internship in Social Foundations of Education. A one-semester teaching internship in undergraduate or

graduate foundations course. For social foundations doctoral students only.

S.Fnd. 693-3. Readings in Social Foundations of Education. Intensive readings in selected areas of educational foundations.

S.Fnd. 699-1 to 4. Independent Study: Social Foundations.

S.Fnd. 700-4. Master's Thesis.

S.Fnd. 701-2. Master of Education Report.

S.Fnd. 800-0 to 8. Doctor of Philosophy Dissertation.

S.Fnd. 801-0 to 8. Doctor of Education Dissertation.

College of Engineering and Applied Science

AEROSPACE ENGINEERING SCIENCES

Note: courses not having a semester designated may be offered in alternate years.

Aero. 130-2. Introduction to Aerospace Engineering I. *Fall, Spring.* Introduction to vector algebra with special emphasis upon the engineering approach to problem solving.

Aero. 195-1 to 3. Special Topics. Specialized aspects of the aerospace engineering sciences or innovative treatment of required subject matter at the lower division level. Course content will be indicated in *Schedule of Courses* and on the transcripts of those taking the course. Prer., variable.

Aero. 295 to 299-1 to 3. Special Topics. Specialized aspects of the aerospace engineering sciences or innovative treatment of required subject matter at the lower division level. Course content will be indicated in *Schedule of Courses* and on the transcripts of those taking the course. Prer., variable.

Aero. 304-3. Analytical Dynamics. *Fall.* Advanced treatment of the dynamics of particles, rigid bodies, and vibrating systems. Prer., A.Math. 231 or 235.

Aero. 311-3. Fluid Dynamics I. *Fall.* Elementary theoretical approach to the problems of fluid mechanics. Includes statics theorem, stream function, velocity potential, and the Laplace equation. Prer., A.Math. 232 or 236 and Aero. 304.

Aero. 312-3. Fluid Dynamics II. *Spring.* Mathematical analysis of fluid flow. Prer., Aero. 311.

Aero. 322-3. Structures I. *Spring.* Introduction to mathematical analysis of aerospace engineering structures. Prer., Aero. 304.

Aero. 326-3. Aerospace Materials. *Spring.* Introduction to materials science; applications to materials in aerospace engineering. Prer., E.Phys. 213.

Aero. 336-3. Foundations of Propulsion. *Spring.* Topics relating to thermodynamics of fluid systems, with emphasis on propulsion. Prer., Aero. 311 and Engr. 301.

Aero. 363-3. Introduction to Acoustics and Noise. (Arch.E. 363.) Engineering and physiological foundations of acoustics. Individual and social response to sound. Environmental noise problems. Engineering and legal control of noise. Prer., junior standing or consent of instructor.

Aero. 380-3. Bioengineering I. *Spring.* Human response to environment and physical stimuli. Use of engineering and physical principles in the study of human dynamics. Prer., Chem. 202, E.Phys. 213, and Engr. 301, or consent of instructor.

Aero. 395 to 399-1 to 3. Special Topics. Specialized aspects of the aerospace engineering sciences or innovative treatment of required subject matter at the upper class level. Course content will be indicated in *Schedule of Courses* and on the transcripts of those taking the course. Prer., variable.

Aero. 400-1 to 6. Independent Study.

Aero. 403-3. Flight Mechanics. *Spring.* Performance, static stability and control; dynamic stability and control, dynamic stability of subsonic aircraft. Prer., Aero. 304, 312, and 336; coreq., Aero. 441.

Aero. 406-3. Introduction to Space Dynamics. *Fall.* Central force fields and satellite orbits. Orbital transfer problems. Rigid body dynamics of space vehicles. Prer., Aero. 304.

Aero. 413-3. Gasdynamics and Propulsion. *Fall.* Dynamics of one- and two-dimensional compressible fluid flow including heat addition, subsonic and supersonic flow in ducts and over aerodynamic bodies. Thermodynamics of jet engines and rockets. Prer., Aero. 312 and 336.

Aero. 417-2. Aerospace Laboratory. *Spring.* One lab. and one rec. per wk. Fundamental measurements in experimental study of

aeronautics and astronautics. Prer., Aero. 304, 312, 322, 326, and 336.

Aero. 441-3. Guidance and Control. *Spring.* A modern introduction to the automatic control of dynamical plants approximable as linear and autonomous. Vector-matrix algebra, matrix transfer functions (resolvents), stability, and design by performance criteria are stressed. Examples include flight control, booster stabilization, and satellite attitude control. Prer., Aero. 304.

Aero. 447-3. Computational Fluid Mechanics. *Fall.* (Similar to Aero. 547.) Numerical solution of fluid mechanics problems involving ordinary and partial differential equations of various types. Prer., C.S./E.E. 201 and Aero. 312 or consent of instructor.

Aero. 456-3. Aircraft Design. *Fall.* One rec. and two lab. per wk. Principles of aircraft layout to meet a given specification, taking account of both aerodynamic and structural considerations. Design of major elements of an aircraft. Coreq., Aero. 403 and 413.

Aero. 460-0. Senior Seminar. *Fall.* Discussion of problems an engineer will face in selecting a job and what is expected of him by his employer. Prer., senior standing.

Aero. 461-1 to 3. Undergraduate Research. *Fall.* Assignment of a research problem on an individual basis.

Aero. 462-1 to 3. Undergraduate Research. *Spring.* Assignment of a research problem on an individual basis.

Aero. 495-1 to 3. Special Topics. Specialized aspects of the aerospace engineering sciences or innovative treatment of required subject matter at the upper class level. Course content will be indicated in *Schedule of Courses* and on the transcripts of those taking the course. Prer., variable.

Aero. 500-1 to 6. Independent Study. Study of special projects.

Aero. 501-3. Atmospheric Flight Mechanics. Generalized drag and power equations. Equations for flight over a flat earth. Problems of range, endurance, take-off, landing. Performance of hypervelocity vehicle. Prer., Aero. 403 and 413.

Aero. 505-3. Space Flight Dynamics. *Fall.* Review of the two-body motion. Determination of orbits. Visibility from orbits. Orbital transfer and rendezvous. Decay of satellite orbits. Influence of the earth's oblateness. Prer., consent of instructor.

Aero. 511-3. Ideal Fluids. The equations of motion, potential flow, circulation and vorticity, axially symmetric flow, review of complex variables and potential theory, conformed mappings, airfoil theory, stratified fluids, and gravity wave mechanics. Prer., Aero. 312.

Aero. 512-3. Viscous Fluids. (M.E. 534.) Navier-Stokes equations, boundary layer theory, laminar and turbulent flow over a flat plate, pressure gradient effects, transition. Prer., Aero. 312.

Aero. 513-3. Compressible Fluids. Dynamics of nonviscous, compressible, subsonic, and supersonic fluid flow; theory of characteristics, shock waves; slender body and wing theory. Prer., Aero. 413.

Aero. 514-3. Introduction to Turbulence. Physical properties of turbulence, shearflows, heat transfer, homogeneous turbulence, diffusion and turbulence in compressible and electrically conducting fluids. Prer., consent of instructor.

Aero. 517-3. Macroscopic Physics of Fluids. (M.E. 532.) *Fall.* Basic equations, fluid at rest and its stability; waves, fluid in motion and its stability; energy transfer; turbulent motion. Prer., Aero. 413 or consent of instructor.

Aero. 518-3. Microscopic Physics of Fluids. *Spring.* Physics of particles, physics of uniform fluids, kinetic description of fluids; transport phenomena, radiation transport. Prer., Aero. 413 or consent of instructor.

Aero. 525-3. Air Pollution. *Fall.* Effect of air pollution on materials, plants, animals, humans, and ecological changes. Sources of air pollution. Chemistry, diffusion, and dispersal of pollutants. Prer., senior standing or consent of instructor.

Aero. 527-3. Noise Pollution and Abatement. *Fall.* Advanced course in the basic physics and physiology of sound. Study of determinants of sound leading to "noise." Identification of "noise" sources and characterization of the detrimental physiological effects of such noise. Promotion of principles governing "noise" control and the application of such controls. Prer., Aero. 363 or Arch.E. 363 or consent of instructor.

Aero. 530-3. Nuclear Energy Systems. *Fall.* Foundations of nuclear energy systems; review of reactor theory, nuclear electric power plants, systems for nuclear auxiliary power, analysis of nuclear energy systems for aerospace propulsion. Prer., consent of instructor.

Aero. 535-3. Advanced Propulsion. *Fall.* Chemical combustion calculations for multicomponent gases and application to air-breathing and rocket propulsion systems; performance criteria and scaling laws; introduction to chemical reaction rates; combustion instability and nozzle heat transfer; ion propulsion and MHD generators. Prer., Aero. 413 or consent of instructor.

Aero. 547-3. Computational Fluid Mechanics. *Fall.* (Similar to Aero. 447.) Numerical solution of fluid mechanics problems involving ordinary and partial differential equations of various types. Prer. C.S./E.E. 201 and Aero. 312 or consent of instructor.

Aero. 556-3. Spacecraft Design. Performance of missiles and satellites; lunar and planetary exploration equipment, including propulsion, guidance, cabin design, and re-entry survival. Prer., Aero. 505 or consent of instructor.

Aero. 565-3. Introduction to Magnetohydrodynamics. Electromagnetism, equations of motion, magnetostatics, wave motion, exact solutions, instability, dynamo theories, solutions of linearized equations. Prer., graduate standing or consent of instructor.

Aero. 566-3. Plasma Dynamics and Plasma Physics. Plasma kinetic theory, including charged particle and neutral collisions, ionization, electronic excitation and recombination; motion of charged particles, macroscopic equations; transport coefficients, gas discharge, instabilities, shock waves; low conductivity flow, sheaths and oscillations, electromagnetic waves and radiation, manmade applications and natural phenomena. Prer., graduate standing or consent of instructor.

Aero. 571-3. Introduction to Modern Astrophysics. (A.G. 580, Aph. 580, E.Phys. 580.) Physical characteristics, distribution, and space motion of stars and stellar systems; internal structure and evolution of stars; structure of stellar atmospheres; interstellar matter and gaseous nebulae. Prer., senior standing or consent of instructor.

Aero. 572-3. The Sun. (A.G. 533, Aph. 533.) Magnetic field in the sun, interplanetary space and planets; particle emissions by the sun; acceleration of particles by the sun and planets. Prer., senior standing or consent of instructor.

Aero. 573-3. Interplanetary Space. (A.G. 530.) Theory of solar wind with and without solar rotation and magnetic field. Anisotropic velocity distribution. Transfer of linear and angular momentum. Interaction of solar wind with the earth and other planets. Dynamics of cometary plasma and solar plasma. Interaction of solar plasma with interstellar gas, its influence of cosmic-ray phenomena, and its influence of solid particles and interstellar space. Prer., Aero. 413 or consent of instructor.

Aero. 578-3. Oceanography. *Spring.* Fundamentals of biological, physical, and dynamic oceanography. Influence of the sea on worldwide weather and ecology. Prer., Aero. 312 or consent of instructor.

Aero. 581-3. Bioengineering II — Neurophysiology. *Fall.* Review of the organization and cell morphology of nervous tissue; electrical and physiological properties of cell membranes; intracellular recordings from single nerve cells; transmission at synapses; muscle contraction; receptor mechanisms; the human nervous system; central and autonomic systems. Prer., Aero. 380.

Aero. 582-3. Neural Control Systems. *Spring.* A survey course dealing with behavioral, neurophysiological, and biochemical controls manifested by the central nervous system. Biological background material prerequisite to application of formal control theory. Prer., Aero. 380 or consent of instructor.

Aero. 583-3. Membrane Transport: Biological and Artificial. *Fall.* Consists of the following topics: the dynamics of membranes in regulating the chemical environment of biological systems, energy

use associated with biological membranes, transport characteristics of organic and inorganic substances, theoretical and physical membrane models, and integration of membrane transport with other biological functions. Prer., Aero. 380 or consent of instructor.

Aero. 585-3. Mammalian Neuroanatomy. (Psych. 608.) Survey of the neuroanatomy of vertebrates with an emphasis on functional systems. Prer., Psych. 405 or Aero. 583, or consent of instructor.

Aero. 587-3. Research Methods in Neurobiology. (Psych. 609.) Laboratory in surgical techniques, stereotaxic methods, gross brain dissection, brain modeling, light microscopy and preparation of tissues, electrophysiological recording techniques, and basic biochemical preparations and assays. Prer., Psych. 405 or Aero. 583, or consent of instructor.

Aero. 591-1. Seminar. *Fall.* Required of all aerospace engineering sciences M.S. candidates.

Aero. 592-1. Seminar. *Spring.* Required of all aerospace engineering sciences M.S. candidates.

Aero. 595-599-0 to 3. Selected Topics in Aerospace Engineering Sciences. Treatment of specialized aspects of the aerospace engineering sciences by staff or visiting lecturers. Course content will be indicated in *Schedule of Courses* and on transcripts of those taking the course. Prer., variable.

Aero. 600-1 to 6. Independent Study. Study of special projects agreed upon by student and instructor.

Aero. 606-3. Advanced Space Flight Dynamics. The Hamilton-Jacobi theory. Perturbation techniques in mathematical physics. Gravitational perturbation of satellite orbits by sun and moon. Second order effects of the earth's gravitational field. Prer., Aero. 505.

Aero. 609-3. Mathematical Theory of Hydrodynamic Stability. (A.Math. 661, M.E. 658.) Mathematical and physical study of laminar flow instability. Topics include derivation of general disturbance equations for curved and parallel viscous and inviscid flows, and nonlinear theory. Prer., A.Math. 441 and Aero. 512 or consent of instructor.

Aero. 611-3. Plasma Spectroscopy. (Phys. 657.) In a plasma, the radiation from atoms and ions depends not only on the properties of the radiator, but also on the properties of the plasma in its immediate environment. In this course properties of radiation from plasmas both in and out of local thermodynamic equilibrium will be considered, with special emphasis on the diagnosis of plasma properties. Particular attention will be paid to line broadening. Prer., Phys. 625-626 or equivalent.

Aero. 613-3. Advanced Compressible Flow. Advanced topics in dynamics and thermodynamics of compressible fluid flow.

Aero. 695-699-0 to 3. Selected Topics in Aerospace Engineering Sciences. Treatment of specialized aspects of the aerospace engineering sciences by staff or visiting lecturers. Course content will be indicated in *Schedule of Courses* and on transcripts of those taking the course. Prer., variable.

Aero. 700-variable credit. Master's Thesis.

Aero. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

The following courses, now inactive, may be offered on demand: Aero. 408 (Aerodynamic Heating), Aero. 425 (Structures II), Aero. 458 (Rocket Vehicle Design), Aero. 516 (Quantum Fluid Dynamics), Aero. 521 (Aeroelasticity), Aero. 523 (Seminar: Advanced Materials), Aero. 542 (Numerical and Simulation Techniques Applicable to Guidance and Control System Design), Aero. 544 (Optimal Control), Aero. 545 (Linear Control Systems), Aero. 563 (Stochastic Processes), Aero. 576 (Atmospheric Turbulence), Aero. 584 (Selected Topics in Macromolecular Biophysics); Aero. 608 (Optimal Trajectories in Space Flight), Aero. 614 (Hypersonic Aerodynamics), Aero. 617/618¹ (Dynamics of Real Gases I, II), Aero. 632 (Aeronautical Heat Transfer), Aero. 641 (Guidance Systems), Aero. 642 (Linear and Nonlinear Filtering), Aero. 644 (Advanced Nonlinear Stability Theory), and Aero. 674 (Cosmic Gasdynamics).

¹M.E. 514 is equivalent to Aero. 617.

Special topics which have been offered recently include: Aero. 295-299 (Engineering Science as Natural Philosophy, Implications of Rapid Transportation and Communication, Measuring the Quality of Life, Computing in Engineering, Aerospace Computer Applications); Aero. 595-599, 695-699. Advanced Bioengineering Seminar, Advanced Mechanics, Advanced Thermodynamics, Aircraft Dynamics and Stability, The Boltzmann Equation, Cosmic Plasma Dynamics, General Theory of Relativity, Graduate Experimental Techniques, Kinetic Theory of Gases, Musical Acoustics, Mathematical Methods in Engineering Problems, Quantum Statistical Mechanics, Superfluid Dynamics, Turbine Aerothermodynamics.

APPLIED MATHEMATICS

A.Math. 120-5. Algebra and Trigonometry for Engineers. Advanced topics in algebra and trigonometry for prospective engineering students. For students who do not make a sufficiently high score on the mathematics placement test for the College of Engineering and Applied Science.

A.Math. 135-4. Calculus for Engineers I. Selected topics in analytical geometry and calculus. Rates of change of functions, limits, derivatives of algebraic functions, applications of derivatives, and integration. Prer., two years of high school algebra, one year of geometry, and one-half year of trigonometry, or equivalent, and an acceptable score on the mathematics placement test for the College of Engineering and Applied Science.

A.Math. 136-4. Calculus for Engineers II. Continuation of A.Math. 135. Applications of the definite integral, transcendental functions, methods of integration, plane analytic geometry, polar coordinates, vectors and parametric equations. Prer., A.Math. 135.

A.Math. 235-4. Calculus for Engineers III. Continuation of A.Math. 136. Completion of required work in the differential and integral calculus. Vector functions and derivatives, partial differentiation, multiple integrals, infinite series. Prer., A.Math. 136.

A.Math. 236-3. Introduction to Linear Algebra and Differential Equations. Vector spaces, matrices, determinants, systems of linear equations. Introduction to differential equations. (Not open to students having credit in both Math. 313 and Math. 443.) Prer., A.Math. 235.

Math. 435-3. Advanced Mathematics for Engineers I. Selected topics in linear algebra, ordinary differential equations and complex variables; series solutions of ordinary differential equations, Bessel functions and other special functions; and Laplace transforms. Prer., A.Math. 236.

Math. 436-3. Advanced Mathematics for Engineers II. Selected topics in partial differential equations and complex variables; the divergence theorem in two and three dimensions, Fourier series, eigen function expansions, and the method of separation of variables. Prer., A.Math. 236.

ARCHITECTURAL ENGINEERING

Arch.E. 130-2. Introduction to Architectural Engineering. A survey of the broad subject area of architectural engineering designed to assist the student in selecting a subject area specialty. A sequence of presentations by different faculty members describing their own particular interests culminates in a group project or term paper on an appropriate topic of the student's choice.

Arch.E. 200-1 to 3. Independent Study.

Arch.E. 240-3. Building Materials and Construction. Three lect. per wk. A study of construction methods and techniques including foundations and structural framing concepts, and particularly materials, components, and systems applications in building construction.

Arch.E. 330-4. Basic Structural Analysis and Design. Four lect. per wk. First principles of structural analysis and the design of structural components of concrete, steel, or timber. Prer., C.E. 312.

Arch.E. 354-3. Illumination I. Three lect. per wk. A study of the fundamentals of illumination and the application of these principles to the illumination of buildings. Prer., E.Phys. 112. (For Arch.E. students only except by consent of instructor.)

Arch.E. 362-3. Mechanical Systems for Buildings. Three lect.-rec. periods per wk. Environmental comfort heat loss and gain, principles of heating and cooling, HVAC systems, principles of water supply and waste, fire protection. Prer., Phys. 202 or E.Phys. 112.

Arch.E. 363-3. Introduction to Acoustics and Noise. (Aero. 363.) Three lect. per wk. Engineering and physiological foundations of acoustics. Individual and social response to sound. Environmental noise problems. Engineering and legal control of noise. Prer., junior standing or consent of instructor.

Arch.E. 400-1 to 6. Independent Study.

Arch.E. 403-2. Structures I.¹ (Arch. 552.) Two lect. per wk. Analysis of basic structural systems, laws of statics, plane force systems, trusses; cables, centroids. Prer., upper-division standing.

Arch.E. 404-2. Structures II.¹ (Arch. 553.) Two lect. per wk. Analysis of basic structural systems. Shear and moment diagrams, design of beams and columns. Introduction to statically indeterminate structures. Prer., Arch.E. 403.

Arch.E. 431-2. Design of Masonry Structures. Two lect. per wk. Design of unreinforced masonry walls and reinforced walls, beams, and columns. Prer., C.E. 350 or Arch.E. 330 or Arch. 553.

Arch.E. 441-3. Construction Costs, Estimating, and Prices. Three lect. per wk. Introduction to building construction cost accounting and controls, analysis of direct and indirect cost fundamentals and collecting systems, methods engineering and value engineering. Also included is a study of the types of estimates, quantity take-off techniques and pricing applications, and the preparation of a detailed estimate for a building project including all cost analyses, a complete quantity survey, development of unit prices, and the final assembly of the bid proposal. Prer., Arch.E. 240, senior standing, or consent of instructor.

Arch.E. 446-3. Construction Planning and Scheduling. Three lect. per wk. A comprehensive study of construction management including the contractor's role in pre-construction activities; the construction contract; bonds and insurance; purchasing and sub-contracts; contractor's central office and job organization; plant, tools, and equipment; methods engineering; value engineering; labor relations and hiring; and the particular application of CPM/PERT techniques to the planning, scheduling, and control of a construction project. Prer., Arch.E. 441.

Arch.E. 455-3. Illumination II. Three lect.-rec. per wk. Application of principles of Illumination I. Develop and apply methods for special problems in interior and exterior illumination. A study of photometry including laboratory experiments. Prer., Arch.E. 354.

Arch.E. 456-3. Luminous Radiative Transfer. Three lect.-rec. per wk. Numerical methods in lighting design and analysis; luminous flux interchange and transfer. Prer., Arch.E. 455.

Arch.E. 457-3. Building Electrical Systems Design. Three lect. per wk. Design of the secondary electrical distribution systems for buildings. Application of the N.E.C. Prer., E.E. 214 or 303. (For Arch.E. students only except by consent of instructor.)

Arch.E. 458-3. Building Electrical Systems Design II. Three lect.-rec. per wk. Analysis and design of electrical systems for special equipment in commercial buildings such as motor controllers, elevators, sound and signal systems. Prer., Arch.E. 457.

Arch.E. 459-3. Computer Applications in Lighting. Three lect.-rec. per wk. Solution of lighting problems by computerized techniques; lighting research and projects. Prer., Arch.E. 455.

Arch.E. 470-3. Applied Structural Design. (C.E. 459.) One lect.-rec. and two computation periods per wk. Lectures on professional engineering practice. Individual design problems involving the use of timber, concrete, steel, and other materials. Prer., C.E. 456, 457 or 458.

CHEMICAL ENGINEERING

Ch.E. 130-2. Introduction to Chemical Engineering. Develops principles for using concepts of chemistry and physics to conceive feasible processes for chemical change. Introduction to the

¹Arch.E. 402, 403, 404, 405, 406, 408, 409 are for nonengineering students and are not acceptable for credit toward a degree in engineering.

chemical engineering profession. Prer., high school chemistry or equivalent.

Ch.E. 200-1 to 6. Independent Study. Available to freshmen and sophomores with approval of chemical engineering department. Subjects arranged to fit needs of the particular student. Prer., at least 2.75 grade-point average.

Ch.E. 201-3. Introduction to Chemical Engineering Calculations. An introduction to computation of chemical engineering problems. Emphasis is placed on use of digital computers. Students will be introduced briefly to analog control and real-time computing. Prer., A.Math. 135 (can be coreq.), majors only.

Ch.E. 210-4. Physical and Chemical Properties of Matter. Three lect. and two rec. per wk. Emphasis is on the principles of chemistry as they relate to engineering materials and systems. (Not for Ch.E. majors.) Prer., high school chemistry.

Ch.E. 212-3. Chemical Engineering Material and Energy Balances. Three lect. periods per wk. Introduction to the quantitative aspects of chemical engineering. Concepts of material and energy balances with and without chemical reactions. Prer., Chem. 106 or 108, or equivalent.

Ch.E. 241-2. Chemical Engineering Materials and Industrial Chemicals. Two lect. rec. hrs., three to six field (plant inspection) trips, introduction to the chemical process industry. The production, economics, and use of the top fifty industrial chemicals. Prer., Chem. 106 or 108 or equivalent.

Ch.E. 321-4. Chemical Engineering Principles I. Three lect. and two rec. or calc. hrs. per wk. Study of the theory and application of the principles of heat and momentum transfer in chemical engineering systems. Prer., A.Math. 235 or 240, and Ch.E. 212.

Ch.E. 322-4. Chemical Engineering Principles II. Three lect. and two rec. or calc. hrs. per wk. Study of the mechanisms of mass transfer including molecular diffusion, eddy diffusion, and convective mass transfer. Application of the theory of mass transfer to the design of chemical equipment. Prer., Ch.E. 321.

Ch.E. 351-3. Engineering Statistics. (EDEE 351.) Two lect. and one comp. hr. per wk. Introduction to probability and statistics with emphasis on engineering applications. Frequency distributions, statistical hypotheses and estimation; linear regression and correlation; nonlinear and multiple regression; analysis of variance. Prer., A.Math. 235 or 240 or equivalent.

Ch.E. 370-3. Animal Engineering. An introduction to molecular biophysics dealing principally with questions related to the structure and function of biological macromolecules. The course concludes by considering a variety of biological systems that interface between the physical and engineering sciences. Prer., MCDB 106, Chem. 332, and consent of instructor.

Ch.E. 400-1 to 6. Independent Study.

Ch.E. 403-4. Chemical Engineering Laboratory. Experimental work and reports in unit operations. Planning and analysis of chemical engineering experiments. Heavy emphasis on preparation of formal technical reports. One lect.-rec. and two 4-hr. labs. per wk. Prer., Ch.E. 322 and 351.

Ch.E. 405/505-3. Solar Energy Utilization. The design and principles of operation of various systems for utilizing solar energy will be discussed. Emphasis will be on thermal processes. Prer., Thermodynamics, Heat Transfer, Fluid Mechanics.

Ch.E. 432-3. Chemical Engineering Thermodynamics. Three lect. per wk. Thermodynamic principles of chemical and physical equilibrium, and application to chemical process problems. Prer., Engr. 301 or Chem. 451.

Ch.E. 433-3. Chemical Engineering Reaction Kinetics. Three lect. per wk. Introduction to chemical kinetics and chemical reactor design. Prer., Ch.E. 321, and Ch.E. 432.

Ch.E. 442-3. Organic and Polymeric Technology. Three rec. per wk. Manufacturing operations of the more important organic chemical and plastics industries with emphasis on the properties and applications of plastics. Prer., organic chemistry: Chem. 332 or 336.

Ch.E. 452-4. Chemical Process Synthesis. Two lect., two rec. or calc. hrs. per wk. Solution of selected comprehensive problems dealing with development, equipment, process design, process control systems, materials, product allocations, and chemical process optimization. Prer., Ch.E. 322, 432, and 433.

Ch.E. 457-3. Instrumentation and Process Control. Two lect. and one lab. per wk. Principles of operation and applications of industrial instruments. Process control system synthesis, design, and implementation. Additional projects required for graduate credit. Prer., E.E. 303.

Ch.E. 458-3. Chemical Engineering Process Dynamics. Three lect. per wk. Study of the theory of process dynamics and its application to many of the systems encountered in large-scale chemical processing. Prer., Ch.E. 322.

Ch.E. 490 to 499-1 to 4. Selected Topics in Chemical Engineering. Senior selected topics courses to be offered upon demand. Prer., senior standing or consent of instructor.

Ch.E. 500-1 to 6. Independent Study. Available only by approval of graduate adviser. Subjects arranged to fit needs of the individual student.

Ch.E. 501-3. Environmental Modeling. Mathematical modeling of the natural and man-made environment as an aid in making national decisions which are politically enforceable, socially accepted, economically feasible, and technically possible. Prer., C.S. 201, E.E. 201, or Ch.E. 201.

Ch.E. 502-3. Technology Assessment. An introduction to individual, group, and computer methodologies for developing technical options to deal with current problems, and to evaluate their economic, social, and political implications.

Ch.E. 528-3. Statistical Thermodynamics. (M.E. 514.) Introduction to the molecular interpretation and calculation of thermodynamic properties of matter. Thermodynamic probability, distribution functions, Schrödinger Wave Equation and solutions, and ensemble theory. Applications to ideal and real gases, solids, liquids, radiation, conduction electrons, and chemical equilibrium. Prer., M.E. 313 or equivalent.

Ch.E. 536-3. Catalysis and Kinetics. Study of the principles of chemical kinetics and catalytic reactions, with emphasis on heterogeneous catalysis. Coreq., Ch.E. 433, or prer., Chem. 453 and consent of instructor, or graduate standing in Ch.E. or Chem.

Ch.E. 537-3. Intermediate Chemical Engineering Thermodynamics. Applications of thermodynamics to chemical processes, with emphasis on properties, measurement, estimation, and computation. Chemical and physical equilibrium. Introduction to statistical thermodynamics. Prer., undergraduate thermodynamics.

Ch.E. 538-3. Macroscopic Thermodynamics. (M.E. 513.) Axiomatic presentation of fundamentals of classical thermodynamics. Energy, heat, work and the first law. Equilibrium, reversible and irreversible processes, entropy production, and the second law. Applications to stability, phase equilibrium, electric and magnetic work. Irreversible thermodynamics and the Onsager Reciprocal Relations. Prer., M.E. 313 or equivalent.

Ch.E. 539-3. Reaction Kinetics. Advanced study of ideal and non-ideal chemical reactors including unsteady state behavior, mixing effects, reactor stability, residence time distribution, and modeling of nonideal reactors. Additional topics covered include fluidized beds, diffusion in porous catalysts and chemical kinetics. Prer., undergraduate reaction kinetics and consent of instructor.

Ch.E. 549-3. Chemical Technology of High Polymers. Engineering aspects of preparation, fabrication, and utilization of natural and synthetic polymers. Prer., organic chemistry: Ch.E. 332 or 336.

Ch.E. 557-3. Computer-Aided Control System Design. The design of controllers for multivariable systems is studied. Computer aids including graphic displays are utilized. Primary emphasis is on the frequency-based techniques of the inverse Nyquist array and multivariable root locus. Prer., Ch.E. 467 or E.E. 413.

Ch.E. 558-3. Optimization and Control of Chemical Processes. Optimization and control of chemical processes using differential calculus, calculus of variations, and Pontryagin's minimum principle. Mini-computer and real-time programming covered for on-line implementation of optimal control policies. Prer., senior or graduate standing.

Ch.E. 566-2. Cryogenic Engineering I. Modern thermodynamics of cryogenic systems and processes; thermodynamic and transport properties of cryogenic fluids including experimental methods and construction of thermodynamic diagrams and tables; fluid transfer; production of low temperatures; refrigeration and liquefaction; separation and purification of gases; phase equilibria; safety. Prer., Engr. 301 or Chem. 451, and senior standing.

Ch.E. 567-2. Cryogenic Engineering II. Heat transfer at low temperatures; thermal insulation systems, including high vacuum technology, insulation types and application to storage and transfer equipment. Low temperature properties of the solid state such as mechanical properties, specific heat, electrical and thermal conductivity; thermal expansion galvano- and thermomagnetic effects, and superconductivity. Cryogenic instrumentation. Prer., Engr. 301 or Chem. 451.

Ch.E. 568-3. Industrial Air Pollution Control. This course treats the chemical and physical basis of industrial pollution and the methods currently available for controlling air pollution from stationary sources. Emphasis will be placed on the design and performance of industrial air pollution control equipment. Prer., senior standing in chemical engineering or consent of instructor.

Ch.E. 569-3. Industrial Water and Solid Waste Pollution Control. The chemical and physical nature of water pollutants and solid wastes from industrial processes. Methods of reducing pollutant generation and treatment for pollutant disposal. Prer., senior standing in Ch.E. and consent of instructor.

Ch.E. 570-3. Biomedical Engineering. Mathematical analysis of biomedical systems via material, energy, and momentum balances. Systems to be studied include neural transmission, renal function, circulation, and special senses. Solutions of mathematical models will be obtained via MIMIC programming. Prer., consent of instructor.

Ch.E. 571-3. Molecular Basis of Behavior. A problems approach to neurobiology. A variety of model behavior systems will be discussed, unicellular and multicellular, in an attempt to trace the molecular steps that occurred during the evolution of simple behavioral systems to more complex ones. Prer., Ch.E. 370, Chem. 332, and Chem. 453.

Ch.E. 572-3. Neural Modeling. An integrated introductory survey of physical theories of bioelectric processes, and of models of the electrical operations of nervous systems. The physical basis of neuroelectric signals and information processing in neurons and neural networks are discussed. Prer., consent of instructor and senior or graduate standing.

Ch.E. 573/Psych. 507-3. Brain/Mind Modeling. A critical survey of theories of brain function developed from various engineering sciences, and discussion of principles of brain modeling. Includes laboratory workshop on simulation and neuroelectric recording techniques for graduate students. Prer., senior or graduate standing in psychology or engineering.

Ch.E. 574-3. Advanced Chemical Engineering Calculations. Analysis and design of equipment and processes for chemical manufacturing based on the application of advanced mathematical techniques. Prer., consent of instructor.

Ch.E. 575-4. Transport Phenomena. Fundamental relationships for transfer of heat, mass, and momentum, and their application to engineering problems. Prer., senior or graduate standing.

Ch.E. 576-3. Engineering Aspects of Animal Locomotion. A survey course dealing with animal locomotion. In general all animals either swim, fly or run. Each of these modes presents a unique physical situation to the biological system in terms of physiology, analytical mechanics, and fluid mechanics. Prer., Ch.E. 370 or consent of instructor.

Ch.E. 585-3. Optimal Equipment and Process Design. Application of fundamentals to the technical selection and design of equipment and the optimal arrangement of such equipment in a chemical process. Includes optimization techniques used in the design, arrangement, location, and construction of chemical plants. (May be used as a core course when taught.) Prer., Ch.E. 539 and 575.

Ch.E. 588-3. Advanced Unit Processes. An up-to-date examination of the current processes and economics in the chemical process industries.

Ch.E. 590-0. Seminar in Chemical Engineering. Required of all chemical engineering graduate students. Reports on research activities and on special current topics.

Ch.E. 591-599-0 to 3. Selected Topics. Credit and subject matter to be arranged.

Ch.E. 600-1 to 6. Independent Study. Available only through approval of the graduate adviser. Subjects arranged to fit needs of the particular student.

Ch.E. 627-3. Heat Transfer I. (M.E. 563.) Review of equations governing transport of heat by conduction and radiation. Analytical and numerical solution of boundary value problems representative of heat conduction in solids. Radiation properties of solids, liquids, and gases and transport of heat by radiation. Prer., M.E. 362 or equivalent.

Ch.E. 628-3. Heat Transfer II. (M.E. 564.) Review of equations governing transport of heat in fluids in motion. Description of heat transfer in free and forced convection including laminar and turbulent flow. Dimensional analysis and heat transfer correlations, numerical methods, combined heat transfer mechanisms. Prer., M.E. 532 or consent of instructor.

Ch.E. 639-3. Advanced Reaction Kinetics. Fundamental laws pertaining to chemical reaction rates and their application to industrial operations. Prer., Ch.E. 539 or equivalent.

Ch.E. 640-3. Advanced Fluid Dynamics. Conservation equations and similarity. Navier-Stokes equations and solutions for small and large Reynolds numbers. Boundary layer flow and transition phenomena. Phenomenological theories of turbulent flow. Prer., Ch.E. 575 or equivalent.

Ch.E. 657-3. Optimal Control of Chemical Processes. Study of stability and optimal control as applied to chemical processes. Topics to be discussed include Liapunov stability, application of the maximum principle and variational calculus to the control of linear and nonlinear chemical systems. Prer., Ch.E. 558 or equivalent.

Ch.E. 691-699-0 to 3. Selected Topics. Credit and subject matter to be arranged.

Ch.E. 700-variable credit. Master's Thesis.

Ch.E. 800-0 to 8. (16 to 24 maximum). Doctor's Thesis.

CIVIL, ENVIRONMENTAL, AND ARCHITECTURAL ENGINEERING

C.E. 130-2. Introduction to Civil Engineering. Two lect. per wk. A survey of the broad subject area coverage of civil, environmental, and architectural engineering designed to assist the student in selecting his subject area specialty. A sequence of presentations by different faculty members describing their own particular interests culminates in a group project or term paper on an appropriate topic of the student's choice.

C.E. 212-3. Analytical Mechanics I. Three lect. per wk. A vector treatment of force systems and their resultants; equilibrium of frames and machines, including internal forces and three-dimensional configurations; static friction; properties of surfaces, including first and second moments; hydrostatics; minimum potential energy and stability. Prer. or coreq., A.Math. 231 or 235.

C.E. 213-3. Analytical Mechanics II. Three lect. per wk. A vector treatment of dynamics of particles and rigid bodies including rectilinear translation, central-force, free and forced vibration, and general motion of particles, kinematics of rigid bodies; the inertia tensor; Euler's equations of motion; energy and momentum methods for particles, systems of particles, and rigid bodies. Prer., C.E. 212.

C.E. 221-3. Plane Surveying. Two lect., one 3-hr. lab per wk. Observation, analysis, and presentation of basic linear, angular, area, and volume field measurements common to civil engineering endeavor. Prer., A.Math. 131 or 135 or equivalent.

C.E. 222-3. Engineering Measurements. Two lect., one 3-hr. lab. per wk. Principles of measurements; methodology, instrumentation, and analysis of data. Prer., C.E. 221.

C.E. 241-3. Introduction to Environmental Engineering. The many aspects of water, air, and land pollution including the special topics of noise, radiation, pesticides, thermal, and mercury pollution.

C.E. 312-3. Mechanics of Materials. Three lect. per wk. Mechanical properties of materials: stresses and strains in members subjected to tension, compression, and shear; flexural and shearing stresses in beams; deflections of beams, column analysis, principal stresses, static equivalent load, fatigue. Prer., C.E. 212.

C.E. 313-3. Applied Mechanics. Three lect. per wk. A limited study of particle and rigid body mechanics for those disciplines in which a broader background is not required. Subject coverage includes an introduction to vector concepts of force, moment, and equilibrium, then concentrates upon kinematics and kinetics of a

particle including oscillatory and orbital motion, energy and momentum methods, and finally discusses rigid bodies by introducing the inertia tensor and appropriate kinematics and kinetics leading to simple applications of Euler's equations of motion. Prer., A.Math. 235 or 236 or equivalent and E.Phys. 111 or equivalent. Intended for electrical engineering majors but open to others upon request.

C.E. 316-2. Materials Testing Laboratory. One lect.-rec., one 3-hr. lab. per wk. Lect. sessions will be devoted to development and explanation of the necessary background and operations required to conduct the materials testing experiments in the lab. Lab. sessions devoted to hands-on performance of a sequence of experiments which determine properties of materials, verify principles of mechanics of materials, or incorporate the requirements of ASTM standards Prer., C.E. 312.

C.E. 323-3. Photogrammetry and Control Surveys. Two lect., one 3-hr. lab. per wk. Characteristics of aerial photographs; measuring and interpreting from aerial photos for planimetric, topographic, hydrological, soil, and land use surveys; analysis and presentation of field measurements over extensive reaches. Prer., C.E. 222.

C.E. 331-3. Theoretical Fluid Mechanics. Three lect. per wk. Basic principles of fluid mechanics. Fluid properties, hydrostatics, fluid flow concepts, including continuity, energy, momentum, boundary-layer theory, and flow in closed conduits. Prer. or coreq., C.E. 213.

C.E. 332-3. Applied Fluid Mechanics. Two lect., one 3 hr. lab. per wk. Application of principles of fluid mechanics and dimensional analysis to problems in open channel flow, pipe systems, hydraulic machinery, fluid flow measurement, and hydraulic models. Includes laboratory demonstrations and experiments. Prer., C.E. 331.

C.E. 340-2. City Planning. Two lect. per wk. Essential principles of city planning, with particular emphasis on the contribution that can be made by civil engineers. Includes detailed discussion of land use, land use boundaries, transportation, street systems, public buildings, parks and recreation, utility design, and zoning. Two or more problems in individual design will be included. Prer., junior standing.

C.E. 341-4. Sanitary Engineering I. Three lect., one 3-hr. lab. per wk. Elements of hydrology, public water supplies, and sewerage. Elements of hydrology include rainfall-runoff relationships, stream discharge, and ground water. Public water supplies include the study of rates of consumption, quality, source of supplies, methods of treatment and disinfection. Sewerage includes collection, treatment, and disposal of wastes; study of characteristics of sewage; design and operation of storm and sanitary sewers. Prer. or coreq., C.E. 331.

C.E. 342-2. Water Treatment. An intensive study of the processes used in treating water for potable supply purposes. Prer., C.E. 241.

C.E. 343-2. Wastewater Treatment. An intensive study of the processes used for the treatment of wastewater with special emphasis on environmental factors which affect process rates and efficiencies. Prer., C.E. 241.

C.E. 350-3. Structural Analysis. Two lect. and one 3-hr. lab. per wk. Principles of structural analysis applied to statically determinate and indeterminate structures. Introduction to modern matrix-computer methods. Prer., C.E. 312.

C.E. 360-3. Transportation Engineering. Three lect. per wk. Introduction to the technology, operating characteristics and relative merits of highway, airway, waterway, railroad, pipeline, and conveyor transportation systems. Evaluation of urban transportation systems. Recent transportation system innovations. Prer., junior standing or consent of instructor.

C.E. 380-3. Introduction to Geotechnical Engineering. Three lect. per wk. Soil mechanics: physical and mechanical properties of soils, seepage, consolidation, settlement, shear strength, earth pressure, slope stability. Rock mechanics: nature of rock masses, geological exploration, mechanical properties of rock and joint samples, *in-situ* tests on rock masses (mechanical and hydraulic). Prer., C.E. 312.

C.E. 400-1 to 6. Independent Study.

C.E. 442-3. Municipal Design Projects. Two lect. and one 3-hr. lab. per wk. Analysis and design of municipal public works, including: street systems; drainage and flood control systems; water pumping and distribution systems; sewage collection and treatment systems. The interplay between these systems and their correlation with land characteristics and use. Prer., C.E. 341.

C.E. 444-3. Sanitary Engineering II. Two lect., one 3-hr. lab. per wk. General studies in water and sewage analysis: their application to design practices and public health standards. Prer., C.E. 341.

C.E. 448/548-3. Public Health Engineering. Three lect. per wk. Public health aspects and disposal methods for radiological wastes; analysis of air pollution control methods and disposal techniques for solid wastes and refuse. Additional student projects required for graduate credit. Prer., for 448, C.E. 341 and senior standing or consent of instructor; for 548, C.E. 341 or equivalent, and graduate standing.

C.E. 449-3. Introduction to Environmental Pollution. Three lect. per wk. A multidisciplinary examination of the problems of environmental pollution. The course will focus particularly on the chemical, social, biological, economic, and engineering aspects of environmental pollution: composition and sources; health and social costs; methods of reduction and control. Open to any non-engineering or engineering student having at least junior standing. Prer., upper division standing.

C.E. 451-3. Matrix Structural Analysis. Three lect. per wk. Finite element analysis of skeletal structures. Systematic formulation of stiffness and flexibility methods for analysis of skeletal structures. Application of modern computational tools to structural analysis. Prer., C.E. 350.

C.E. 453-3. Computer Techniques in Engineering. (EDEE 453, E.E. 455.) Three lect. per wk. Introduction to the use of numerical methods in engineering and science. Those methods suitable for solution by high speed digital computers are emphasized. Prer., E.E. 201, A.Math. 235 or 236 or equivalent.

C.E. 456-2. Design of Timber Structures. Two lect. per wk. Design of floor systems, beams, columns, and trusses. Design of joints; glued laminated construction. Prer., C.E. 350.

C.E. 457-3. Design of Steel Structures. Two lect., one 3-hr. lab. per wk. Methods used in design of structural steel members and their connections. Introduction to plastic design of steel frames. Prer., C.E. 350.

C.E. 458-3. Reinforced Concrete Design. Two lect., one 3-hr. lab. per wk. Conventional and ultimate strength methods for design of reinforced concrete structures. Prer., C.E. 350.

C.E. 459-3. Applied Structural Design. (Arch.E. 470.) One lect.-rec. and two computation periods per wk. Lectures on professional engineering practice. Individual design problems involving the use of timber, concrete, steel, and other materials. Prer., C.E. 457 or 458.

C.E. 460-3. Highway Engineering. Three lect. per wk. Evaluation of alternate highway routes. Discussion of highway drainage, finance, maintenance, pavement design, traffic operations, and principles of economic analysis. Impact of the highway on the environment. Prer., C.E. 360 and 380.

C.E. 461-3. Municipal Traffic Engineering. Analysis of traffic engineering problems commonly found in urbanized areas and design of alternative solutions. Prer., C.E. 360 or consent of instructor.

C.E. 481-2. Intermediate Soils Engineering. One lect., one 3-hr. lab. per wk. Continuation of C.E. 388 into selected topics in soils engineering. Grain size, consistency, and plasticity properties governing pavement design, permeability and seepage, stress distribution, settlement analysis, stabilization of soils. Prer., C.E. 380.

C.E. 485-3. Basic Geotechnical Engineering for Geologists. A basic course in soil mechanics and rock mechanics for geologists. Some elements of statics and mechanics of materials are first introduced as background material, then the emphasis is put on the mechanics of soil and rock masses. Prer., one year of college physics and one year of calculus.

C.E. 495-1 to 6. Special Topics for Seniors. Supervised study of special topics of interest to students under guidance of instructor. Prer., consent of instructor.

C.E. 497-3. Engineering Economy. (EDEE 497.) Three lect. per wk. Application of economic and financial principles to engineering alternatives. Calculation of annual costs, present worth, and prospective rates of return on investment. Depreciation and replacement studies. Economic aspects of public works. Preparation of engineering reports on economy studies. Prer., senior standing.

C.E. 498-3. Engineering Contracts. Three lect. per wk. Application of law in engineering practice: contracts, construction contract

documents, construction specification writing, agency, partnership, and property: types of construction contract; legal responsibilities and ethical requirements of the professional engineer. Prer., senior standing in civil or architectural engineering or permission of instructor.

C.E. 499-1. Senior Seminar. One lect. per wk. A series of lectures by outstanding university faculty members in the humanities, and eminent professional engineers in special fields of practice, particularly on subjects with new developments. Also emphasis on the EIT examination. Prer., senior standing.

C.E. 500-1 to 6. Independent Study. Available only through approval of graduate adviser. Subjects arranged to fit needs of the particular student.

C.E. 511-3. Introduction to Structural Dynamics. Three lect. per wk. Introduction to the dynamic response of structural systems, both linear and nonlinear. Prer., consent of instructor.

C.E. 512-3. Intermediate Mechanics of Materials. Three lect. per wk. Intermediate-level course in the mechanics of deformable bodies. Plane stress and strain; stress-strain relations, with emphasis on elastic and inelastic behavior of members, and theories of failure. Discussion of basic methods of structural mechanics, with applications to unsymmetric and curved beams, thick-walled pressure vessels, torsion of members of noncircular sections, and other selected problems in stress analysis. Prer., C.E. 312 and differential equations.

C.E. 514-3. Cement and Concrete Technology. Three lect. per wk. Constituents of Portland cement, types of cements, cement chemistry, additives and admixtures, types and properties of aggregates, properties of fresh concrete, properties of hardened concrete, topics from current literature. Prer., C.E. 316.

C.E. 515-3. Structural Similitude and Model Analysis. One lect., two 3-hr. labs. per wk. Dimensional analysis, prediction equations. Buckingham PI theorem. Theory of models with special emphasis on structural models. Lab. work includes selected problems plus a student term project. Prer., C.E. 512.

C.E. 525-3. Construction Management. Three lect. per wk. The advanced study and analysis of construction top- and upper-middle management responsibilities, particularly relating to union craft labor, on- and off-site production and workmanship, construction financing, construction safety, inspection and quality control, and disputes and claims. Investigations to improve construction management efficiency and to lower construction costs will be stressed. Prer., senior standing with Arch.E. 240, 441, 446, or consent of instructor.

C.E. 526-3. Industrialized Building Techniques and Systems. Three lect.-rec. periods per wk., including factory on-site inspections of industrialized building techniques and systems. The advanced study, investigations, and analysis to effect change and innovation in industrializing the construction process from product development through manufacture and transportation to assembly. Prer., graduate standing with Arch.E. 240, 441, and 446, or consent of instructor.

C.E. 528-3. Construction Engineering I. Three lect. per wk. Construction methods improvement, time-lapse movie analysis, deterministic models of construction operations, and construction bidding of strategy models. Prer., graduate standing with Arch.E. 441 and 446, or consent of instructor.

C.E. 529-3. Construction Engineering II. Three lect. per wk. Advanced construction planning and scheduling, simulation of uncertainty in a construction project, construction decisions under risk, risk analysis of project markup, contract provisions, and cash flows. Prer., graduate standing with C.E. 528 and EDEE 351, or consent of instructor.

C.E. 533-3. Applied Hydrology. Three lect. per wk. Engineering applications of principles of hydrology. Hydrologic cycle, rainfall and runoff, groundwater, storm frequency and duration studies, stream hydrograph, flood frequency, and flood routing. Prer., consent of instructor.

C.E. 534-3. Hydraulics of Open Channels. Three lect. per wk. Flow in natural and artificial channels, water surface profiles, critical depth, hydraulic jump, applications of energy and momentum principles, unsteady flow, flow in alluvial channels. Prer., C.E. 331.

C.E. 537-3. Water Law, Policy, and Institutions. Three lect. per wk. Contemporary issues in water management based on legal doctrine. Legal issues in water resources problems are identified

and discussed in close relationship with technical, economic, and political considerations. Prer., senior or graduate standing.

C.E. 539-3. Seminar in Water Resources Development and Management. (Econ. 691.) Three lect. per wk. A multidisciplinary exploration of the principles governing water resources planning and development. Emphasis is on the sciences of water—physical, engineering, chemical, biological, and social—and their interrelationships.

C.E. 540-2. Advanced Environmental Engineering. Application of chemistry to environmental engineering type problems. Prer., C.E. 241, 342, 343, or equivalent.

C.E. 541-3. Unit Operations in Sanitary Engineering.¹ Three lect. per wk. Fundamental approach to physical processes used in treatment of water and waste water. Prer., C.E. 341 or equivalent.

C.E. 542-3. Advanced Water Supply.¹ Three lect. per wk. Advanced studies on theory and operation of domestic and industrial water supplies. Prer., graduate standing.

C.E. 543-3. Advanced Waste Water Treatment.¹ Three lect. per wk. Advanced studies on theory and operation of wastewater treatment works. Prer., C.E. 341 and graduate standing.

C.E. 544-3. Advanced Sanitary Engineering Design. One lect., two design labs per wk. Applications of theory to the design of water and wastewater systems. Prer., C.E. 543; coreq., C.E. 542 or consent of instructor.

C.E. 545-3. Administration of Public Works.¹ (P.Ad. 545.) Three lect. per wk. A descriptive course concerned with the administration of engineering and planning aspects of urban public works and with listing and comparing modern methodologies. Prer., graduate standing in civil engineering, public administration, or consent of instructor.

C.E. 547-3. Physical-Chemical Treatment for Waste Water Reuse.¹ Three lect. per wk. Studies of theory and application of physical and chemical processes to the secondary and tertiary treatment of municipal waste water for waste water reclamation and reuse. Prer., C.E. 543 or consent of instructor.

C.E. 548-3. Processing and Disposal of Wastewater Concentrates. Principles and methods of stabilization dewatering and disposal of sludges generated from the removal of pollutants from water and wastewater treatment. Prer., graduate standing or consent of instructor.

C.E. 551-3. Matrix Structural Analysis. Three lect. per wk. Finite element analysis of skeletal structures. Systematic formulation of stiffness and flexibility of methods for analysis of skeletal structures. Application of modern computational tools to structural analysis. Differs from C.E. 451 by the addition of individual student projects. Prer., C.E. 350.

C.E. 553-3. Numerical Methods in Civil Engineering. Three lect. per wk. Introduction to the use of numerical methods in the solution of civil engineering problems with emphasis on obtaining solutions with high-speed electronic computers. Applies methods to all types of civil engineering problems. Prer., senior or graduate standing.

C.E. 554-3. Theory of Structural Design. Three lect. per wk. Fundamental propositions for the design of skeletal structures, automatic design of optimal structures, problem-oriented computer languages, linear and nonlinear programming methods for structural design. Prer., C.E. 551.

C.E. 558-3. Advanced Topics in Reinforced Concrete. Three lect. per wk. Advanced topics relating to design and analysis of reinforced concrete structures. Includes review of the current ACI design code, slabs, prestressed concrete, seismic design, folded plates and shells, finite element analysis, and other topics determined by class interest. Prer., C.E. 458 or equivalent.

C.E. 560-3. Advanced Highway Design.¹ Three lect. per wk. Design and location of various classes of rural and urban highways. Development of theory as a rational basis of design for highway alignment, cross-section, intersections, and interchanges is stressed. Prer., C.E. 360.

C.E. 561-3. Quantitative Techniques in Urban Transportation Engineering.¹ Three lects. per wk. Probability—events, sets, independence, distributions. Measures of dispersion—means, standard deviation, variance, confidence intervals. Statistical decision making—statistical hypothesis, level of significance (α), second

¹Courses usually offered at Boulder Campus only.

type of error (b), tests of statistical hypotheses. Simple and multiple regression—scatter diagrams, least squares estimates, simple and multiple regression forecasting models. Queueing theory—arrivals and service distributions, queue lengths, and waiting times for single and multiple channel facilities. Prer., C.E. 360 or consent of instructor.

C.E. 562-3. Urban Transportation Planning.¹ Three lect. per wk. Definition of the urban transportation problem, sociology of urban regions, history of urban growth, models of urban growth, population forecasts, land use surveys and planning, trip generation, characteristics, distribution and assignment, modal split, system evaluation, CBD transportation planning. Prer., C.E. 561.

C.E. 563-3. Airport Planning and Design. National airport system plan, air travel demand, geometric design of airport facilities, design of airport pavement and drainage structures, airport capacity, coordination with other modes, airport environmental impact. Prer., consent of instructor.

C.E. 564-3. Urban Traffic—Characteristics.¹ Three lect. per wk. Human and vehicular characteristics, speed and volume studies, origin and destination studies, traffic flow theory, stream characteristics, intersection characteristics, signalized intersections, accident characteristics, parking characteristics, highway lighting, and miscellaneous topics. Prer., C.E. 360 or consent of instructor.

C.E. 565-3. Urban Traffic—Operations.¹ Three lect. per wk. Traffic control devices, traffic signal timing and equipment, signal systems, computer application to traffic control, urban operations, freeway operations, traffic applications of linear programming, Markov chains, transportation problem, dynamic programming, surveillance, and control. Prer., C.E. 564.

C.E. 566-3. Transportation System Safety. Safety aspects of highway, railroad, and airway transportation systems. Accident analysis; accident prevention; economic consequences of accidents. Prer., C.E. 360.

C.E. 568-3. Pavement Design.¹ Three lect. per wk. Design of flexible and rigid pavements for highways and airports; stress analysis in flexible and rigid pavements; design of joints and reinforcing steel for rigid pavements; principles of subgrade stabilization. Prer., C.E. 360 and 481.

C.E. 569-3. Urban Traffic—Workshop.¹ Lect. and lab. Selected laboratory problems related to urban traffic. Prer., C.E. 564 or equivalent.

C.E. 570-3. Specification of Visual Stimuli. Three lect. per wk. Principles of radiometry, photometry, and colorimetry; study of visual stimuli and apparatus to control parameters such as intensity, spectral composition, and retinal location; calibration and practical application of apparatus. Prer., graduate or advanced standing or consent of instructor.

C.E. 572-3. Visual System Anatomy—Eye and Orbit. Three lect. per wk. Gross anatomy of the head and neck with emphasis on the eye and orbit; visual pathway organization, and embryology of the eye and associated structures. Prer., graduate or advanced standing or consent of instructor.

C.E. 580-3. Advanced Soils Engineering. Three lect. per wk. An advanced course in the principles of soil mechanics and foundations engineering. Coverage includes consolidation, shear strength, lateral pressures, and slope stability. Prer., C.E. 380.

C.E. 581-3. Engineering Properties of Soils. Three lect. per wk. Study of the interrelationship of applied stresses, pore pressures, permeability, strain, and shear strength of soils. Determination of these interrelationships in the laboratory. Prer. or coreq., C.E. 580 or consent of instructor.

C.E. 582-3. Groundwater and Seepage. Three lect. per wk. Principles which govern the flow of water in soils. Potential theory; confined flow, unconfined flow; seepage pressure. Application of seepage principles to earth structures. Seepage into wells and from canals and ditches. Prer., C.E. 380.

C.E. 583-3. Foundation Engineering. Three lect. per wk. The general principles of soils engineering applied to preliminary foundation design. Properties of subsurface materials, foundation types, construction methods, bases of selection and design, preliminary design of foundations for earth retaining structures. Prer., C.E. 380.

C.E. 584-3. Design of Earth Structures. Three lect. per wk. Theory, design, and construction of earth embankments. Use of published data, field exploration, and laboratory tests on soils and

rock in investigating foundations and construction materials. Principles of compaction and settlement. Slope stability analysis, landslide recognition and control, use of benches and beams. Prer., C.E. 580 or consent of instructor.

C.E. 585-3. Mechanics of Multiphase Media. Three lect. per wk. Development of the general relationships governing load-deformation-time response of multiphase media. Three-dimensional consolidation theory including thermal, electrical, and chemical effects. Interrelationship of theory of mixtures and theory of consolidation. Applications to geotechnical problems; the analysis of loaded clay layers; the influence of pore pressure diffusion on laboratory and field test results; the application of three-dimensional consolidation theory to laboratory and field tests and to predictions of the magnitude and progress of deformation. Prer., C.E. 580 or consent of instructor.

C.E. 586-3. Theoretical and Applied Rock Mechanics. Three lect. per wk. Nature of rock masses, geological exploration, deformability and strength of rock and joint materials, slope stability in hard rocks, physical models in geological engineering, *in-situ* tests of deformability and strength, *in-situ* stresses and deformations, rock hydraulics. Prer., C.E. 380 or consent of instructor.

C.E. 587-3. Applied and Experimental Rock Mechanics. Two lect., one 3-hr. lab. per wk. Finite element method in rock mechanics; theory and practice, including workshop. Geological engineering of tunnels and slopes: evacuation, support, reinforcement. Laboratory testing of rock and joint samples. Field tests of rock mass properties. Prer., C.E. 380, or consent of instructor.

C.E. 588-3. Selected Advanced Topics in Geotechnical Engineering. Three lect. per wk. Selected advanced topics in soil mechanics, rock mechanics, and geotechnical engineering. Coverage depends on the curriculum needs of that year. Such topics as seepage, clay mineralogy, finite elements, analysis of geotechnical problems, rheology of soils, plasticity applied to soil mechanics, soil dynamics, computational methods in geotechnical engineering, etc. are possible choices. This course can be taken more than once. Prer., C.E. 580 or consent of instructor.

C.E. 591-2. Seminar: Urban Problems. Two lect. per wk. Topics of current interest in the field of urban development with particular emphasis on engineering aspects. Prer., C.E. 340 and 442.

C.E. 592-1. Graduate Environmental Research Seminar. One lect. per wk. A seminar in environmental engineering research methods with emphasis on conducting studies and preparing presentations and publications. Prer., graduate status in environmental engineering.

C.E. 595-599-0 to 3. Selected Topics. Credit and subject matter to be arranged.

C.E. 600-1 to 6. Independent Study. Available only through the approval of the graduate adviser. Subjects arranged to fit needs of particular student.

C.E. 611-3. Dynamics of Structures. Three lect. per wk. General vibrations of civil engineering structures and their response to various types of time-independent loads. Prer., C.E. 511.

C.E. 613-3. Theory of Elasticity. Three lect. per wk. Mathematical theory of elasticity and its applications to engineering problems. Discussion of the basic analytical and numerical methods of solution. Prer., C.E. 512 and basic course in differential equations.

C.E. 614. Plates and Shells. Mathematical theories of plate and shell structures and their applications. Numerical finite element solutions of plates and shells of various shapes under static and dynamic loadings. Prer., C.E. 512 or 613.

C.E. 616-3. Buckling in Structures. Three lect. per wk. Buckling of columns, beams, frames, plates, and shells in the elastic and plastic range. Postbuckling strength of plates. Beam-columns. Analysis by exact and approximate methods with special emphasis on practical implications and application of solutions. Prer., C.E. 312.

C.E. 635-3. Hydraulic Design I. Three lect. per wk. Design of dams, spillways, stilling pools, transitions, and penstocks; flood prediction and control, detention reservoirs, and river control structures. Prer., C.E. 534.

C.E. 651-3. Advanced Theory of Structures. Three lect. per wk. Generalized approaches to the analysis of civil engineering and continuous elastic structures (such as plates and plane stress bodies) by force and displacement methods. Emphasis is on formulation by

¹Usually offered at Denver Campus only.

finite elements and solution by matrix methods. Prer., C.E. 551 and basic knowledge of computer programming.

C.E. 656-3. Inelastic Theory of Structures. Three lect. per wk. Inelastic behavior of materials. Calculation of ultimate capacity of perfectly plastic structures by use of upper and lower bound theorems. Theories of inelastic action as applied to structural design in steel and concrete. Elements of theory of plasticity with applications in ultimate analysis of plates, shells, and continuous bodies.

C.E. 680-3. Selected Topics in Analytical Soil Mechanics. Three lect. per wk. Selected advanced topics in soil mechanics and geotechnical engineering. Coverage depends upon the curriculum needs of that year. Such topics as seepage, clay mineralogy, finite elements, analysis of geotechnical problems, rheology of soils, plasticity applied to soil mechanics, soil dynamics; computational methods in geotechnical engineering, etc., are possible choices. This course may be taken more than once for additional credit. Prer., C.E. 580 or consent of instructor.

C.E. 695-699-0 to 3. Selected Topics. Credit and subject matter to be arranged. Prer., consent of instructor.

C.E. 700-variable credit. Master's Thesis.

C.E. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

ELECTRICAL ENGINEERING

E.E. 130-2. Problems and Methods of Modern Electrical Engineering. Application of mathematical techniques to the solution of a variety of problems from electrical engineering and related fields. Translation of engineering problems into mathematical models, and the engineering interrelation of the mathematical results. Approximation techniques. Series expansions and transcendental functions in engineering problems. Problems will include optimization techniques, feedback, resonance, etc. Coreq., A.Math. 135.

E.E. 200-1 to 3. Independent Study. An opportunity for students to do independent, creative work. Prer., consent of instructor.

E.E. 201-3. Introduction to Computing. An elementary course in computing, covering computer programming methods, FORTRAN programming, numerical applications, and nonnumerical applications. Prer., high school algebra and trigonometry.

E.E. 210-3. Fundamentals of Computing I. (C.S. 210.) A first course in computing for those who will specialize in computers, covering the capabilities of the computer, the elements of a programming language, and the basic techniques for designing algorithms to solve practical problems. The programming language PASCAL is used as a vehicle for expressing these concepts (lecture and recitation). Prer., three years of high school mathematics including trigonometry, or Math. 110 or 102, or consent of department.

E.E. 213-4. Circuit Analysis I. Transient solution of circuits by classical and Laplace transform techniques. Steady state sinusoidal solutions by means of phasors. Coreq., A.Math. 235.

E.E. 214-4. Circuit Analysis II. Additional steady-state solutions, polyphase circuits, Fourier series. Pulses, impulses. Mechanical analogs. Prer., E.E. 213.

E.E. 253-1. Circuits Laboratory I. Electric circuits and measurements; cathode-ray oscilloscope; electrical instruments, transients in circuits involving resistance, inductance, and capacitance; and resistance measurements. Coreq., E.E. 213.

E.E. 254-1. Circuits Laboratory II. Impedance measurements, resonance, Fourier series, polyphase measurements, magnetic measurements, introduction to analog computer. Prer., E.E. 253; coreq., E.E. 214.

E.E. 257-3. Logic Circuits. A study of Boolean algebra, and its application to the synthesis of logical circuits from logical elements such as and-gates, or-gates, not-gates, nand-gates, nor-gates, delay elements, and memory elements.

E.E. 300-1 to 3. Independent Study. An opportunity for students to do independent, creative work. Prer., consent of instructor.

E.E. 302-3. Statistical Thermodynamics. Thermodynamics of materials interacting with electric, magnetic, mechanical, and thermal environments. The laws of thermodynamics, statistics of weakly coupled systems, connections between microscopic and classical thermodynamics, semiconductor statistics partition function. Prer., E.E. 313, 321, 381; coreq., Chem. 202 or equivalent.

E.E. 303-3. Electric Circuits I. For students not majoring in electrical engineering. Transient solution of circuits by classical and Laplace transform techniques, steady-state sinusoidal solutions. Prer., A.Math. 235.

E.E. 313-3. Electromagnetic Fields I. Maxwell's equations postulated for free space and developed for material regions together with boundary conditions. Vector analysis concepts including gradient, divergence, and curl are developed as needed. Static and quasi-static electric and magnetic fields and energy are treated, with applications to capacitive, inductive, and resistive elements of circuit theory. Uniform plane waves in free space and lossy regions exemplify dynamic field problems. Prer., A.Math. 235.

E.E. 314-3. Electromagnetic Fields II. Reflected and transmitted plane waves in layered media. Poynting's theorem of electromagnetic power, hollow waveguides, and two-conductor transmission line theory and practice; Smith chart and impedance matching. Elements of antenna theory. Prer., E.E. 313.

E.E. 316-3. Energy Conversion I. Theory of transformers. Singly excited transducers. Energy relations in rotating machines. Basic rotating energy converters. Prer., E.E. 214 and 313.

E.E. 321-3. Electronics I. Fundamentals of semiconductor devices and their application in electronic circuits. Topics include semiconductor concepts, theory of semiconductor devices, digital circuits, and low-frequency transistor applications. Prer., E.E. 213.

E.E. 322-3. Electronics II. Transistor model at high frequencies; multi-stage amplifiers; frequency response of amplifiers; feedback; operational amplifiers; large signal amplifiers and distortion. Prer., E.E. 213 and 321.

E.E. 331-3. Linear Systems Theory. Characterization of linear systems by impulse response convolution, transfer function. Linear differential equations and linear difference equations, as models. Applications to circuits, biological systems, etc. Transform methods including Fourier series and transforms, Laplace transforms, and Z transforms. Prer., E.E. 381 or A. Math. 481.

E.E. 343-1. Electrical Laboratory I. For students not majoring in electrical engineering. Cathode-ray oscilloscope; electric circuits and measurements; electrical transients; introduction to the transformer and rotating electrical machinery. Coreq., E.E. 303.

E.E. 351-3. Introduction to Computer Engineering. Machine structure, assembly language programming, and laboratory applications of small computers. Basic topics in computer design and software engineering. Prer., C.S. 210 and E.E. 257.

E.E. 354-2. Power Laboratory I. Basic concepts concerning electromagnetic energy conversion principles as related to practical devices. An overview of magnetics, transformers, and rotating machinery. Measurement techniques in power circuits are emphasized. Prer., E.E. 254; coreq., E.E. 316.

E.E. 357-3. Computer Applications in the Mathematical Sciences. An advanced FORTRAN programming course for scientists and engineers. Emphasis on the use of computers as computational tools in engineering and in science. Programming of typical mathematical applications. Prer., E.E. 201 or equivalent; coreq., A.Math. 236 or Math. 313 or equivalent.

E.E. 361-2. Electronics Laboratory I. Experimental investigations of the characteristics of semiconductor devices and their applications. Prer. or coreq., E.E. 321.

E.E. 362-2. Electronics Laboratory II. Continuation of E.E. 361. Prer., E.E. 361; prer. or coreq., E.E. 322.

E.E. 381-3. Introduction to Probability Theory. Basic concepts, conditional and total probability, repeated independent trials, continuous distributions, functions and moments of random variables. Central Limit Theorem, characteristic functions. Prer., A.Math. 235.

E.E. 400-1 to 3. Independent Study. An opportunity for students to do independent, creative work. Prer., consent of instructor.

E.E. 401-3. Survey of Programming Languages. A variety of programming language features are studied from the point of view of the language user. Students explore these features by writing programs in PASCAL, ALGOL 60, FORTRAN, COBOL, LISP, and SNOBOL. Prer., E.E. 210/C.S. 210 or consent of instructor.

E.E. 403-2. Elements of Electronics. For students not majoring in electrical engineering. Fundamentals of electronic devices and applications. Prer., E.E. 303 and 343 (or for physics and engineering physics majors only, Phys. 331 and 317); coreq., E.E. 443.

- E.E. 411-3. (F) Environmental Electromagnetics.** The electromagnetic spectrum and its utilization, with emphasis on microwave line-of-sight and earth-satellite paths. Thermal radiation, the atmosphere, and atmospheric effects on electromagnetic waves. Remote sensing of the atmosphere and sea and land surfaces by radar, radiometric, and satellite techniques. A brief introduction to environmental problems in general is also included. Prer., E.E. 313 and 314.
- E.E. 413-3. (S) Control Systems Analysis.** Linear analysis and analog simulation of electrical, chemical, hydraulic, and mechanical systems using block diagrams and signal flow graphs. Comparison of open and closed loop configurations. Stability studies using Nyquist, Bode, and root locus methods. Effects of simple networks on system response. Introduction of state variable techniques and digital computer solutions. Prer., senior standing with background of Laplace transforms.
- E.E. 415-3. (S) Nonlinear Control Systems.** The analysis and design of nonlinear feedback control systems; types and characteristics of equilibrium states; limit cycle phenomena; the behavior of nonlinearities such as hysteresis, saturation, and dead zone; phase space, describing function analysis. Liapunov and Popov stability will be introduced. Prer., E.E. 413.
- E.E. 416-3. (P) Energy Conversion II.** Polyphase transformers. Equivalent d-q and a-b models of machines. Transients in machines. Prer., E.E. 313 and 316.
- E.E. 422-3. (E) Electronics III.** Switching state models of discrete components and integrated circuits including logic gates, comparators, and operational amplifiers. Input, output, and transfer characteristics. Non-ideal properties. Application to signal generation, amplification, conditioning, and processing. Analog-digital conversion. MOS integrated circuits for memories, shift registers, and charge coupled devices. Phase lock loops. Prer., E.E. 322.
- E.E. 424-3. (C) Communication Theory.** Introduction to principles of modern communication theory and signal processing. Random processes will be introduced and used to compare the noise performance of AM, FM, and various digital modulation systems. Definition of information and channel capacity. Introduction to error correcting codes and further topics in modern communication theory. Prer., E.E. 381 and 331 or 421.
- E.E. 432-3 (M) Introduction to Quantum Electronics (Lasers).** Introduction to lasers and other quantum electronic devices and to the general quantum principles that govern their operation. No background in the mathematical formalism of quantum theory is required. Discussion of various laser types, applications. Prer., E.E. 302 and 314.
- E.E. 434-3. (M) Introduction to Solid State.** (E.Phys. 446.) Introduction to crystallography, free electron theory including ac and dc conductivity, energy band theory, semi-conducting, dielectric, magnetic, optical and superconducting materials, processes and devices. Prer., E.E. 302 and E.E. 314.
- E.E. 436-2 (M) Laboratory for Materials in Electrical Engineering.** A laboratory course to accompany E.E. 434. Experiments selected from x-ray crystallography, phase diagrams of binary alloys, p-n junction technology, optical properties of semiconductors and dielectrics, liquid crystals, and others. Measurement techniques include use of cryogenic fluids, lasers, grating spectrometers, and other special instruments. Coreq., E.E. 434.
- E.E. 437-2. Integrated Circuit Technology.** A lab. course offering experience in monolithic silicon integrated circuit fabrication techniques including IC layout, pattern compiling and generation, mask making, oxidation, photolithography, diffusion, metallization, bonding, process analysis, testing. A design project is included. Prer., E.E. 321.
- E.E. 443-1. Elements of Electronics Laboratory.** For students not majoring in electrical engineering. Prer., E.E. 303 and 343 (or for physics and engineering physics majors only, Phys. 331 and 317); coreq., E.E. 403.
- E.E. 450-3. (S) Analog Computer Simulation.** Analog computing techniques including time and amplitude scaling, programming of linear and nonlinear differential equations. Applications of these techniques to simulate dynamic systems including an introduction to iterative analog computing. Some laboratory work on an analog computer and with digital simulation languages will be required. Prer., A.Math. 235 and background in basic Laplace transform and matrix operations.
- E.E. 451-2. (P) Power Laboratory II.** Experimental investigations of the design and operating characteristics of synchronous machines, induction machines, transformers, power rectifiers, and single phase machines. Prer., E.E. 316 and 354.
- E.E. 452-2. (P) Power Systems Laboratory.** Emphasis is placed upon analysis and operation of power systems and interactions of power equipment under dynamic conditions. Transient phenomena of rotating machines. Prer., E.E. 316 and 354.
- E.E. 453-3. (D) Assembly Language Programming.** (C.S. 453.) A laboratory course in programming at the machine language level. Lectures will deal with the organization of the machine, its effect on the order code, and techniques for programming in assembly language. Primary emphasis will be on preparing and running programs. Prer., E.E. 210/C.S. 210 or consent of instructor.
- E.E. 454-3. (S) Control Systems Laboratory.** Experimental analyses of elementary control systems are considered. Measurements of steady-state and transient characteristics of feedback control systems are performed. Prer., E.E. 413.
- E.E. 456-3. Digital/Analog Instrument Design.** The interconnection of functional digital and analog electronic modules to perform complex instrumentation and control tasks which are described by an algorithm. Design of algorithmic state machines with gates, read only memories, and programmed logic arrays. Linked machines. Application to system control, automatic testing, and design of "intelligent" instruments. Prer., E.E. 257, 322, or consent of instructor.
- E.E. 458-2. (D) Logic Circuits Laboratory.** Concerned with the actual wiring of electronic logic circuits and with investigation of the properties and characteristics of those circuits. Circuits will be built from solid state gates, memory elements, and medium scale integrated circuits. Computer, control, communication, and data processing systems are studied. Prer., E.E. 254 and 257.
- E.E. 459-3. (D) Computer Organization.** (C.S. 459.) This course is concerned with computer arithmetic units, memory systems, control systems, and input-output systems. The emphasis is completely on logic structure rather than electronic circuitry. Prer., E.E. 257 or equivalent.
- E.E. 460-2. (D) Computer Laboratory.** This course will provide laboratory experience both with digital computer subsystems and with complete computer systems. The student will construct small subsystems and work with actual subsystems of a full digital computer. Prer., E.E. 257, 458, and 459.
- E.E. 461-2. (E) Electronics Laboratory III.** Experimental work with oscillators, counters, switching circuits, r-f amplifiers, AM and FM modulators and demodulators, the superheterodyne receiver. Prer., E.E. 362.
- E.E. 463-2. (F) Transmission Laboratory.** Experiments verifying and extending concepts learned in E.E. 314. Applications of coaxial transmission line and waveguide to slotted-line measurement of impedance, stub impedance matching, antenna patterns, and the microwave superheterodyne receiver, making use of electronic and solid-state generators, crystal detectors and frequency converters, bolometer power bridge, cavity frequency meter, etc. Studies of the low-frequency artificial line for power and telephone transmission, time-domain reflectometer, hybrid tee, and ferrite devices. Prer., E.E. 314 or equivalent.
- E.E. 464-3 (F) Electro-Optics Laboratory.** Lasers, light emitting diodes, polarization effects upon reflection and refraction. Diffraction, interference, imaging, spatial filtering. Optical modulation, detection, optical receivers. Prer., E.E.314, electronics lab.
- E.E. 465-2. (C) Communication Laboratory.** Laboratory experiments demonstrating material taught in E.E. 424. Use is made of spectrum analysis to study baseband signals and signal processors. Topics include noise, AM, FM, PM, sampling, TDM, digital modulations, errors, equalizers, and a complete communication system. Prer. or coreq., E.E. 421 or 331.
- E.E. 491 to 499-1 to 3. Special Topics.** Credit and subject matter to be arranged. Prer., variable.

To register for 500-level courses, an undergraduate student must have a *B* average or consent of instructor. The courses listed below are in general offered once per year with the exception of courses marked with an asterisk, which are offered occasionally or on demand.

E.E. 500-1 to 6. Independent Study. Affords an opportunity for students to do independent, creative work. Prer., consent of adviser.

E.E. 501-3. (M) Quantum Theory. Wave-particle duality. Schrodinger equation. Operators. Quantum states. Stationary and time-dependent perturbation theory. Electron spin. Many-particle systems. Pauli principle. Prer., E.E. 302, 314, and 381.

E.E. 503-3. (M) Physical Properties of Crystals.* Utilizing the symmetry properties of crystals, a number of their physical properties will be studied. Tensor analysis will be developed and used to study paramagnetic and diamagnetic susceptibility, electric polarization, stress and strain tensor, piezoelectricity, elasticity, thermal and electrical conductivity, thermoelectricity, refraction, and optical activity.

E.E. 505-3. (M) Principles of Electronic Devices. A course relating performance and limitations of solid state devices to their structures and technology. For both advanced circuit and device engineers. Semiconductor physics and technology. PN-junction and MOS devices. Optoelectronics and bulk devices. Prer., senior standing.

E.E. 509-3. (M) Laboratory in Solid State Physics. (E.Phys. 509.) Experimental investigation on significant experiments in solid state physics. Short lectures in basic theories and experimental techniques. Experiments include X raying, thermal arrest, NMR, various optical and magneto-optical effects, liquid crystals, semiconductor parameters, and others. Measurement techniques use cryogenic fluids, lasers, IR spectrometers, high pressure apparatus and other special instruments. Prer. or coreq., E.E. 434 or E.Phys. 446 or consent of instructor.

E.E. 513-3. (F) Electromagnetic Fields and Waves III. A continuation of E.E. 314 at an intermediate level. Includes a polynomial development of linear antenna array patterns and synthesis, radiation from horn and reflector aperture antennas, transform theory of aperture field patterns including optical sources, reflection and refraction of plane waves at oblique incidence, waveguide wall losses, cylindrical waveguides, resonant cavities, wave modes in spherical coordinates, the antenna boundary-value problem. Green's functions, ray theory in electromagnetics. Prer., E.E. 314 or equivalent.

E.E. 514-3. (F) Electromagnetic Fields and Waves IV. The solution of various boundary-value problems in electromagnetics and its application. The first part is a study of some mathematical theories and physical concepts related to Maxwell's equations. Topics such as potential representations, scalar and vector Green's functions, eigenfunction expansions, Green's theorem, reciprocity, equivalence principle, and image theorem will be treated. The second part of the course involves specific application of those theorems and concepts to radiation, scattering, propagation, and wave guiding of electromagnetic waves. Topics include radiation from apertures in cylindrical surfaces, scattering of a plane wave by cylinders and wedges, general mode theory of metallic and dielectric surface-wave wave-guides, excitations, discontinuities and bends in waveguides, impedance and scattering matrices of microwave junctions. Prer., E.E. 513 or equivalent.

E.E. 518-3. Probabilistic Methods in Electromagnetic Wave Propagation.* Random phasor sums and their applications, field received from random scatterers, applications to ionospheric, tropospheric and other scattering, elements of scattering from rough surfaces, propagation through inhomogeneous media, and polarization of scattered waves. Prer., E.E. 381 or Math. 481.

E.E. 519-2 (F) Radio Meteorology.* Application of electromagnetic field concepts plus some atmospheric physics to the problem of propagation of radio waves through the lower atmosphere. Problems in radio communication and atmospheric sensing are considered. Prer., E.E. 513 or consent of instructor.

E.E. 521-3. Analytical Processes in Engineering. Develops analytical skills in areas of concern in engineering applications. Teaching will be by example rather than by course content but will include integration, differentiation, summation of series, approximations, and manipulation of trigonometrical expressions. Prer., fluency in elementary mathematical operations, A.Math. 235 or equivalent.

E.E. 526-3. (F) Atmospheric Effects on Electromagnetic Waves. Faraday rotation, refraction, time delay, and attenuation in the ionosphere and/or troposphere, including the effects of rain on

electromagnetic waves. Incoherent backscatter, Ionospheric disturbances and irregularities. Applications to telecommunications and remote sensing of the atmosphere. Prer., E.E. 513 or equivalent.

E.E. 531-3. Telecommunications Systems. The telecommunication systems currently in use and some of the basic technical concepts of their operation are treated in this course. The systems treated include telephone systems (voice, data, and facsimile); coaxial cable and waveguide systems; microwave relay systems (surface and satellite); low-frequency radio systems (communication, instrumentation, and navigational); medium-frequency radio systems (broadcast and point-to-point communications); high frequency radio systems (broadcast, including FM and TV; point-to-point, including troposcatter and meteor scatter; instrumentation; and navigation); and radar. The basic technical concepts treated include signal transmission theory (involving the propagation of guided and unguided electromagnetic waves) and interrelations between channel capacity, traffic theory, information measurement, bandwidth, signal power, and noise power. For persons with engineering background. Prer., calculus and some engineering background.

E.E. 532-3. Telecommunications Systems Theory. This course is concerned with three principal topics: operations management (operations research), communication traffic theory, and future trends in communication systems information handling capabilities. The mathematical fundamentals for study of these topics will be covered, but the student will be assumed to have a knowledge of elementary mathematical probability theory and statistics. Prer., E.E. 531 and 534 or equivalent.

E.E. 534-3. Introduction to Telecommunication Systems Theory. Fundamentals of electromagnetic fields and waves, probability, waveform analysis, and information theory for persons without a previous technical background. Designed especially for those participants in the telecommunication curriculum whose undergraduate major was in a nontechnical field.

E.E. 535-3. (S) Network Synthesis I. Fundamentals of one- and two-port synthesis techniques for achieving networks with specified frequency- or time-domain response. Theory of rational-function approximation to ideal response characteristics. Synthesis of the active inductorless networks essential for practical implementation of large-scale integrated circuit technology. Prer., E.E. undergraduate mathematics and network analysis.

E.E. 537-2. Telecommunications Laboratory. Laboratory experiments demonstrating and verifying material taught in E.E. 531. Use is made of spectrum analysis to study signal processors. Topics include noise, AM, FM, PM, TDM, FDM, and data communication. Prer. or coreq., E.E. 531.

E.E. 541-3. (S) Automatic Control Systems I. Fundamental feedback equation and flow graph and its use in analysis. Synthesis of the one degree of freedom system and its inherent limitations. Synthesis of two degrees of freedom systems for controlled sensitivity to plant ignorance and disturbance attenuation. The critical role of internal noise. The ideal Bode characteristic for absolutely stable and conditionally stable systems. Nonminimum phase and open-loop unstable systems. The extraordinary properties of parallel-plant system and z-transforms. The synthesis of multiple-loop multi-variable and sampled-data systems is treated with special attention to design for disturbance attenuation and controlled sensitivity to parameter ignorance. Statistical optimization for minimum- and nonminimum-phase, and open-loop unstable plants. Prer., E.E. 413.

E.E. 542-3. (S) Automatic Control Systems II. Continuation of E.E. 541. Prer., E.E. 541.

E.E. 544-3. (S) Introduction to Modern Control Theory. State space concepts, state space representation of automatic control systems; state transition matrix and state transition function; stability of linear systems, controllability and observability; state-feedback control, realization of system transfer matrices; state estimator and design of feedback systems. Prer., E.E. 413 or 421.

E.E. 545-3. (S) Sampled-Data and Digital Control Systems I. A study of the analysis and synthesis of control systems characterized by the transmission of control signals by means of periodic pulses; z-transform theory and pulse transfer functions are introduced with applications to digital computers. Prer., E.E. 413.

E.E. 548-3. (S) Engineering System Analysis and Design.*¹ Procedures of mathematical engineering analysis and design. The

¹Taught in Colorado Springs only.

formulation and solution of system problems of an interdisciplinary nature are stressed. Analog and digital computer methods of solution are used. Prer., E.E. 541 or equivalent.

E.E. 550-3. (D) Minicomputer Signal Processing. On-line computer processing of analog signals. Assembly language of a minicomputer will be presented with no prior background assumed. Introduction to problems and practical constraints of analog signal sampling. Emphasis on applications in medicine, industry, and research. Prer., senior standing.

E.E. 551-3. The Hardware-Software Interface. Principles of interfacing hardware and software. Hardware and software processes and how to synchronize them. Hardware-software tradeoffs. Prer., E.E. 257, E.E./C.S. 453.

E.E. 552-3. Computer Data Structures. Basic concepts of data. Linear lists, strings, and arrays. Representation of trees and graphs. Storage systems and structures, storage allocation and collection. Multilinked structures. Searching and sorting techniques. Prer., E.E. 453.

E.E. 553-3. (D) Fundamental Concepts in Programming Languages. (C.S. 553.) A study of the concepts which underlie the design of a programming language. Basic operations, operand modes, and formation rules. Examples are drawn from contemporary languages such as FORTRAN, COBOL, ALGOL, LISP, ANOBOL, and PASCAL. The relationship among languages, hardware, and applications is studied in the light of the underlying concepts. Prer. E.E. 453.

E.E. 554-3. (D) Seminumerical Methods for Digital Computers. (C.S. 554.) This is a survey of topics in the borderline area between numerical analysis and computer systems programming and design. A knowledge of assembly language and some familiarity with computer architecture are necessary for the course. Some topics covered are computer round-off error, floating point arithmetic, the generation of random numbers, and parallelism in numerical calculations. Prer., E.E. 401 and 453 and numerical analysis.

E.E. 555-3. (D) Nonnumerical Techniques for Digital Computers. (C.S. 555.) A study of the methods used in implementing processors for nonnumerical problems; dynamic storage allocation, list processing, recursive programming and string manipulation. Several special purpose languages and their implementations will be studied in detail. Prer., E.E. 453 and 401 or equivalent.

E.E.556-3. (D) Translation of Programming Languages. (C.S. 556.) A study of practical techniques for translating text generated by humans into programs understood by machines: lexical, syntactic and semantic analysis, code generation, assembly and optimization, error reporting and recovery. Students write and run their own compilers. Prer., E.E. 453, E.E. 401, and either E.E. 257 or C.S. 402, or consent of instructor.

E.E. 557-3. (D) Operating Systems. (C.S. 557.) A study of the means by which programming systems are integrated into the overall operations of a computing facility. Program segmentation and loading, filing systems, resource allocation. Prer., E.E. 401 and 453.

E.E. 558-3. (D) Artificial Intelligence. (C.S. 558.) The design of machines and systems that have been created to perform tasks that are considered to require intelligence. Prer., E.E. 401.

E.E. 559-3. (D) Advanced Computer Architecture. A broad scope treatment of the important concepts in the structural design of computer systems. A large number of actual computers will be studied in depth. Prer., E.E. 459 or consent of instructor.

E.E. 561-3. (C) Noise and Random Processes. (C.S. 564.) Brief review of probability theory, sequences of random variables, specification of stochastic processes, stationarity, correlation functions and power spectra, derivative of a random process, Markov chains, linear and nonlinear systems with random input, application to noise theory. Prer., E.E. 381.

E.E. 562-3. (C) Information Theory and Coding. (C.S. 562.) Information and entropy. Markov chains, combined systems, continuous systems, coding theory, channel capacity, modulation, applications to communication engineering. Prer., E.E. 381 or consent of instructor.

E.E. 563-3. (C) Theory and Application of Digital Filtering. The use of digital and discrete time systems in engineering has been increasing due to the widespread use of digital computers and because of the ease of manufacture of digital components. This

course is an introduction into the techniques that are used to analyze such systems. The primary emphasis is on study of linear discrete time systems that are used to perform operations on random sequences for the purposes of signal detection, prediction, and signal enhancement. The course will cover such topics as linear difference equations, z-transforms, characterization of discrete-time systems by state variables, random sequences, deconvolution filters, discrete-time matched filters and Wiener filters, discrete-time filters in estimation and detection, properties of discrete stochastic processes. Prer., E.E. 381 or Math. 481 and E.E. 331 or 421.

E.E. 565-3. (C) Detection and Extraction of Signals from Noise.* This course is an introduction into detection and extraction methods used in signal processing and includes such subjects as decision theory, detection of known and random signals, optimum received design and evaluation, estimation theory, estimation of parameters, Wiener filtering, Kalman-Bucy filtering, applications to problems in communication theory. Prer., E.E. 381 or equivalent.

E.E. 566-3. Optimization Techniques. An introduction to problems involving optimization in the presence of uncertainty and a survey of computational methods for obtaining solutions. Introductory material includes necessary conditions for solutions to unconstrained and constrained minimization problems (Kuhn-Tucker conditions, convex programming). Several algorithms for single and multidimensional search are given, including direct and gradient methods. Applications may include linear programming and game theory, decision theory, pattern recognition, dynamic programming, sequential decision theory, Markov chains with decision rules, and optimization of dynamical systems. Prer., E.E. 381 or equivalent.

E.E. 567-3. (S) Reliability and Queuing Theory. Queuing theory, particularly applied to communication traffic; component reliability, environmental reliability, system reliability, stand-by redundancy, parallel redundancy, repair and preventive maintenance, system availability. Prer., E.E. 381.

E.E. 568-3. (C) Optical Communication Systems. Analysis and design of communication systems which use light as the information carrier. Free-space, fiber-optic, turbulent atmospheric, and scattering channels; statistical channel characterization; spatial aspects of optical channels; modal representation of random fields. Coherent and incoherent sources; modulation methods; spatial modulation. Modeling and statistical analysis of quantum photodetectors; Poisson and related processes; thermal and shot noise. Direct and heterodyne detection; analog and digital transmission; signal-to-noise ratios; error probabilities. System optimization. Prer., E.E. 381 and 331, or 421, or consent of instructor.

E.E. 569-3. (C) or (D) Optical and Spatial Information Processing.* Treats the processing of two- and three-dimensional spatial information. The scalar diffraction theory necessary to describe the information-bearing wavefront is developed and wavefront recording, modulation, and reconstruction are described. Topics included are holography, Fourier transform properties of lenses, two-dimensional convolution and correlation, pattern recognition, optical information processing, and data storage. Prer., E.E. 314 and E.E. 331 or 421, or equivalent.

E.E. 570-3. (P) The Nature of Polyphase Induction Motors.* Operational behavior of induction motors and the effect of design on performance characteristics are studied. The effect of unbalanced supply voltages and of unbalanced design are investigated. The effect of variable frequency supplies and application of inverter supplies to induction machines are considered. Prer., E.E. 316.

E.E. 571-3. (P) Energy Systems Analysis I. Transmission line constants, including details of GMD methods, skin effect. Analysis of balanced and unbalanced line using distributed parameters, energy flow from circle diagram approach, traveling-wave phenomena, stability. Prer., E.E. 313 and 316.

E.E. 572-3. (P) Energy Systems Analysis II. Application of symmetrical components to faults on transmission systems, determination of system constants, introduction to calculating board and network analyzers, measurement of sequence quantities, relaying philosophies, power-flow studies. Prer., E.E. 316.

E.E. 573-3. (P) Tensor Analysis of Electric Energy Systems.*¹ The application of matrix and tensor methods to the analysis of energy systems and subsystems; energy transfer; load prediction and system design. Introduction to Kron's method of Diakoptics. Prer., E.E. 416 or equivalent.

E.E. 575-3. (P) Energy Systems Stability I.*¹ Transient and steady-state stability limits of energy transmission systems; electrodynamic characteristics of generators, synchronous condensers and motor loads. Prer., E.E. 416 or equivalent.

E.E. 576-3. Industrial Power Systems. Use of per unit methods to find transient voltage behavior of industrial power systems due to motor starting, spot welders, etc. System and device responses due to series and shunt capacitors and problems of subharmonic and over-excitation on induction motors. Prer., E.E. 213, 214, 316, 331, or 421.

E.E. 577-3. Power System Protection. Concepts of power system operation and the use of R-X diagrams in selection of protection needs. Comparison of electromechanical and static protection systems. Review of problem areas such as system stability, loss-of-excitation and /EHV line protection. Prer., E.E. 213, 214, 316, 331, or 421.

E.E. 578-3. (P) Electromagnetic Fields in Electrical Devices I.* Methods for linear magnetic fields in electrical devices; potential equations of electromagnetic fields; function theory; conformal mapping; method of images; numerical methods. Prer., E.E. 314 and 416.

E.E. 583-3. Biomedical Systems Analysis. (EDEE 571.) Quantitative modeling of biological processes aided by computer simulation. Typical systems studied will be mammalian cardiovascular and respiratory systems, skeletal and cardiac muscle, eye-tracking mechanisms, and ecological models. Necessary biological background will be presented. Prer., A.Math. 235 or 236.

E.E. 585-3. (S) Electroacoustics.¹ Derivation of the acoustic wave equation; plane waves; solutions in closed and open pipes, acoustic compliance, inductance, and resistance; signal flow graphs for electromechanical systems; electro-acoustic signal flow graphs; time-shared digital computer analysis via complex matrix inversion. Prer., E.E. 214, 314, or consent of instructor.

E.E. 586-3. (S) Loudspeaker Synthesis.¹ Continuation of E.E. 585. Closed and vented box direct radiator drivers, eigenvalues for loudspeakers; closed box loudspeaker analysis; Thiele alignment of vented box loudspeakers; filter assisted alignments; Small's syntheses of acoustic and mechanical parameters; limitations of presently marketed systems; power handling considerations; cross-over network theory. Prer., E.E. 585.

E.E. 588-3. (D) Computer Solution of Engineering Problems I. Use of computers and timesharing systems to solve typical engineering problems, including real and complex roots of equations, integration, and ordinary differential equations. Prer., undergraduate calculus.

E.E. 589-3. (D) Computer Solution of Engineering Problems II. Use of computers and timesharing systems to solve typical engineering problems, including partial differential equations, matrices and matrix eigenvalues, least-squares, Fast Fourier Transform, and power spectrum analysis. Prer., E.E. 588.

E.E. 590-0. Graduate Seminar. Meetings of staff members, visiting speakers, and graduate students to discuss recent advances in electrical engineering research.

E.E. 591 to 599-0 to 3. Special Topics. Intermediate courses of variable title and variable credit, usually offered once by guest lecturers. See current departmental notices for details.

E.E. 600-1 to 6. Independent Study. Affords an opportunity for students to do independent, creative work. Prer., consent of advisor.

E.E. 601-3. Solid State Electronics I. Introduction to the quantum theory of solids: free electron theory of metals; crystal lattices; energy band theory of crystals (particularly semiconductors); electron dynamics in perfect crystals (including tunneling); Fermi statistics; electron-photon interactions; lattice vibrations; electron transport in real crystals; elementary theories of ferromagnetism and of super-conductivity. Prer., E.E. 434 and 501, or consent of instructor.

E.E. 602-3. Solid State Electronics II. Intermediate quantum theory of solids: advanced methods in band theory (group theory,

approximation methods, pseudopotentials); electron-electron interaction effects; quantum theory of electron scattering; BCS theory of superconductivity. Prer., E.E. 601.

E.E. 606-0 to 6. Advanced Topics in Physical Electronics.* Semi-formal lecture-discussion of topics of current interest. Most lectures are presented by the participants. Each student registered for credit will present at least one lecture per semester. Prer., consent of instructor.

E.E. 609-3. Quantum Electronics. Introduction to the theory of lasers, optical resonators, and nonlinear optics, with the emphasis on application to devices. Prer., some background in quantum mechanics, E.E. 501.

E.E. 621-2. Advanced Analytical Processes in Engineering. Derivation and exposition of important functional properties as required in engineering applications. Functions examined include gamma, Bessel, Legendre, and elliptic functions. Prer., E.E. 521 or equivalent skills.

E.E. 627-3. Mathematical Methods of Field Theory I.* Study and application of some of the mathematical methods needed in solving certain boundary-value problems in electromagnetic field theory. The material will be chosen from a wide area including the following: Wiener-Hopf and other transform methods; singular integral equations; variational calculus; mode expansions; Green's theorem; quasi-static methods; asymptotic, steepest-descent, and WHB techniques, linear vector spaces, and matrices. The methods will be illustrated by physical examples taken from waveguide diaphragms; junctions and other discontinuities; linear antennas and antenna arrays; diffraction and scattering; wave propagation at surface and inhomogeneous media. Prer., an introduction to complex variables and E.E. 514, or equivalent.

E.E. 628-3 Mathematical Methods of Field Theory II.* Continuation of E.E. 627. Prer., E.E. 627.

E.E. 636-3. Network Synthesis II. Active network synthesis employing negative impedance converters, gyrators, and operational amplifiers. Matrix manipulation of networks, the scattering matrix, approximation methods for generating rational functions, transfer function synthesis. Prer., E.E. 535.

E.E. 641-3. Optimal Control Theory.* Formulation of optimal control problems, performance index; the variational approach to optimal control problems; Pontryagin's maximum principle; Bellman's dynamic programming; the principle of optimality, the Hamilton-Jacobi equation; computational methods; the steepest descent method, variation of extremals, quasilinearization; and gradient projection, etc. Prer., E.E. 544.

E.E. 642-3. Learning and Adaptive Systems.* System identification theory; adaptive systems subject to deterministic and random inputs and disturbances, sensitivity analysis; parameter variation problems, learning systems. Prer., E.E. 542 and 544.

E.E. 643-3. Theory of Nonlinear Systems.* The phase plane, singular points, limit cycles. Describing functions for single, multiple, and random inputs. System compensation and design by describing functions. The self-oscillating adaptive system—single- and multiple-loop designs. Liapunov functions for stability analysis and system design. Popov's method and extensions. Applications of functional analysis. Prer., E.E. 544.

E.E. 645-3. Sampled-Data and Digital Control Systems II.*¹ An advanced study of the theory of discrete-time systems. Discrete-time control system stability and stochastic processes will be treated in depth. Prer., E.E. 545.

E.E. 663-3. Advanced Digital Signal Processing Methods. Presents the application of digital filtering theory to problems in communication and signal processing. Topics covered include computer implementation techniques, fast Fourier transforms, quantization effects, and recursive (adaptive) digital filtering. Prer., E.E. 563.

E.E. 673-3. Advanced Synchronous Machines.* Study of transient characteristics of synchronous machines such as short-circuit currents and torques, out-of-phase synchronizing, and starting torque. Prer., E.E. 416 or equivalent.

E.E. 678-3. Electromagnetic Fields in Electrical Devices.* Numerical methods for nonlinear electrical devices; nonlinear partial differential equations; representation of magnetization characteristics; successive pointwise overrelaxation; successive line overrelaxation; alternating direction methods; underrelaxation of

¹Taught in Colorado Springs only.

reluctivities; application to rotating machines and nuclear accelerator magnets. Prer., E.E. 578.

E.E. 691 to 699-0 to 3. Selected Topics. Courses of variable title and variable credit, usually offered once by guest lecturers. See current departmental notices for details.

E.E. 700-variable credit. Master's Thesis.

E.E. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

ENGINEERING — NONDEPARTMENTAL COURSES

Engr. 101-2. Engineering Drawing I. Beginning engineering drawing including use of instruments, orthographic projection, pictorial drawing, sections, fasteners, dimensioning, and working drawings.

Engr. 109-3. Creative Uses of Technology I. An introductory-level course for students not majoring in engineering or science. The course is constructed around concepts and procedures employed by the engineer and scientist, but with major emphasis on improvement of the understanding of modern technology, its methods, and its impact on society. Modeling, decision making, and feedback as applied to biological, mechanical, electrical, thermal, and other systems. Study of problems such as population growth, traffic flow, spread of disease. Use and impact of computers.

Engr. 110-3. Creative Uses of Technology II. A continuation of Engr. 109 in which the techniques learned there are developed further and applied to problems of general interest. Prer., Engr. 109.

Engr. 131-3. Man and His Environment. A study of the interaction between technological innovations and the natural environment during the last century.

Engr. 300-2. Interaction of Engineering and Society. A seminar course of case studies in the interrelationships of engineering and society — the effects of social, political, and economic pressures on decision making and operations related to engineering and, conversely, the effects of engineering works on society. The students prepare written cases for discussion by the class. Prer., consent of instructor.

Engr. 301-3. Thermodynamics. Introduction to energy and its transformations, entropy and information theory, states of matter, and statistical mechanics, with engineering applications. Prer., E.Phys. 114 and A. Math. 236.

Engr. 316-2. Technical Report Writing and Communication. Instruction and practice in writing and analyzing reports, papers, articles, and other forms of communication. Style and editing are emphasized. Prer., junior standing.

Engr. 400-3. Occupational Safety Management. Introduction and orientation to the basic fundamentals of the interdisciplinary field of occupational safety and health including the philosophy of recent federal and local governmental enactments. Open to students in the Master of Engineering program or by consent of instructor.

Engr. 401-3. Undergraduate Research. Supervised individual research projects in the student's major department.

Engr. 403-1. Literature of the Sciences and Engineering. (Bib. 403.) A brief survey of the chief reference sources in the sciences and engineering leading to the development of a bibliography in the student's chosen field of interest under the guidance of the appropriate science librarian. Recommended for majors in sciences and engineering.

ENGINEERING DESIGN AND ECONOMIC EVALUATION

EDEE 102-2. Fundamentals of Design II. Engineering design drawing fundamentals. Perspective, sectional views, vectors, surface intersections and developments, warped surfaces, shades and shadows, graphical calculus, and engineering applications thereof. Prer., EDEE 101.

EDEE 151-3. Engineering and Technology in History. Three 1-hr. rec. per wk. The history of problems, ideas, developments, and achievements in engineering. Possible impacts and influences of present and future engineering and technological developments. Sociocultural, humanistic, economic, and political factors encouraging or inhibiting engineering and technological growth.

EDEE 203-3. Fundamentals of Design III. Introduction to the use of computational tools in graphic display and design. Includes review of fundamentals of FORTRAN, graphic techniques in batch processing, interactive terminals, and interactive computer graphics. Prer., E.E. 201 or C.S. 201.

EDEE 221-3. Product Definition. One 1-hr. rec., two 3-hr. lab. periods per wk. Methods of production in parts and assemblies. Graphical tools applied to production; design layouts, details, and functional drawings. Prer., EDEE 101.

EDEE 222-3. Introduction to Computer-Aided Design. Three 1-hr. rec. per wk. Application of digital computers to linear and nonlinear problems in engineering design. Applications in mechanisms and the mathematical modeling to execute dimensional synthesis and analysis. Introduction of analog computers and simulations in engineering design. Prer., consent of instructor.

EDEE 232-3. Experimental Mechanics for Design. Elementary case studies in design involving both analytical and experimental solutions. Relationships between load and deformation, stress and strain due to axial, flexural, torsional, or combined loading. Prer., C.E. 212.

EDEE 331-3. Engineering Materials. Three 1-hr. rec. periods per wk. Comparative study of the characteristics and applications of materials as they influence the design of a product. Economics of selection and fabrication, and specification of materials. Prer., EDEE 221 or consent of instructor.

EDEE 332-3. Experimental Stress Evaluation, Analysis, and Design. Two 1-hr.-rec., one 3-hr. lab. per wk. Stress analysis. Methods of evaluating maximum stress and strain in typical shapes and under typical conditions. Strain gauge, photoelastic, and photostress techniques. Design consequence of combined stress, variable stress, and variable combined stress; thermal and impact stresses; relative compliance in structural systems. Prer., EDEE 232 or C.E. 312.

EDEE 351-3. Engineering Statistics I. (Ch.E. 351.) Three 1-hr. rec. per wk. Introduction to probability and statistics with emphasis on engineering applications. Frequency distributions, statistical hypotheses and estimation: linear regression and correlation; nonlinear and multiple regression; analysis of variance. Prer., A.Math. 231 or 235 or equivalent.

EDEE 352-3. Engineering Statistics II. Three 1-hr. rec. per wk. Continuation of EDEE 351. Topics include linear regression and correlation, curvilinear and multiple regression, analysis of variance, design and analysis of experiments, evolutionary operation, optimum seeking, desirability function, quality-assurance applications, reliability and life-testing. Prer., EDEE 351 or equivalent.

EDEE 400-1 to 6. Independent Study. Study of special projects by student and instructor. For undergraduates. Prer., consent of instructor.

EDEE 421-3. Advanced Materials in Design. An advanced and relatively comprehensive coverage of materials topics, a knowledge of which is significant to the design process: environmental considerations, friction and wear, data analysis, materials systems, and biomedical materials. Prer., senior standing or consent of instructor.

EDEE 441-3. Introduction to Operations Research. Introduction to operations research involving formulation and Simplex solution to linear programming. Sensitivity, duality, and optimization in networks. Algorithms for linear OR models. Introduction to dynamic optimization models. Prer., Math. 236.

EDEE 442-3. Operations Research II. Continuation of EDEE 441. Integer and combinatorial models. Optimization of nonlinear problems, stochastic programming. Waiting line models. Implementation of OR. Prer., EDEE 441.

EDEE 451-3. Engineering Management. Relationship of the engineer to functions and decisions of management. Design of organization systems, manufacturing policies and facilities, work design, product cost determination, basic legal concepts, project administration, audit and evaluation for optimum use of resources. Prer., senior standing.

EDEE 453-3. Computer Techniques in Engineering. (E.E. 455, C.E. 453.) Introduction to the use of numerical methods in engineering and science. Those methods suitable for solution by high speed digital computers are emphasized. Prer., E.E. 201 and A.Math. 231 or 235.

EDEE 461-2. Senior Project. One 3-hr. lec. per wk. A major project of the student's proposal, simulating as closely as possible the design engineer's professional activity. Strong emphasis on economic evaluation methods. Preparation of all specifications and final report. Prer., senior standing.

EDEE 462-2. Senior Project. One 3-hr. period per wk. Continuation of work begun in EDEE 461.

EDEE 465. Human Factors in Design. An interdisciplinary study of the contributions that human engineering can make to the design process. Within the concept of the science of engineering design, human engineering encompasses the search for compatibility between man and his technical environment.

EDEE 471-2. Seminar in Engineering Research and Development. One 2-hr. seminar per wk. An introduction to methods and topics of engineering research. Problems and practices in planning and executing scientific research and development. Intended for students beginning research and for those who wish an introduction to various topics which were not included in their study. Prer., consent of instructor.

EDEE 490-3. Biomechanics. Bioengineering of the human body with emphasis on man as a complex machine. Kinematic and dynamic analysis of human joints as spatial complex mechanisms. Computer modeling of biomechanics for motion simulations. Design of biomechanics instruments and experiments. Precision computer-aided X-ray analysis. Prer., consent of instructor.

EDEE 497-3. Engineering Economy. (C.E. 497.) Three lect. per wk. Application of economic and financial principles to engineering alternatives. Calculation of annual costs, present worth, and prospective rates of return on investment. Depreciation and replacement studies. Economic aspects of public works. Preparation of engineering reports on economy studies. Prer., senior standing.

EDEE 500-1 to 6. Independent Study. Study of special design projects agreed upon by student and instructor.

EDEE 515-3. Servomechanisms. Basic mechanics of servomechanisms. Typical components, typical systems, and both optimum and practical transient behavior of systems. Laboratory demonstrations, using special demonstration equipment and electronic analog computer. Prer., senior standing or consent of instructor.

EDEE 518-3. Photoelasticity. Two rec., one lab. demonstration period per wk. Principles of photoelastic stress analysis. Laboratory demonstrations illustrate the use of the photoelastic polariscope, with suitable plastic models for determining fringe value, principal stress difference and direction and numerical value of stress at a free boundary. Prer., EDEE 332 or C.E. 312 and senior standing.

EDEE 520-3. Plastics Technology. Three rec. periods per wk. Selection and specification of materials, molding and fabrication processes, engineering design of plastic products, cost estimating, and production of specifications. Prer., senior standing or consent of instructor.

EDEE 521-3. Failure Analysis. Evaluation of failure of mechanical parts or assemblies due to unusual loads, manufacture defects, or material defects. The legal implications of these failures. Fatigue failure will be studied in detail. Case studies method will be used. Prer., M.E. 362 or equivalent; M.E. 414 or equivalent; or consent of instructor.

EDEE 541-3. Linear and Integer Programming. Formulation of LP models, the Simplex Method, fundamental concepts from linear algebra. Duality, post optimality, and parametric programming. Network and integer programming models. Prer., Math. 236.

EDEE 542-3. Nonlinear Programming. Formulation of NLP models. Fundamental concepts from convex analysis. Saddlepoint optimality conditions. Kuhn-Tucker theory. Unconstrained optimization methods. Constrained optimization algorithms. Dynamic programming and discrete optimization. Prer., EDEE 541.

EDEE 545-3. Production Automation Systems. Development of models for production automation systems with emphasis on control of production machinery, the information requirements, the use of original product design information and the computer network. Prer., EDEE 441 or consent of instructor.

EDEE 548-3. Applied Probability Models. A renewal theory approach to common stochastic models of operations research. Some

topics treated are queuing, Markov and semi-Markov decision processes, maintenance and replacement models. Prer., EDEE 441.

EDEE 551-3. Design and Analysis of Experiments I. Three 1-hr. rec. per wk. Review of statistical hypothesis testing, regression and simple analysis of variance. Pros and cons of experimental designs for physical sciences and engineering. Planning efficient experiments to answer various kinds of questions. Response-surface analysis. Desirability function. Optimization of experimental systems. Prer., introductory statistics, e.g., EDEE 351, or consent of instructor.

EDEE 561-3. Design of Engineering Models. Three 1-hr. rec. per wk. Design of physical, graphical, mathematical, and computer (analog, digital, hybrid) models for feeding back information vital to engineering decisions. Prer., EDEE 431 or equivalent.

EDEE 571-3. Biomedical Systems Analysis. (E.E. 583.) Quantitative modeling of biological processes aided by computer simulation. Typical systems studied will be mammalian cardiovascular and respiratory systems, skeletal and cardiac muscle, eye-tracking mechanisms, and ecological models. Necessary biological background will be presented. Prer., A.Math. 236.

EDEE 572-3. Neuro-Behavioral Systems. (Psych. 507.) Application of control system theory to behavioral and dynamical properties of nervous systems. Examples chosen from sensory, sensorimotor, housekeeping, motivational, and cognitive systems. Prer., Psych. 405 or consent of instructor.

EDEE 581-3. Optimal Design. Three 1-hr. rec. per wk. Engineering design by optimization. Various nonlinear constraints and optimization theories applied to synthesis of components and systems with use of computer. Sizes, shapes, and material selection by kinematics, dynamics, and mechanical behavior of engineering material. Prer., consent of instructor.

EDEE 582-3. Space Mechanisms. Three 1-hr. rec. per wk. Mathematical notations of three-dimensional displacement, velocity, and acceleration. Displacement matrix method for synthesis and analysis of space mechanisms. Advanced kinematics of gears. Computer techniques for space mechanics design. Prer., consent of instructor.

EDEE 591-3. Advanced Engineering Economy. Three 1-hr. rec. per wk. Advanced theory and concepts of economic analysis incorporating probabilistic aspects. Techniques of mortality analysis for equipment and production items. Mathematical models for equipment replacement. Measures of cost effectiveness concepts. Incremental models. Prer., Ch.E. 452, C.E. 497, or EDEE 342.

EDEE 592-3. Engineering-Economic Simulation. Three 1-hr. rec. per wk. Design, construction, testing, and operation of engineering-economic models for simulation. Starting with the simple hand-computed simulations, progressing to complex models requiring the use of a high speed digital computer. Prer., E.E. 201 or consent of instructor.

EDEE 593-3. Design Estimating. Directed toward the evaluation of design in economic terms. With design as the focus, methods of estimation, forecasting, and optimization are treated. Computer modeling. Cost-benefit analysis. Prer., EDEE 342.

EDEE 595-1 to 6. Selected Topics. Treatment of specialized aspects of engineering design and economic evaluation by staff or visiting lecturers. Prer., consent of instructor.

EDEE 700-variable credit. Master's Thesis.

ENGINEERING PHYSICS

E.Phys. 105-3. General Astronomy. (A.G. 111.) Principles of modern astronomy for nonscience majors, summarizing present knowledge about the earth, moon, planets, and the origin of life. In both A.G. 111 and A.G. 112, emphasis is placed on how knowledge is obtained, on concepts rather than details, and problems to be solved. In both courses there is considerable use of the Fiske Planetarium, but only limited use of telescopes. Students desiring more extensive laboratory and observing experience should also register for A.G. 121 or 122.

E.Phys. 106-3. General Astronomy. (A.G. 112.) Principles of modern astronomy for nonscience majors summarizing present knowledge about the sun, stars, birth and death of stars, galaxies, and the structure and origins of the universe. E. Phys. 105 and 106 may be taken in either order.

- E.Phys. 111-4. General Physics.** Two lect., two rec. per wk. First semester of three-semester sequence for science and engineering students. Covers kinematics, dynamics, momentum of particles and rigid bodies, work and energy, gravitation, simple harmonic motion, and introduction to thermodynamics. Prer., knowledge of algebra, geometry, and trigonometry; coreq., calculus through derivatives and indefinite and definite integrals of polynomials and trigonometric functions, as typically covered in Math. 130 or A.Math. 135.
- E.Phys. 112-4. General Physics.** Two lect., two rec. per wk. Covers electricity and magnetism, wave motion, and geometrical optics. Prer., E.Phys. 111; coreq., Math. 230 or A.Math. 136.
- E.Phys. 114-1. Experimental Physics.** One lect., one 2-hour lab. period per wk. To be taken in parallel with E.Phys. 112.
- E.Phys. 125-1. General Astronomy Laboratory.** (A.G. 121.) Optional laboratory for E.Phys. 105, involving observatory, planetarium, and laboratory experience, emphasizing the planetary system. One scheduled hour per week plus additional day and night time hours to be arranged.
- E.Phys. 126-1. General Astronomy Laboratory.** (A.G. 122.) Optional laboratory for E.Phys. 106 involving observatory, planetarium, and laboratory experience, emphasizing sun, stars, and galaxies. One scheduled hr. per wk. plus additional day and night time hours to be arranged.
- E.Phys. 213-3. General Physics.** Two lect., one rec. per wk. Covers thermodynamics, physical optics, and introductions to special relativity, quantum theory, atomic physics, solid state, and nuclear physics. Prer., E.Phys. 112 and 114.
- E.Phys. 214-3. Introductory Modern Physics.** Three rec. per wk. A continuation of the modern physics topics from Phys. 213. Introduces mathematical techniques required for a quantitative understanding of the phenomena of modern physics, including vector algebra and vector calculus, Fourier analysis, and some of the differential equations of physics. Prer., E.Phys. 213.
- E.Phys. 215-1. Experimental Physics.** One lect., one 2-hr. lab. per wk. To accompany E. Phys. 213. Includes many experiments in modern physics, including atomic physics, solid state physics, electron diffraction, radioactivity, and quantum effects.
- E.Phys. 317-2 and 318-2. Junior Laboratory.** One lect., one 3-hr. lab. per wk. Contains experiments on data handling, electrical measurements, electronics, optics, vacuum techniques, heat and thermodynamics, mechanics, and modern physics. Emphasis will be on developing basic skills and on design of experiments. Each student will carry out at least one project experiment each semester. Coreq., E.Phys. 331.
- E.Phys. 321-3. Classical Mechanics.** Topics covered include Newtonian mechanics, oscillations, Lagrange's and Hamilton's equations, central forces, and scattering. Analytical procedures employing the methods of vector analysis and calculus will be stressed. Prer., E.Phys. 214 and A.Math. 236 or equivalent.
- E.Phys. 322-3. Classical Mechanics and Quantum Mechanics.** Topics covered include non-inertial reference frames, rigid body motion, coupled oscillators, introduction to quantum mechanics, Bohr theory, simple solutions to Schrodinger equation, and perturbation theory. Prer., E.Phys. 321.
- E.Phys. 331-3 and 332-3. Principles of Electricity and Magnetism.** Elements of mathematical theory of electricity and magnetism including electrostatics, magnetostatics, polarized media, direct and alternating current theory, introduction to electromagnetic fields and waves, introduction to special relativity. Prer. for E.Phys. 332 is E.Phys. 331.
- E.Phys. 341-3. Thermodynamics and Statistical Mechanics.** Statistical mechanics applied to macroscopic physical systems; statistical thermodynamics; classical thermodynamic systems; applications to simple systems. Relationship of the statistical to the thermodynamic points of view is examined. Prer., E.Phys. 321.
- E.Phys. 370-3. Introductory Electronics.** Spring. Not for physics or E.E. majors. Meets the needs of chemists, engineers, biologists, and science teachers. Principles and applications of electron tubes and solid state devices for use in power supplies, amplifiers, and oscillators with emphasis on understanding circuit operation. Applications are taken from the field of electronic instrumentation. For maximum benefits the lab., E.Phys. 375, should be taken concurrently. Prer., knowledge of elementary d.c. and a.c. circuits.
- E.Phys. 375-1. Introductory Electronics Laboratory.** Spring. Lab. course to be taken concurrently with E.Phys. 370. Covers assembly and test of circuits involved in power supplies, amplifiers, and oscillators. Use and operation of modern electronic test instruments is included.
- E.Phys. 446-3. Solid-State Physics.** (E.E. 434.) Primarily for senior physics majors. Crystal structure, lattice dynamics, band theory, semiconductors, ferromagnetics, etc. Prer., E.Phys. 491.
- E.Phys. 451-3. Light.** Basic electromagnetic theory of light, using Maxwell's equations. Examples in geometrical optics; extensive applications in physical optics, including diffraction and polarization. Spectra, including Zeeman effect and fluorescence. Recent advances in experimental techniques; microwaves, optical lasers, image converters, etc. Prer., E.Phys. 332.
- E.Phys. 455-1. Light Laboratory.** One 3-hr. lab. per wk. Lab. experiments to supplement E.Phys. 451. Emphasis on techniques as well as basic principles. Prer., E.Phys. 451.
- E.Phys. 491-3, 492-3. Atomic and Nuclear Physics.** Topics include quantum-mechanical treatment of the one-electron atom, atomic shell structure, atomic and molecular spectroscopy, band theory of solids, X rays, nuclear properties, radioactivity, and properties of the fundamental particles. Prer., E.Phys. 322 and 332.
- E.Phys. 495-2, 496-2. Senior Laboratory.** One lab. per wk., designed to be taken with E.Phys. 491 and E.Phys. 492. Experiments introduce the student to realities of experimental physics so that he will gain a better understanding of lecture material and an appreciation of the vast amount of experimental work done in the physical sciences today. For students registered for E.Phys. 496 and not E.Phys. 455, and with E.Phys. 451 as a prerequisite, some experiments from the light laboratory can be included on a replacement basis. Prer., consent of instructor.
- E.Phys. 500-variable credit. Selected Topics for Independent Study.** Credit and subject matter to be arranged. Prer., consent of instructor.
- E.Phys. 501-3. Health Physics.** Spring. Two lect., one lab. per wk. Health physics is a course designed to provide job-oriented skills. Topics covered include radiation dosimetry, radiation biophysics, radioecology, reactor health physics, and medical physics. The labs include exercises with radioactive isotopes as well as tours of off-campus facilities. Prer., consent of instructor.
- Phys. 503-3, 504-3. Intermediate Mathematical Physics, I, II.** (Math. 553, 554.) Survey of classical mathematical physics, starting with complex variable theory and finite dimensional vector spaces. Topics in ordinary and partial differential equations, the special functions, boundary value problems, potential theory, and Fourier analysis. Prer., Math. 431 and 432 or equivalent.
- E.Phys. 515-3. Introductory Plasma Physics.** (A.G. 515.) The basic phenomena of ionized gases; an introduction using the particle and field approach. Single-particle motion in external fields, small-amplitude waves, simple instabilities, and Landau damping.
- E.Phys. 516-3. Theoretical Plasma Physics.** (A.G. 516.) Theoretical analysis of collective phenomena of high temperature plasmas. MHD equilibria and stability, resistive instabilities, microinstabilities and universal modes, collisionless shock waves and radiation phenomena.
- E.Phys. 517-3. Waves and Fluctuations in Plasmas.** (A.G. 517.) General dielectric theory of electromagnetic and electrostatic waves in linear dispersive media, examples drawn mainly from plasma physics; inhomogeneous wave propagation and energy flow; fluctuations and correlation function; generalized Kirchoff's law, fluctuation-dissipation theorems, Cerenkov emission; radiation scattering; collisional and transport phenomena; collisionless waves and wave particle interactions in a magnetic field.
- E.Phys. 560-3, 561-3. Introduction to Theoretical Physics.** A survey of both classical and modern theoretical physics for nonphysics majors. Classical mechanics with Lagrangian and Hamiltonian formalisms, special relativity, classical electrodynamics, quantum mechanics, structure of matter, statistical thermodynamics, radiation processes, and scattering theories. Prer., consent of instructor.
- E.Phys. 580-3. Introduction to Modern Astrophysics.** (A.G. 580, Aph. 580, Aero. 571.) Physical characteristics, distribution, and space motion of stars and stellar systems; internal structure and evolution of stars; structure of stellar atmospheres; interstellar matter and gaseous nebulae. Prer., senior standing and consent of instructor.

E.Phys. 585-3. Gravitational Theory. *Alternate years.* Theory of general relativity. Three lect. per wk. Einstein's relativistic theory of gravitation is presented from a geometric viewpoint; applications to astrophysical problems (gravitational waves, stellar collapse, etc.) are given.

E.Phys. 590-3. Introduction to Space Science. (Aero. 590.) A survey of space technology and space research. Topics include historical developments, the space environment, flight dynamics, rocket propulsion, space vehicle design, communications and control, man in space, and scientific research from space vehicles. Prer., consent of instructor.

MECHANICAL ENGINEERING

M.E. 130-2. Introduction to Mechanical Engineering. Introductory survey of statics, mechanics of materials, thermodynamic processes, machine design; emphasis is on engineering approach to problem solving.

M.E. 195-1 to 3. Special Topics in Mechanical Engineering and Mechanics. Subject matter to be selected from topics of current technological interest. Credit to be arranged. Prer., consent of instructor.

M.E. 212-3. Engineering Thermodynamics I. First and second laws of thermodynamics; properties, states, thermodynamic functions, entropy, and probability. The thermodynamics requirements can be met by completing M.E. 313. M.E. 212 alone does not satisfy thermodynamics requirements. Prer., E. Phys. 112.

M.E. 281-3. Mechanics I. Elements of vector algebra, abstract statics of a system of bound vectors, equilibrium of rigid bodies, dynamics of a particle. Prer., sophomore standing.

M.E. 282-3. Mechanics II. Kinematics of rigid bodies, principle of virtual work, kinetics of a system of particles. Prer., M.E. 281.

M.E. 295-1 to 3. Special Topics in Mechanical Engineering and Mechanics. Subject matter to be selected from topics of current technological interest. Credit to be arranged. Prer., consent of instructor.

M.E. 301-3. Introduction to Materials Science I. The development of the physical principles relating the structural features of materials to their observed properties. Prer., E.Phys. 213.

M.E. 313-3. Engineering Thermodynamics II. Thermodynamics of state, thermodynamic cycles, reacting and nonreacting mixtures, chemical and phase equilibrium. Prer., M.E. 212.

M.E. 314-2. Measurements I. Principles of digital and analog measurements; systems for sensing, transporting, modifying, and outputting information; impedance matching of components; systematic and random error analysis; Students' *t* and *Chi* squared significance tests. Prer., M.E. 212, junior standing.

M.E. 316-2. Measurements II. Two lab. periods per wk. Application of the theory of measurement to a wide variety of instruments and measurement systems. Prer., M.E. 314.

M.E. 362-3. Heat Transfer. Basic laws of heat transfer by conduction, convection, and radiation; engineering applications. Prer., junior standing.

M.E. 371-3. Systems Analysis I. Representation of mechanical and electrical lumped parameter elements and systems, steady-state sinusoidal analysis, integral transform theory. Prer., junior standing.

M.E. 372-3. Systems Analysis II. Transfer function, the root-locus method, analog simulation; hydraulic, pneumatic, and electrical systems applications. Prer., M.E. 371.

M.E. 383-3. Mechanics III. Elements of tensor notation. Kinematics of deformable media. Mass, momentum, and energy conservation principles. Constitutive equation for linearly elastic solids and Newtonian viscous fluids. Prer., M.E. 282.

M.E. 384-3. Mechanics IV. Application of exact and approximate theories to engineering problems in solids. Examples include: torsion of rods; bending of beams (static deflection, vibration, and stability). Prer., M.E. 383.

M.E. 385-3. Mechanics V. Application of exact and approximate theories to engineering problems in fluids. Examples include: potential flow theory; Euler's equations for inviscid fluids; Bernoulli's equations; Navier Stokes equation; pipe flow; boundary layers; and compressible flow. Prer., M.E. 383.

M.E. 395-1 to 3. Special Topics in Mechanical Engineering and Mechanics. Subject matter to be selected from topics of current

technological interest. Credit to be arranged. Prer., consent of instructor.

M.E. 400-1 to 6. Independent Study. Subjects arranged in consultation with undergraduate adviser to fit needs of the particular student. Prer., senior standing.

M.E. 401-3. Introduction to Materials Science II. Application of the physical principles controlling the structure-property relationships in ceramics, metals, polymers, and composite materials. Specific properties considered to include mechanical, electrical, and magnetic behavior. Prer., M.E. 301.

M.E. 414-3. Mechanical Engineering Design I. Review of mechanics of materials and stress analysis; detailed design of various machine elements such as screws, springs, brakes, and gears. Prer., M.E. 383.

M.E. 416-3. Mechanical Engineering Design II. Individual device development and product development cycles. Introduction of topics to motivate the creative process, the quantitative process, or a blend. Incorporation of the supporting disciplines of analysis, organization, computation, and communication as needed. Identification of difficulties in creation, organization, decision, and compromise. The subject material is organized chronologically so that a project can be started immediately. Prer., M.E. 414.

M.E. 421-3. Air Conditioning. Physical and thermodynamic laws of water vapor and air mixtures; basic principles of heating and ventilating; determination of heating and cooling loads; examination of heating and cooling systems. Prer., M.E. 362.

M.E. 422-3. Air Conditioning Design. Design and layout of heating, ventilating, air conditioning systems. Prer., M.E. 421.

M.E. 424-3. Refrigeration. Principles of mechanical refrigeration; absorption cycle; liquefaction of gases; properties of refrigerants. Thermodynamic analysis of refrigeration systems. Prer., M.E. 313 and 332.

M.E. 442-3. Mechanical Engineering Laboratory. Three lab. periods per wk. Team participation on five or more experience projects on conventional equipment (pumps, compressors, engines, etc.). There is considerable emphasis on oral and written communication. Prer., M.E. 316.

M.E. 450-3. Nuclear Engineering. Elements of atomic and nuclear processes. Basic concepts of reactor theory, design, and operation. Prer., senior standing in engineering.

M.E. 455-3. Energy Conversion. Power cycle thermodynamics, turbocompressor and expander processes, combustion systems, applications and limitations of direct energy conversion systems. Prer., M.E. 313.

M.E. 457-4. Combustion Phenomena. The multicomponent fluid equations of motion and chemical thermodynamics are used to study a variety of combustion problems. These include droplet and particle combustion, boundary layer combustion, detonation and deflagration wave theory, topics related to internal combustion engines, liquid and solid rockets. Prer., M.E. 313 and 385.

M.E. 458-3. Computer Aided Thermal Design. Computer programming of thermodynamic cycles; compressor, expander, and heat exchanger component design; team design project in solar power, heating, or cooling system; oral and written reporting. Prer., M.E. 313, M.E. 362.

M.E. 461-4. Analytical Methods of Engineering I. Solutions of linear algebraic equations and applications to theory. Topics include matrix analysis, eigenvalue problems, bilinear and quadratic forms, boundary and initial value problems of physics, solution of wave equations by the method of characteristics and applications to elastic wave propagation and supersonic flows. Prer., A.Math. 235 or 236 or equivalent.

M.E. 462-4. Analytical Methods of Engineering II. Boundary and initial value problems of physics. Topics include solution of partial differential equations of physics by the methods of separation of variables; Sturm-Liouville theory, variational principles and applications; Green's functions and applications. Prer., A.Math. 235 or 236 or equivalent.

M.E. 471-4. Fluid Mechanics. Viscous incompressible and compressible fluid flows. Topics include derivation of equation governing viscous compressible fluid motion; specializations to simple flows; boundary-layer theory; nozzles and diffusers; transition. Prer., M.E. 385 or equivalent.

M.E. 483-4. Vibration Analysis. Single and multiple degree of freedom lumped parameter systems. Shock spectra. Generalized

coordinates; Lagrange's equations. Vibration of continuous systems. Prer., M.E. 384.

M.E. 485-4. Mechanisms. Analysis and synthesis of two- and three-dimensional kinematic systems. Plane motion: linear and angular velocity and acceleration, relative velocity and instantaneous centers; the Kennedy-Aronhold theorem. Four-bar linkage, coupler curves, the Euler-Savary equation. Three-dimensional motion: finite rotation, Euler's and Chasles' theorem. Geometric and algebraic methods for generating specified motions. Prer., M.E. 383.

M.E. 486-4. Lagrangian Dynamics. Brief review of Newtonian dynamics, Lagrange's equations for particles, systems and rigid bodies. Conservative and nonconservative systems, potential energy and dissipation functions. Constraints. Quasi-coordinates. Nonmechanical systems. Prer., M.E. 281 and 282 or equivalent.

M.E. 487-4. Rigid-Body Dynamics. Kinematics of a rigid body, principal axes, and moments of inertia, angular momentum of a rigid body, Euler equations. Applications include topics such as motion of a rigid body with a fixed point under no forces, the spinning top, stability of a sleeping top, the gyrocompass, motion of a billiard ball, rotating machinery, etc. Prer., M.E. 282 or equivalent.

M.E. 490-1. Senior Seminar. Presentation of broad range of professional opportunities available to graduating seniors through discussions with practicing engineers. Prer., senior standing.

M.E. 491-2. Legal Aspects of Engineering Practice. Professionalism in engineering; canons of ethics. Legal system. Law of contracts, torts, agency, property, sales, business associates, negotiable instruments, and patent protection. Prer., senior standing in mechanical engineering.

M.E. 495-1 to 3. Special Topics in Mechanical Engineering and Mechanics. Subject matter to be selected from topics of current technological interest. Credit to be arranged.

M.E. 500-1 to 6. Independent Study. Available only through approval of graduate adviser. Subjects arranged to fit needs of the particular student. Prer., graduate standing.

M.E. 501-3. Yield-Limited Behavior of Materials. Analysis of material behavior within the "elastic range" with emphasis on the phenomenon of yield and factors that influence it. Introduction to the theory of elasticity; examination of the theory of dislocations; study of strengthening mechanisms in solids. Consideration of various time-dependent but reversible (inelastic) deformation phenomena. Presentation of appropriate engineering case studies to augment various topics. Prer., M.E. 401 or equivalent.

M.E. 503-3. Plasticity and Creep. Inelastic deformation of materials such as metals, alloys, glasses, composites, polymers, etc., from the phenomenological and structural point of view. Case studies of plastic and creep deformations in engineering materials. Prer., M.E. 401 or equivalent.

M.E. 505-3. Fracture. Examination of basic mechanisms controlling fracture of high-strength materials. Examples include reduction of capacity for plastic deformation in engineering materials used at high-strength levels prior to catastrophic fracture. Emphasis is placed on selection of materials in terms of toughness as well as strength. Prer., M.E. 401 or equivalent.

M.E. 513-3. Macroscopic Thermodynamics. (Ch.E. 538.) Axiomatic presentation of fundamentals of classical thermodynamics. Energy, work and heat; first law. Equilibrium, reversible and irreversible processes; entropy production and the second law. Applications to stability, phase equilibrium, electric and magnetic work. Irreversible thermodynamics and the Onsager reciprocal relations. Prer., undergraduate thermodynamics.

M.E. 514-3. Statistical Thermodynamics. (Aero. 617, Ch.E. 528.) Introduction to the molecular interpretation and calculation of thermodynamic properties of matter. Thermodynamic probability, distribution functions, Schrodinger wave equation and solutions, ensemble theory. Applications to ideal and real gases, solids, liquids, radiation, conduction electrons, and chemical equilibrium. Prer., undergraduate thermodynamics.

M.E. 521-3. Method of Engineering Analysis I. Selected topics from linear algebra, complex variable theory, and ordinary differential equations. The presentation is correlated with other analysis topics included in mechanical engineering courses and emphasizes application. Prer., graduate standing or consent of instructor.

M.E. 522-3. Methods of Engineering Analysis II. Selected topics from integral transform methods, partial differential equations,

perturbation theory, and probability and statistics. The presentation is correlated with other analysis topics included in mechanical engineering courses and emphasizes application. Prer., graduate standing or consent of instructor.

M.E. 532-3. Introduction to Fluid Dynamics. (Aero. 517.) Physical properties of gases and liquids; kinematics of flow fields; equations describing viscous, heat conducting Newtonian fluids. Exact solutions and rational approximations for low and high speed dissipative flows, surface and internal waves, acoustics, stability, and potential flows. Coreq., M.E. 521, M.E. 575, or equivalents.

M.E. 534-3. Viscous Flow. (Aero. 512.) Low Reynolds number flows, incompressible and compressible laminar boundary layer theory. Similarity theory. Separation, transition, and turbulent boundary layers. Prer., M.E. 532 or equivalent.

M.E. 536-3. Compressible Flow. Energy, continuity, and momentum principles applied to compressible flow; one-, two-, and three-dimensional subsonic, supersonic, and hypersonic flows. Normal and oblique shocks, method of characteristics. Prer., M.E. 532 or equivalent.

M.E. 563-3. Heat Transfer I. (Ch.E. 627.) Review of equations governing transport of heat by conduction and radiation. Analytical and numerical solution of boundary value problems representative of heat conduction in solids. Radiation properties of solids, liquids, and gases; transport of heat by radiation. Prer., M.E. 362 or equivalent.

M.E. 564-3. Heat Transfer II. (Ch.E. 628-3.) Review of equations governing transport of heat in fluids in motion. Description of heat transfer in free and forced convection including laminar and turbulent flow. Dimensional analysis and heat transfer correlations, numerical methods, combined heat transfer mechanisms. Prer., M.E. 532 or equivalent.

M.E. 573-3. Theory of Vibration. Review of free and forced vibration or lumped parameter systems. Matrix methods. Nonlinear systems. Prer., M.E. 581 or equivalent.

M.E. 575-3. Introduction to Continuum Mechanics. Cartesian tensor notation. Deformation, strain, strain rate, and compatibility. Definition of stress vector and tensor. Fundamental balance laws of mass, momentum, and energy; entropy invariance requirements. Constitutive equations for elastic, viscoelastic and plastic materials; ideal, compressible, and viscous fluids. Beltrami-Mitchell and Navier-Stokes equations. Prer., graduate standing or consent of instructor.

M.E. 581-3. Dynamics. Elements of vector analysis, particle motion, kinematics of a rigid body, rotating axes, rigid body motion, and Euler's equations and applications. Introduction to analytical mechanics. Hamilton's principle, Lagrange's equations for holonomic and non-holonomic systems. Prer., graduate standing or consent of instructor.

M.E. 584-3. Advanced Strength of Materials. Review of basic equations governing a linear elastic material and associated boundary-value problems. Deduction of approximate theories for elementary structures with techniques of solution of resulting practical problems. St. Venant torsion. Prer., M.E. 383 or equivalent.

M.E. 585-3. Theory of Elasticity I. Review of the basic equations of linear theory of elasticity. St. Venant torsion and flexure. Plane strain, plane stress, and generalized plane stress. Application of conformal mapping and Fourier transform techniques. Variational principles. Prer., M.E. 575.

M.E. 595 to 599-1 to 4. Selected Topics. Credits and subject matter to be arranged.

FOR GRADUATE STUDENTS ONLY

M.E. 600-1 to 6. Independent Study. Available only through approval of the graduate adviser. Subjects arranged to fit needs of the particular student. Prer., graduate standing.

M.E. 671-3. Advanced Dynamics. Tractable problems of particle and rigid body dynamics. Dissipative and non-holonomic systems. The principle of least action, Hamilton-Jacobi equation. Small amplitude vibration theory. Prer., M.E. 581.

M.E. 678-3. Dynamics of Continuous Media. Derivation of the wave equation from the basic equations of dynamic elasticity. Propagation of elastic waves in infinite and partially bound media; Rayleigh waves and Love waves. Pochhammer solution for rod; extensional and flexural vibration of beams, plates and shells.

Influence of material nonlinearity on vibrations and wave propagation. Prer., M.E. 581, 585.

M.E. 685-3. Theory of Elasticity II. Variational principles with applications. Three-dimension solutions. Concentrated and line loads in complete and half spaces; problems of Kelvin, Boussinesq, and Mindlin. Transform techniques. Contact stresses. Anisotropic and nonlinear elasticity. Thermoelastic problems. Prer., M.E. 585.

M.E. 686-3. Theory of Plasticity. Fundamental concepts: the yield surface and associated flow laws. Isotropic and kinematic work-hardening. The theory of rigid, perfectly plastic, and of general elastic-plastic solids with applications. General theorems. Prer., M.E. 575.

M.E. 687-3. Theory of Inelastic Materials. Mathematical theory of linear viscoelasticity. Finite element models. Solution of boundary-value problems in linear viscoelasticity. Non-Newtonian flow. Selected topics in non-linear material behavior. Prer., M.E. 575.

M.E. 695 to 699-1 to 4. Selected Topics. Credit and subject matter to be arranged. Advanced graduate-level courses are available upon demand in the following subjects; statistical thermodynamics, theory of plates, theory of shells, theory of hydrodynamic stability, continuum mechanics. Outlines of these courses may be obtained in the departmental office.

M.E. 700-variable credit. Master's Thesis.

M.E. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

College of Environmental Design

ENVIRONMENTAL DESIGN

Env.D. 100/101-6. Problem-Solving Design. Introduction to environmental problem solving with emphasis on analysis of existent solutions to environmental problems at the individual or familial scale. Team-selected environmental problem solving with emphasis on man's basic needs; growth, safety, bodily comfort, movement, health, metabolism, and reproduction.

Env.D. 104/105-2. Environmental Design Perspective. This introductory course for non-environmental design students will provide an overview of the environmental design philosophy and problem-solving approach to selected environmental malfunctions. Application of media, social science, natural science, and technology to the problem-solving process will be demonstrated.

Env.D. 110-3. Societal Science. A study of social science methodology, theory, and research as applied to environmental design. Emphasis on analysis of human perception and behavior and its demography.

Env.D. 120/121-3. Media. Emphasizes development of the student's ability to convey ideas. Toward that end the course will attempt to introduce the student to the widest possible media experiences and their associated problems.

Env.D. 130/131-3. Natural Science/Technology. A survey of current and future impacts of human settlement on natural resources including water, air, wildlife, minerals, and land from a national perspective.

Env.D. 200-6. Problem-Solving Design. Continuation of problem-solving methodology applied to organizational problems in the human physical environment. Students work in teams and define their own problems discovered at organizational scale, which may include education, commerce, government, religion, arts and sciences.

Env.D. 210/211-3. Societal Science. Social science methodology, theory, and research findings as applied to environmental design. The stress will be on methodological problems at the organizational scale.

Env.D. 220/225-3. Media. Continuation of rigid drawing systems as well as graphics in general, including felt pens, ink, typography, photography, etc. Introduction to three-dimensional media, including mathematical models, films, and the display of more complex information in general.

Env.D. 230-3. Natural Science/Technology. Exploration of fabrication system to problem solving and design.

Env.D. 300-6. Problem-Solving Design. Continuation of problem-solving methodology applied to communal problems in the human physical environment. Student teams define, research, and solve problems with faculty consultation to guide scope, scale, methodology, sources, tools, and form.

Env.D. 320/321-1. Media. Introduction to various materials, tools, and processes for three-dimensional physical modeling at all scales of environmental design. Emphasizes sources and access to materials and their uses, not total model building.

Env.D. 330-3. Natural Science/Technology. Laws governing planning and design. Familiarity will be gained with types of local, state, and federal regulations with regard to housing, historic preservation, water, sewer, health, handicapped, and other planning design subjects.

Env.D. 332-3. Solar Technology. Solar energetics, with emphasis placed upon energy awareness, natural functions, physical and technical responses, and design. Will include field trips, working projects, papers, and general dialogues toward developing tools through which to meet the oncoming renewable future.

Env.D. 400/401-6. Problem-Solving Design. The application of problem-solving methodology to problems on the societal (regional, state, and national) scale. Problems that may be considered include matters dealing with economic organization, kinship systems, psychological and physical health, housing, energy utilization, etc. Extensive individual work will be required.

Env.D. 403-3. Interior Design. Analysis of problems in interior design and techniques of solution including circulation, space, structure and materials, physical comfort, and humanistic values.

Env.D. 405-3. Regional Planning. Will include comprehensive plans, county planning; cultural resources; growth policies, housing, historic preservation, flood control, urban design, etc. Exposure will include concepts and skills with application in a series of coordinated long and short term projects in local communities.

Env.D. 407-3. Industrial Design Option. Introduction to basic design processes of product design with overview of current manufacturing/production techniques. Common materials and processes will be covered by lecture and field trips. Students work in teams.

Env.D. 412-3. Human Nature and Environment. (Phil. 446.) Exploration of human possibilities through the study of mental, social, and physical transformation spaces and the mapping of ideal environments. Encouragement of group projects involving the areas of philosophical, psychological, and environmental transformation in terms of designing an ideal society.

ARCHITECTURE

Graphic Communication

Arch. 410/411-3. Graphic Communication. Two lect.-studio periods per wk. Techniques of graphic communication and architectural presentation for design.

Design—Architecture

Arch. 320/321-3. Architectural Appreciation and Design. One lect. and two lect.-studio periods per wk. Open only to architectural engineering majors. Basic problems and principles of architectural design to provide the student with a basis for understanding and evaluating architecture.

Arch. 500/501-5. Architectural Design. One lect. and three studio periods per wk. Scope of study expands in scale from a small social unit to a subcommunity. User needs and activities, climate, structural systems and materials, human and vehicular circulation, legal requirements (zoning, building codes, etc.), change, site planning and development, public health and safety, utilities and services, and costs. Includes problem definition, analysis, synthesis, and evaluations.

Arch. 600/601-5. Architectural Design. Three studio-seminar periods per wk. The investigation and design of a building complex and the integration of the environmental and structural systems in the design of a building. The building complex design deals with site planning and development to accommodate the building considering the constraints of site surroundings, climate, codes and ordinances, utilities, on- and off-site human and vehicular circulation; three-dimensional integration of the building and spaces; development of a single building of the complex in detail. The integration of environmental and structural systems utilizes a medium- to high-rise building as a design vehicle. Involves space planning for various heating, ventilating and air-conditioning systems, vertical transportation, plumbing and water supply and electrical service systems as well as site development, economic considerations, and building form.

Arch. 700/701-7. Architectural Design. Three studio-seminar periods per wk. The first course deals with a large-scale design problem that requires major planning considerations and attempts to integrate the previous courses in design and content study into the design process. Design problems used are usually actual or proposed and have real sites requiring the student to develop thorough research techniques. During the second semester the students pursue a design study of their choice. Options are facility design, design methods, architectural technology, architectural history and preservation, and man and environment.

Arch. 710/711-7. Research/Design. Advanced study and research in an area of major professional interest to the student. Areas of emphasis are (1) facility design—research and design work in design programming, the design process, and the products of architectural design (i.e., housing educational facilities, recreational facilities); (2) design methods—systematic methods for decision making in architectural design such as computer-aided design, simulation, gaming, decision theory, and information systems; (3) architectural technology—exploration of building technology and its relationship to architectural design; (4) architectural history and preservation—history and its social relevance as it pertains to renewal, restoration, and the preservation of significant examples of architecture; (5) man and environment—investigation of interactions between people and the man-made and natural environment. Man's physiological, sociological, and psychological relationships to the design environment are studied.

Technologies

Arch. 450-3. Environmental Systems. Two lect. and one lab. per wk. Fundamental systems consideration of water supply—management and treatment; waste water—treatment and reuse; power supply and consumption; transportation; land use planning.

Arch. 551-3. Materials and Methods of Construction. Two lect. and one lab. or field trip per wk. Study of materials and components for construction and construction methods and techniques for residential and commercial buildings.

Arch. 552-2, 553-2. Structures I and II. Two lect. per wk. Analysis of basic structural systems (statics and strength of materials).

Arch. 650-3. Mechanical Systems for Buildings. Three lect. per wk. Specific building systems study, including water supply systems; sanitation systems; principles and applied design of heating, ventilating, and air conditioning.

Arch. 651-3. Illumination and Electrical Systems. Two lect. per wk. Specific building systems study, including basic principles of electricity, quantity and quality of illumination, light sources and characteristics, lighting design and application, electrical wiring design.

Arch. 652-2. Timber Structures. Two lect. per wk. Design with wood of floor systems, beams, columns, trusses, connections, and glued laminated construction.

Arch. 653-2. Steel Structures. Two lect. per wk. Design of structural steel for buildings: beams, columns, trusses, rigid frames, and connections.

Arch. 654-2. Concrete Structures. Two lect. per wk. Design of concrete structural elements for buildings.

Arch. 655-1. Acoustics. Principles of sound, sound transmission, and noise reduction as they relate to architecture.

Arch. 750-3. Environmental Systems Synthesis. A synthesis of the preceding environmental systems and structures courses. The stu-

dent will perform the structural frame design and select and detail the mechanical and electrical systems of a specific building.

Arch. 751-3. Environmental Systems Seminar. Provided as an elective for students with strong structural interests. Principles of thin shell concrete, space frames, unique shapes, and new building materials.

Arch. 752-3. Industrial Housing Seminar. Study of the industrialized processes and how they relate to the design and production of housing.

Professional Practice

Arch. 660-2. Professional Practice. Two lect. per wk. Ethics, management, documents, organization, and production procedures of a professional practice.

Arch. 661-2. Construction Documents. Two lab. per wk. Preparation of working drawings and specifications for a small building.

Arch. 662/663-3. Internship. Eight hrs. per wk. Work in a practicing professional's office during the regular semester. The student is placed in an office by the college and receives academic credit instead of pay.

Planning

Arch. 520-3. Planning. Two lect. per wk. The integration of architecture and city and regional planning. Basic influences in the development of cities. Accepted practice in zoning, transportation, housing, land use, economics, social, and aesthetic factors leading to urbanization.

Landscape Architecture

Arch. 630-3. Landscape Architecture. Two lect. and one studio period per wk. Basic principles of landscape design related to site planning and development, including plant materials, planting design, grading, drainage, and design process.

History/Philosophy

Arch. 470/471-3. History/Philosophy I and II. Three lect.-rec. per wk. A survey of architectural and related design responses to changing attitudes, technologies, and natural settings from primitive through contemporary cultures.

Arch. 572-3. Seminar: Designer Philosophy. An examination of the philosophies of a selected group of designers and the contributions generated by those philosophies.

Additional Courses and Special Problems

Arch. 680-3. Research Methods in Architecture. Developing research and design methods appropriate to architecture including computer-aided design, gaming, simulation, decision theory, and information systems.

Arch. 683-3. Teaching Methods in Architecture. Seminar for teaching assistants.

Arch. 590/591-1 to 3. Independent Study. Studies initiated by students or faculty and sponsored by a faculty member to investigate a special topic or problem related to architecture.

URBAN DESIGN

U.D. 450/451-3. Urban Design Systems I and II. First of a series planned to acquaint students of architecture, urban design, and planning with the man-made systems which alter or supplement the natural environment. The year sequence includes water supply, waste water, power, transportation, land use planning. Scale is regional.

U.D. 540-3. Basic Ecology of Environmental Impact Statements. (U.P.C.D. 540.) Individual case studies that determine site environmental resources. An inventory and analysis of spatial, physical, biological, and sociocultural assets and liabilities for particular urban and regional locations and activities.

U.D. 720/721-2. Urban Design Seminar. An outline of the history and theories of urban design, including case studies in urban design, urban planning, new towns, and urban renewal projects. Specific emphasis will be on the CBD and its adjacent areas,

Denver and Colorado (720). The inner city outside Colorado; past, present and future (721).

URBAN AND REGIONAL PLANNING— COMMUNITY DEVELOPMENT

U.P.C.D. 500-3. Introduction to Planning and Community Development. A basic review of the history of planning and urban areas. Theories of community and regional planning, basic techniques, changing philosophies of planning in modern society, and the process of community development.

U.P.C.D. 506-3. Community Development Methodology. Provides the student with exposure to methods of achieving planned change in both neighborhoods and communities through classroom work and field and laboratory exercises.

U.P.C.D. 510-3. Planning Graphics. An introduction to mapping, aerial interpretation, and graphics for the student who is deficient in these basic background areas.

U.P.C.D. 512-3. The Modern Metropolis. Provides a basic background in the structure and dynamics of the modern metropolis. Includes a review of the historical background of the metropolis; an analysis of its economic, social, and political components; and a consideration of various interpretations of its role in modern society.

U.P.C.D. 540-3. Basic Ecology of Environmental Impact Statements. See U.D. 540.

U.P.C.D. 546-3. Regional Analysis Methodology. Acquaints the student with the concept of the planning region as well as with techniques for analyzing the region. Demographic, economic, social, and historical methods are used.

U.P.C.D. 547-3. Regional Planning. Discusses the unique aspects of planning at regional levels. Reviews the various types of regional planning activities that have taken place in the United States and other parts of the world.

U.P.C.D. 550-3. Physical Systems of Urbanization. Provides basic knowledge of the physical systems that exist within an urban environment. Topics covered include water supply, waste disposal, transportation, and energy systems.

U.P.C.D. 552-3. Legal Aspects of Planning. A review of the legal framework within which planning operates and the current trends in the courts toward land-use regulations and housing law.

U.P.C.D. 560-3. Theory and Philosophy of Planned Change. Describes and critically evaluates contemporary theories and ideologies of the planning process and planned change. Aids the student to develop his own powers of critical theoretical analysis and his own positions on what planning is and ought to be.

U.P.C.D. 570-3. Basic Planning Analyses. Teaches the basic analyses that are used in the comprehensive planning process. General theoretical understandings, specific analytical methods and techniques, and available data sources are discussed in regard to economics, demography, urban activities, physical structures, and land and natural features.

U.P.C.D. 571-3. Advanced Planning Analyses. Covers the more advanced methods and techniques which have been considered for and/or applied to the planning process. Included is a review of urban development models, cost-benefit analysis, general systems analysis, decision-making techniques, linear programming, and advanced statistical methods.

U.P.C.D. 615-3. Development of Environmental Form. Describes and evaluates the history and present developments of the man-made environment. Western culture's town-planning traditions, American planning history, and selected schools of modern environmental design thought. Special attention is given to linking major traditions and trends with environmental design in the development of the Denver metropolitan area.

U.P.C.D. 620-3. Principles of Urban Design. (U.D. 620.)

U.P.C.D. 630-3. Social Factors in Urban Design. A review and evaluation of major theories and empirical studies dealing with the impact of social forces on the design of the physical environment. Methods of studying and defining user needs. Projects aimed at improving the harmony between social life and its physical containers.

U.P.C.D. 641-3. Social Policy Analysis and Application. A critical review of the evolution of national, state, and local social policies

with an emphasis on current social issues and programs. Special attention is given to the application of techniques and procedures of policy analysis to community and regional systems.

U.P.C.D. 680-variable credit. Experiential Learning. Laboratory and internship. A series of designed and programmed experiences dealing with the particular aspects of urban planning and community development with emphasis on the interpersonal, group process, and organizational dimensions, together with real life experiences in the professional arena.

U.P.C.D. 692-variable credit. Independent Study. Permits the student to pursue independent research in a subject area of special interest. Advance approval by faculty adviser is required.

U.P.C.D. 700-3. Master's Thesis.

U.P.C.D. 710-3. Urban Problems and Issues. A seminar which enables the student to engage in advanced study and original research with regard to selected urban problems and issues.

U.P.C.D. 711-3. Politics and Planning. A seminar designed to expose the student to the realistic political facts ever present in the planning process and to prepare the individual to deal effectively with governmental operation at all levels of his professional career.

U.P.C.D. 712-3. Regional and State Problems and Issues. A seminar which provides the student with a broad exposure to problems related to planning and community development at the regional and state levels.

U.P.C.D. 713-3. The Community and the Federal System. This seminar is directed toward exploring the expanding role played by the federal government and its programs and the effect which it has upon the local community. Federal grants-in-aid programs will be studied as well as the processes for dealing with the federal bureaucracy.

U.P.C.D. 716-3. The Zoning Game/Impact Zoning. Explores new trends in land-use controls including impact zoning, growth management, environmental reviews, etc., through class exercise and simulation.

U.P.C.D. 752-3. Planning Laboratory I. Site and master plan projects aimed at expressing the student's ability to apply the knowledge and experience gained in the program to specific problem areas and complex client situations. Planning research, community relations, problem identification, program development, plan making, and plan evaluation.

U.P.C.D. 753-3. Planning Laboratory II. A continuation and expansion of Planning Laboratory I, dealing with more complex problems.

LANDSCAPE ARCHITECTURE

L.A. 511-3. Graphic Communication II. Considerable freehand sketching and rendering of perspectives, sections, elevations, and plans of all types and scales. Both quick and more elaborate techniques will be explored. Sheet composition, title blocks, legends, functional diagrams, scale figures, and lettering will be included.

L.A. 520-3. Large-Scale Regional Resource Planning. Regional resource planning and analysis such as promoted by Ian McHarg and Phil Lewis are the focus of this course. Agencies like the National Park Service and National Forest Service, as well as issues like oil shale and coal development, will also be studied.

L.A. 600-5. Landscape Architecture Design II. Emphasis on regional scale design. Regional resource inventories and a search for regional character in planting and architecture are areas of important concern.

L.A. 610-5. Landscape Architecture Design III. Urban scale projects. College campuses, large housing complexes, urban malls or plazas, etc., are suitable projects. Studies of spatial development, human scale, regional variations in similar projects, etc., are sub-topics of special concern.

L.A. 641-3. Computer Applications for Physical Designers. An exploration of computer applications in such areas as highway horizontal and vertical curve calculations, perspective drawing, mapping and earthwork computations.

L.A. 650-5. Landscape Architectural Engineering I. Topography and contours, grading plans, staking plans, earthwork calculations and drainage design are covered in this course. For very advanced students special projects or sections will be arranged.

L.A. 651-5. Landscape Architectural Engineering II. Continuation of L.A. 650 with special concern for engineering of parking facilities;

horizontal and vertical curve alignment of roads, etc. as well as residential subdivision road and lot layout. Special work will be arranged for advanced students.

L.A. 660-1. Landscape Architecture Seminar. Intended to provide an opportunity to research and discuss a wide range of topics relating to the profession of landscape architecture.

L.A. 661-1. Landscape Architecture Seminar. A forum for discussion of any topics of particular concern during this phase of the design sequence.

L.A. 680-3. Rocky Mountain Plant Materials I. Concerned with deciduous trees and shrubs important for landscape work in the Rocky Mountain region. Three aspects of plant materials are stressed: identification under normal growing conditions, knowledge of common and botanical names, and important design and horticultural considerations.

L.A. 681-3. Rocky Mountain Plant Materials II. A continuation of L.A. 680 with emphasis on useful native and exotic evergreens as well as the spring character of the deciduous plants previously covered.

L.A. 700-5. Landscape Architecture Design IV. Small-scale design is the primary concern of this course. Emphasizes designs of sufficient detail that they could be implemented.

L.A. 701-5. Landscape Architecture Design V. An individual thesis or design project.

L.A. 750-5. Landscape Architectural Construction I. Concerns construction materials and methods for using them. Materials such as concrete, brick, wood, asphalt, plastic, etc.; construction details like curbs, paved surfaces, seats, signs, retaining walls, etc., are among subjects covered.

L.A. 751-5. Landscape Architectural Construction II. A continuation of L.A. 750 covering such areas as conventional plank and beam framing, decks, gazebos, piers, mall shelters, retaining walls, fountains, lighting and electricity. Adjustments made for those already familiar with this material.

L.A. 760-1. Landscape Architecture Seminar. Concerned with choosing and developing a thesis or design project for individual study in the final term.

L.A. 761-1. Landscape Architecture Seminar. Provides opportunity to discuss development of individual design projects or thesis projects and also future career possibilities.

L.A. 780-3. Rocky Mountain Planting Design Principles. Aesthetic principles, maintenance concerns, and appropriate uses of native and exotic plant species.

L.A. 781-3. Rocky Mountain Planting Design Technology. Techniques for proper staking, guying, watering, soils, sodding, container grown plants, etc.

L.A. 790-3. Independent Study or Electives.

School of Journalism

Jour. 100-3. Contemporary Mass Media. *Fall, Spring.* Examines the mass media and their interaction with society, looking at journalism and the mass media in historical, intellectual, economic, political, and social contexts.

Jour. 250-3. Reporting. *Fall, Spring.* Fundamentals of news gathering and writing; reportorial skills; news story forms. Assignments include reportorial work for campus publications. *Prer., Jour. 100.*

Jour. 310-3. Press Photography. *Fall, Spring.* The camera as a reporting tool; training in the use of cameras; composition; darkroom procedures. *Prer., Jour. 250.*

Jour. 340-3. Principles of Advertising. *Fall, Spring.* Basic principles of publication and radio and television advertising; analysis of consumers, markets, and media; organization of advertising departments and agencies.

Jour. 345-3. Advertising Copy and Layout. *Fall, Spring.* Creation of advertising copy and layout, analysis of consumer and product appeals. Preparing copy for various media: newspapers, magazines, radio, and television. *Prer., Jour. 340.*

Jour. 350-4. Reporting of Public Affairs. *Fall, Spring.* Problems and practice in reporting news of government, politics, the courts, industry, business, science, and other areas involving public issues. *Prer., Jour. 250.*

Jour. 355-3. News Editing. *Fall, Spring.* Principles and practice in copy editing and writing headlines for local and wire stories. Practice in page makeup, picture editing, and proofreading for both newspapers and magazines. *Prer., Jour. 250.*

Jour. 360-3. Radio and Television News. *Fall, Spring.* Principles and techniques involved in the preparation of news for broadcasting. *Prer., Jour. 250.*

Jour. 377-3. History of Journalism. *Fall, Spring.* Major trends in the development of contemporary American journalism, its role in United States history, famous journalists, and foundations and evolution of freedom of the press.

Jour. 410/510-3. Advanced Photography. *Spring.* Advanced camera and darkroom techniques, the picture story, picture editing, trends in pictorial journalism, and individual projects. *Prer., Jour. 310.*

Jour. 420-3. International Journalism. *Fall.* Journalism in the international system, including comparative examinations of national and international press organizations, methods, and content. The role of mass media in developed and developing countries and the international flow of news and opinion.

Jour. 427/527-3. Public Relations. *Fall.* Survey of public relations in America. Case studies and individual projects.

Jour. 428/528-3. Public Relations Programs. *Spring.* Development and application of public relations programs from identification of the problem through execution of the public relations techniques. *Prer., Jour. 427.*

Jour. 429/529-3. Public Relations Practice. *Fall.* Seminar for students intending to enter the public relations field. Examines specific tools and activities of the field.

Jour. 440/540-3. Advertising Media and Campaigns. *Fall.* Advanced copy and layout. Emphasis on planning integrated advertising campaigns; study of media, markets, and audiences. Planning of national and regional advertising campaigns. *Prer., Jour. 345.*

Jour. 443/543-3. Retail Advertising Campaigns. *Spring.* Preparation, selling, and servicing of advertising in the retail field; rate structures; building national and retail lineage. *Prer., Jour. 440.*

Jour. 450/550-3. Advanced Reporting. *Fall, Spring.* *Prer., Jour. 350.*

Jour. 460/560-3. Editorial and Opinion Writing. *Fall.* The editorial page and its readers; analysis and writing of editorials and columns.

Jour. 462/562-3. Advanced Radio-TV News. *Fall, Spring.* Emphasis on visualization. Special advantages and limitations of broadcasting news and public affairs. *Prer., Jour. 350 and 360.*

Jour. 463/563-3. Broadcast News Projects. *Fall.* Interpretation, preparation, and reporting of public affairs for broadcast media; preparation of radio and film documentaries. *Prer., Jour. 360 and consent of instructor.*

Jour. 465-3. Journalism and the Law. *Fall, Spring.* Legal rights and responsibilities of news media. Study of cases and case briefs.

Jour. 470/570-3. Critical Writing for the Journalist. *Spring.* Analysis of the entertainment area, especially as it pertains to the print media; emphasis is on the composition of criticism and the attitudes and writing techniques of individual critics.

Jour. 480/580-3. Magazine Article Writing. *Fall, Spring.* Practice in writing free-lance articles; consideration of types, sources, methods, titles, illustrations, and marketing. *Prer., Jour. 250 or consent of instructor.*

Jour. 485/585-3. Magazine Editing and Production. *Spring.* Editorial and production aspects of magazines, both general and specialized, including company publications, industrial journals, and other types of limited-audience publications. *Prer., Jour. 355 and consent of instructor.*

Jour. 490/590-3. Journalism and Public Opinion. *Fall, Spring.* Opinion-shaping role of the mass media; theories of public opinion and propaganda; polling; communications effects and communication theories.

Jour. 495-1 to 3. Special projects.

Jour. 498-1 to 3. Internship.

Jour. 500-1 to 4. Research in Journalism. Participation in research projects with faculty members or pursuit by the student of his own primary research interest.

Jour. 505-3. Theories of Mass Communication. Study of theories and perspectives of mass communications and exploration of the role of mass media in society.

Jour. 506-3. Methods of Mass Communication Research. Continuation of Jour. 505 with emphasis on experimental and survey research methods.

Jour. 520-3. Readings in International Mass Communication. Mass communications within the international system, including similarities and differences in functions, facilities, and content; social theories of the press; and the international flow of mass communications.

Jour. 533-3. Scholastic Publications. The student newspaper, literary magazine, and yearbook. All grade levels. Emphasis on the responsibilities of the adviser in the areas of teaching, sponsoring, organizing, financing, etc.

Jour. 551-3. Investigative Reporting. Investigative techniques and problems, including opportunity, under supervision, to put the training into practice.

Jour. 571-3. Mass Communications and the Arts. Inquiry into relationship of the arts and the mass media, including study of critics, their function, and their works.

Jour. 577-3. Readings in the History of Mass Communications. Intensive examination of specialized areas in the history of mass communications.

Jour. 592-3. Economic and Political Aspects of Mass Communications. Economic problems and political issues relevant to newspapers, magazines, broadcasting, and CATV. Problems of telecommunications and the impact of future technology on mass communications.

Jour. 595-1 to 3. Special Projects.

Jour. 598 1 to 3. Internship.

Jour. 599-1 to 3. Independent Study.

Jour. 700-1 to 6. Master's Thesis.

School of Law

FIRST YEAR

Law 510-3, 511-3. Contracts I and II. Basic principles of contract liability, offer, acceptance and consideration, statute of frauds, contract remedies, and the parole evidence rule. Performance of contracts, conditions, effect of changed circumstances, third party beneficiaries, assignment, specific performance.

Law 520-1. Legal Writing. Texts and mimeographed materials. Materials and methods of legal research and writing. After intensive consideration of the types of law books and their functions, students prepare written material of various kinds designed to develop both research technique and writing style.

Law 521-1. Appellate Court Advocacy. Preparation of an appellate brief and delivery of an oral argument before a three-judge court composed of a faculty member and upperclass students.

Law 530-3, 531-3. Civil Procedure I and II. Brief survey of common law and code pleading; major emphasis on trial and appellate practice under Federal and Colorado Rules of Civil Procedure, including jurisdiction, venue, parties, commencement, pretrial, pleadings, and jury trial; federal jurisdiction; federal and state court organization.

Law 540-3, 541-3. Torts I and II. Involves the study of the non-consensual allocation of losses for civil wrongs, focusing primarily on the concepts of negligence and strict liability.

Law 550-4. Criminal Law. Statutory and common law of crimes and defenses, the procedures by which the law makes judgments as to criminality of conduct, the purposes of the criminal law, and the constitutional limits upon it.

Law 561-4. Property. Estates and interests in land; public and private land use controls; easements, licenses, and covenants; and landlord-tenant law.

SECOND YEAR

Law 605-2. Future Interests. Examination of dispositive provisions which divide property rights into successive interests, including the historical background and current applications of the legal concepts involved.

Law 606-3. Real Property Conveyancing and Security. Brokers' duties and commissions, contracts for sale of land, remedies for breaches, deeds, escrows, mortgages, recording systems, title examination, and title insurance.

Law 610-2. Agency-Partnership. The rights and liabilities of the principal, the agent, and third parties with respect to each other, including the concepts of vicarious tort liability, apparent authority, ratification, imputation of knowledge and the undisclosed principal are covered as well as the partnership form of doing business or investing.

Law 618-4. Commercial Transactions. Examination of the methodology of the Uniform Commercial Code and a study of legal devices and substantive principles thereunder relating to financing transactions in personal property and to negotiable instruments, bank deposits, and collections. Some attention to documentary transactions in the sale and shipment of goods.

Law 625-4. Corporations. The formation of corporations and their management, the relations between shareholders and officers and directors, the impact of federal legislation on directors' duties, and the special problems of the closed corporation.

Law 631-3. Water Resources. Analysis of regional and national water problems, including the legal methods by which water supplies are allocated, and an examination of the problems involved in water resource planning.

Law 632-3. Land and Mineral Resources. Policies and legal devices used to forward and control production of oil, gas, hard rock minerals. Attention to management programs on public and private lands.

Law 635-3. Evidence. Basic methods and forms of proof in the adjudicative process, responsibility for proof, judicial notice, examination and competence of lay and expert witnesses, privileged communications, relevancy, opinion and scientific evidence, real proof, writings, and hearsay.

Law 640-3. International Law. Examination of the principles of public international law as developed and applied by all participants in the international legal process, including national and international tribunals, governmental bodies, international organizations, and others. Particular attention to the role of international law in recent events.

Law 645-3. Comparative Law. Selected aspects of German, French, and Swiss law designed to acquaint students with the history and structure of civil law and to provide comparative insights into the conceptual nature of the common law system.

Law 650-3. Labor Law. Decisions and statutes relating to rights of workers to act in concert, including legal aspects of strikes, picketing, and boycotts; representation proceedings; establishment of collective bargaining; and administration of the collective agreement.

Law 651-3. Criminal Procedure. This course focuses primarily on the constitutional limitations applicable to such police investigative techniques as arrest, search, seizure, electronic surveillance, interrogation, and line-up identification.

Law 652-3. Unfair Competition and Intellectual Property. Federal and state laws aimed against unfair competition; federal law of copyrights, patents, and trademarks; protection against misinformation; protections accorded information and ideas having economic value, such as inventions, literary, musical, and other artistic works, designs, commercial symbols, and trade secrets.

Law 653-3. Criminal Procedure: The Adjudicative Process. This course focuses primarily on criminal procedure at and after trial. It treats such topics as bail, prosecutorial discretion, discovery, plea bargaining, speedy trial, jury trial, the right to counsel at trial, double jeopardy, appeal, and federal habeas corpus.

Law 655-3. Legal Accounting. Study of accounting problems in the form they are placed before the lawyer, including a succinct study of basic bookkeeping, in-depth legal analysis of the major current problems of financial accounting, and consideration of the conduct of financial affairs of business.

Law 660-4. Income Taxation. Basic course in taxation with major emphasis on the fundamentals of the federal income tax system. Generally approached from the standpoint of the impact of the federal income tax system on the individual.

Law 661-4. Constitutional Law. A basic exposure to the full panorama of constitutional law problems. Survey of the legal problems posed by the federal system and protections afforded individual rights.

Law 664-3. State and Local Tax. Emphasizes administration of and policies underlying choices between different methods of financing state and local government, including income, sales, property, and other taxes; user charges, borrowing, and federal grants. Considers which expenditures should be borne at different levels of government.

Law 665-1. Professional Responsibility. The legal profession as an institution, its history and traditions, and the ethics of the bar with particular emphasis on the professional responsibilities of the lawyer.

Law 670-2. Extern Program. A special program allowing academic credit of 2 hours (or a total of 4 hours when combined with Law 772, Extern Program) for legal work done with an approved agency under the supervision of a faculty member. Open only to students who have completed three full semesters (40 hours).

Law 672-1. Legal Aid. Representation of clients in civil matters and criminal misdemeanor matters.

Law 673-2. Legal Aid—Civil Practice. Emphasizes procedural and practical remedies and defenses available in civil litigation. In conjunction with this course, students (who must normally be enrolled in Legal Aid) will be assigned civil cases related to the course material.

Law 674-2. Legal Aid—Criminal Practice. Thorough grounding in problems of criminal defense. Students must be enrolled in Legal Aid and will defend indigent misdemeanants in Boulder area courts.

Law 683-2. Legal Aid—Evidence Presentation. Develops working knowledge of courtroom skills. Prer. or coreq., Law 635; coreq., Law 672.

Law 699-2. Wills and Trusts. Intestate succession; family protection; execution of wills; revocation and revival; will contracts and will substitutes; creation of trusts; modification and termination; charitable trusts; fiduciary administration, including probate and contest of wills; constructional problems in estate distribution.

THIRD YEAR

Law 700-3. Administrative Law. Practices and procedures of administrative agencies and limitations thereon including the Federal Administrative Procedure Act; the relationship between courts and agencies.

Law 702-2. Immigration Law. Detailed study of how to get and maintain temporary and permanent visas and defend against exclusion and/or deportation from the U.S. through analysis of immigration history, laws, regulations, case law, constitutional protections, and the agency's wide discretionary practices.

Law 705-3. Conflict of Laws. The general approach to conflicts, problems, jurisdiction of courts in conflicts cases, foreign judgments, choice of law rules governing contracts, torts, workmen's compensation, property and estates, constitutional limitations on choice of law rules, and law applied in the federal courts in conflicts cases.

Law 710-3. Domestic Relations. Nature of marriage, actions for annulment and divorce, problems of alimony, separation agreements, custody of children. Consideration also of illegitimacy, abortion, contraception, the status of the married woman at common law and under modern statutes, and the economic relations of parent and child.

Law 715-3. Federal Estate and Gift Tax. Introduction to the federal estate and gift taxation of inter-vivos and testamentary transfers with emphasis on the drafting of wills and trusts.

Law 716-3. Advanced Estate Planning. Income taxation of estates and trusts and estate planning problems and solutions for the owner of a closely held business, a family farm, and joint tenancy property.

Law 722-3. History of Jurisprudence. History of western legal thought in its social setting. The purpose is to provide historical material useful for reflections on and understanding of actual legal problems.

Law 730-3. Due Process and Equal Protection. The course is broken up into three parts. The first deals with Congress' enforcement power under the Thirteenth, Fourteenth, and Fifteenth amendments. The second part explores the substantive content of the equal protection and the due process clauses. The last part is concerned with "state action."

Law 731-2. First Amendment Law. Advanced constitutional law course examining issues raised by free speech and free press clauses of the First Amendment.

Law 732-3. Land Use Planning. Analysis of common law precedents and conventional planning, zoning, and subdivision regulation. Special attention to new state-wide and federal land-use control programs, the taking issue, and exclusionary zoning.

Law 734-2. Employment Discrimination. Examines constitutional, statutory, and regulatory proscriptions of race, gender, and age discrimination in private and public employment.

Law 735-3. Real Estate Planning. Consideration of the various contemporary legal problems involved in the ownership, use, development, and disposition of real estate. Particular emphasis on the income tax and financing aspects of commercial and residential use and development such as shopping plazas and apartment development.

Law 740-1. Interviewing. Designed to train students to greater sensitivity and awareness of clients' problems by the use of tape-recorded interviews. Conducted jointly by a psychiatrist and a member of the faculty. Concurrent participation in legal aid is a requisite.

Law 744-3. Regulated Industries. An examination of the legal and policy questions arising when direct, administered regulation is substituted for market forces in controlling an industry's conduct.

Law 745-2. Securities Regulation. Concerned with the various federal statutes regulating the issue of and trading in corporate securities and the cases and regulations which have arisen out of those statutes. Some attention to state blue sky laws.

Law 747-3. Environmental Law. Introduction to problems of environmental regulation and control. Related economic theory on the ability of the physical sciences to predict environmental impacts and to the creation and review of Environmental Impact Statements under NEPA. Detailed review of problems experienced under recent major federal air and water pollution control programs.

Law 750-3. Antitrust. Concerned with the law developed from the Sherman, Clayton, and Federal Trade Commission acts.

Law 755-3. Creditors' Remedies and Debtors' Protection. A study of typical state pre-judgment and post-judgment rights and procedures for enforcement of claims (including fraudulent conveyance principles) and treatment of exemptions and the developing limitations and remedies affording protection to debtors. Special attention is given multi-jurisdictional problems.

Law 756-2. Bankruptcy. Examination of the law and procedure of bankruptcy liquidation proceedings and a brief introduction to debtor rehabilitation proceedings under the National Bankruptcy Act. Throughout the course, reference is made to changes proposed in pending bankruptcy legislation.

Law 762-2. Trial Advocacy. A concentrated study of the theory and practice of trial work, covering the step-by-step handling of a case from the first interview with the client through the closing argument and verdict.

Law 766-3. Business Planning. Focuses on the development and use of concepts derived from a number of legal areas in the context of business planning and counseling. Topics such as formation of business entities, sale of a business, recapitalization, division, reorganization, and dissolution are considered.

Law 769-3. Advanced Taxation. Considers the impact of the federal income tax system on the business enterprise. The major emphasis is in the partnership and corporate area. Based on a series of problems involving the taxation of partnerships and corporations and the participants in these forms of business entity.

Law 771-variable credit. Independent Legal Research. (Two sem. hrs. maximum.) Independent study and preparation of a thesis under supervision of faculty member. Specific permission of the supervising faculty member is required before registering.

Law 772-2. Extern Program. A special program allowing academic credit of 2 hours (or a total of 4 hours when combined with Law 670, Extern Program) for legal work done with an approved agency under the supervision of a faculty member.

Law 787-3. Federal Courts. Structure and jurisdiction of the federal courts, with particular emphasis on problems of federalism as they relate to administration of justice through a dual court system.

Law 790-1. Practice Court.¹ Students try a case from start to finish before a Colorado judge. Conduct of each case includes interviewing parties and witnesses, filing suit, drafting pleadings, filing and arguing motions, pretrial conference, and a complete jury trial.

SEMINARS

Law 703-2. Natural Resources and the Environment: Law, Policy and Economics. Selected legal issues involving the environment, water resources, and mineral resources (especially oil and gas), with an emphasis on identifying the economic consequences of alternative legal strategies.

Law 707-2. Federal Courts in the American Political System. An examination of the modern political roles taken on by the federal courts in order to implement constitutional objectives.

Law 720-2. Problems in Comparative Law. Focuses on differences existing between European legal systems and that of the United States. Emphasis will be given to comparative criminal law and procedure.

Law 727-2. Constitutional Litigation. The seminar functions as a small law firm, each member having primary responsibility for an actual case involving constitutional questions. These cases are usually referred to the seminar by the American Civil Liberties Union of Colorado.

Law 729-2. Appellate Adjudication. Seminar introduces appellate decision making by study of civil and criminal cases currently on appeal in state and federal courts. Students are required to study the briefs and record, to discuss the issues in conferences, and to draft opinions.

Law 737-2. American Indian Law. Investigation of the federal and state laws which bear upon problems of American Indians, and on Indian reservations.

Law 746-2. Legal Philosophy. Selected streams in legal philosophy and their contemporary political meaning. Emphasis on the application of legal theories to criminal law. Prer., Law 722.

Law 758-3. Remedies. Examines the types of relief available to persons with actual or anticipated injuries in the areas of contracts, torts, property, and constitutional law. Emphasis on injunctions, but the course also covers restitution, specific performance, declaratory relief, damages, etc.

Law 760-3. Local Government Law. Creation, annexation, dissolution, classification of local governmental units; problems of inter-governmental relations and legislative control of local governmental units; and the powers, duties, and liabilities of local governmental units.

Law 749-2. Securities Regulation. In-depth study of state and federal securities regulation statutes applied in realistic business contexts through use of problems requiring extensive research and written memoranda.

Law 751-2. The Law of Corrections. Selected topics related to incarceration and its alternatives, including preconviction "diversion" programs, sentencing, probation, parole, and rights of prisoners while in prison. Rights of juveniles are also treated.

Law 763-2. Federal Tax Policy. "I like to pay taxes. With them I buy civilization."—Oliver Wendell Holmes. "... the power to tax involves the power to destroy..."—*McCulloch v. Maryland*. This seminar focuses on current issues of federal income tax policy, but also considers nonfederal and nonincome taxes. Prer., Law 660.

Law 765-2. Antitrust Procedure. This seminar considers some of the procedural problems involved in bringing and defending both private and public antitrust suits, such as pleading, damages, standing to sue, multi-district litigation, class suits, statute of limitations, the defense of state action, and similar matters. Prer., Law 750.

Law 767-2. Government Regulation of Water Resources. A general review of governmental restraints on use of water resources, with particular attention to the area of federal-state conflict. Prer., Law 631.

Law 775-2. Law and Medicine. Concerns issues of common interest to lawyers and physicians.

Law 776-2. Law and Mental Health. The law's reaction to a judgment that an individual's mental state is abnormal. Possible topics include civil commitment, competency to stand trial, the insanity defense, the right to treatment, the privilege to refuse treatment, guardianship, liability of mental health professionals.

Law 777-2. Labor Relations Law in the Public Sector. Study of growing impact of public sector unionization. Examines judicial decisions and statutory law bearing on rights and obligations of employees and employers, the right to organize, the collective bargaining relationship, strikes, impasse, and dispute settlement. Seminar paper required.

Law 781-2. Legal Process. The study of law as a purposive process and the functions and interrelationships of the various public and private institutions through which the process is carried on. Gives a general view of the American legal system as a framework to help in organizing knowledge about the various elements of the system.

Law 782-2. Labor Arbitration. A study of arbitration procedures and techniques, including standards used for interpreting labor contract language. Students are assigned problems in important areas of arbitration and are required to submit a research paper.

Law 783-2. Federal Common Law of Corporations. Study of federal regulation of relations among the constituents of a corporation.

Law 785-2. Social Legislation. Study of governmental efforts to combat poverty and maintain income. Examines welfare programs, Social Security, unemployment and workmen's compensation, fair labor standards, occupational safety and health, employment discrimination, and Title VII. Seminar paper required.

Law 797-2. Legal Expression. A seminar in reading and writing legal literature, examining judicial opinions, statutes, contracts, arguments, and briefs. The perspective from which the course approaches these materials is the question: Is it possible for the lawyer to be a serious writer in the way a poet, novelist, or historian is? Weekly writing assignments.

¹Each student is required to participate as a juror or bailiff during the first year and as a counsel representing a party during the third year.

College of Music

CHORAL MUSIC

Mus. 515-2. Seminar in The Literature and Performance of Choral Music. *Fall, Spring.* Advanced conducting, analytical study. Required of all choral graduate students each semester of residence. Byers, Collins, Whitten.

Mus. 570-3. Introduction to Historical Research. *Fall.* Introduction to materials and procedures of historical research. For choral majors. Collins, Hayes.

Mus. 576-3. History of Choral Literature. *Spring.* Systematic survey of literature of vocal ensembles and choral music from polyphonic works of Renaissance to present. Luhring.

HISTORY AND LITERATURE

Mus. 180-2. Introduction to Music. *Fall.* Three lect.-labs per wk. Study of music literature with emphasis on development of intelligent listening habits and analytical tools. Coreq., Mus. 100 and 102.

Mus. 181-2. Introduction to Music History. *Spring.* Three lect.-labs per wk. Introductory survey of music history and literature designed to provide basic historical skills. Recommended for those taking Mus. 380 in sophomore year. Prer., Mus. 100.

Mus. 182-2. Appreciation of Music. *Fall, Spring.* Basic knowledge of music literature and development of discriminating listening habits. In addition, each section emphasizes a different aspect—aesthetics, history, concert attendance. For nonmusic majors only.

Mus. 183-3. Introduction to Music. *Fall, Spring.* Basic knowledge of music literature and development of listening in depth. For non-music majors only. Galm, Luhring.

Mus. 364-3. History of Jazz. *Fall.* Study of origins, development, and current trends. Open to all University students. Scott.

Mus. 375-3. Introduction to American Music. *Spring.* Important trends in folk, popular, and elite music which comprise the music of the United States are examined. Prer., Mus. 180, 182, or 183.

Mus. 376-3. Music and Drama. *Fall.* Techniques used in combining music and dramatic arts through examples from musical and dramatic literature of the West from ca. 1000 to present. Prer., Mus. 180, 182, or 183.

Mus. 377-3. World Music. *Spring.* Musics outside western art tradition, using current ethnomusicological materials. Prer., Mus. 180, 182, or 183.

Mus. 379-3. Twentieth-Century Music and Media. *Spring.* Musical theatre, jazz, folk, rock, and hybrid styles, electronic music, and related art forms. Prer., Mus. 180, 182, or 183.

Mus. 380-3, 381-3. History of Music. *Fall, Spring.* Survey of Western art music with stylistic analysis of representative works from all major periods. Prer., Mus. 200 and one of the following: Mus. 181, 375, 376, 377, or 379.

Mus. 382-3. Music Literature I. *Fall.* Study of music masterpieces from choral, orchestral, chamber music, and operatic repertoire. For nonmusic majors only. Prer., Mus. 182 or consent of instructor. Clendenin, Ellsworth.

Mus. 383-3. Music Literature II. *Spring.* Continuation of Mus. 382. Prer., Mus. 182 or Mus. 382 or consent of instructor. Clendenin, Hayes.

Mus. 466/566-2. Chamber Music Literature: Winds and Percussion. *Spring, 1979.* Stylistic-historical survey in various genres from Baroque era to present. Prer., Mus. 381. Aaholm.

Mus. 471-2, 3/571-2, 4. Renaissance Music. *Fall.* Intensive study of monophonic and polyphonic music circa 1400-1600. History majors and others desiring extended study in this epoch may enroll for 3 hrs. credit. Prer., Mus. 380. Mus. 571—Two regular class meetings per wk., plus seminar meeting for variable credit. Those wishing to study white mensural notation in seminar should enroll for 4 hrs. credit. Clendenin.

Mus. 476/576-3. History of Choral Literature. *Fall.* Systematic survey of literature of vocal ensembles and choral music. From polyphonic works of Renaissance to present. Prer., Mus. 380 and 381. Luhring.

Mus. 477/577-3. History of the Opera. *Spring.* Literature of the lyric theatre in its most salient currents and works from early Baroque to contemporary productions. Prer., Mus. 381. Clendenin.

Mus. 479/579-3. Twentieth-Century Music. *Fall.* Western art tradition in an historical context. Major trends and developments explored while focusing on specific compositions of important composers. Prer., Mus. 381. Galm.

Mus. 481/581-3. Symphonic Literature. *Fall.* Study of literature for orchestra, band, and other symphonic ensembles; pre-classic, classic, romantic, and 20th century. Prer., Mus. 381. Galm.

Mus. 482-2, 3/582-2, 4. Ancient and Medieval Music. *Spring.* Survey from early times to circa 1400. History majors and others desiring extended study in this epoch should enroll for 3 hrs. credit. Prer., Mus. 380. Mus. 582—Two regular class meetings per wk., plus seminar for variable credit. Those wishing to study black mensural notation in seminar should enroll for 4 hrs. credit. Ellsworth.

Mus. 483-3/583-3. American Music. *Spring.* Survey of traditional, popular, and art music in United States from colonial period to present. Prer., Mus. 381.

Mus. 484-3/584-3, 4. Music Aesthetics. *Fall.* Various philosophies of music as they have developed during past 100 years in writings of philosophers, psychologists, sociologists, composers, critics, and historians. Mus. 584—three regular class meetings per wk., plus seminar for 4 hrs. credit. Prer., Mus. 381. Kearns.

Mus. 485/585-2, 3, 4. Seventeenth- and Early 18th-Century Music. *Spring.* Music from 1680 to 1760 examined in terms of vocal and instrumental styles and national influence. Prer., Mus. 380, Mus. 585. Two regular class meetings per wk., plus seminar in analysis for 4 hrs. credit. Luhring.

Mus. 487/587-3. Late 18th- and 19th-Century Music I. *Fall.* Music and documents of classic and romantic periods, 1750-1900. Prer., Mus. 381. Hayes.

Mus. 488/588-3. Late 18th- and 19th Century Music. *Spring.* Selected topics in classic and romantic music, 1750-1900. Prer., Mus. 381. Hayes.

Mus. 489/589-3. Latin-American Music. *Spring.* Music of cultures south of United States—Mexico, Peru, Brazil, Cuba, other countries having substantial musical heritage, with emphasis on relationship of folk, popular, and art styles. Galm.

Mus. 570-3. Introduction to Historical Research. *Fall.* Introduction to materials and procedures of historical research. Collins, Hayes.

Mus. 782-3, 783-3. Seminar in Musicology. *Fall, Spring.* Required of all musicology majors prior to completion of comprehensive examinations. A different research area is designated each semester. Periodic reports to Musicology Colloquium required.

MUSIC EDUCATION

Mus. 110-2. Introduction to Music Education. *Fall, Spring.* Following preliminary reading and discussion, designed to acquaint students with entire scope of music education process. Students are assigned as instructional aides in public schools at several levels. Hieronymus, McCarthy.

Mus. 111-2. Fundamentals of Conducting. *Fall, Spring.* Basic and preliminary beat patterns, releases, and simple cueing techniques. Reeves.

Mus. 213-2. Instrumental Music in the Schools. *Spring.* Survey for students preparing to teach general and choral music in the schools. Sandford.

Mus. 217-2. Choral Literature and Conducting. *Fall, Spring.* Conducting techniques and choral literature for the secondary schools. McCarthy.

Mus. 310-4. Music in the Elementary School. *Fall.* Pedagogical techniques used in teaching music concepts in grades kindergarten through six. Hieronymus.

Mus. 311-4. Music in the Secondary School. *Spring.* Pedagogical techniques used in teaching general and choral music in junior and senior high schools. McCarthy.

Mus. 312-2. Teaching Humanities. *Spring.* Methods of presenting music and the arts as implied in present-day humanities and allied arts courses in the schools. McCarthy.

Mus. 316-2. Techniques of Teaching Strings. *Fall.* Survey of problems of class teaching of the string instruments through actual use in class. Hilligoss.

Mus. 317-2. Orchestra Materials and Conducting. *Spring.* Preparing student to become director of school orchestral ensembles. Bernstein.

Mus. 318-3/518-2, 3. Band Literature and Conducting Techniques. *Spring.* Band literature and materials. Examination of available materials for individual instruments, smaller ensembles, and concert band. Mus. 518—paper required. McMillen.

Mus. 319-1. Woodwind and Percussion Design and Repair. *Fall, Spring.* May be repeated for additional credit. McKinley.

Mus. 320-3. Music for the Classroom Teacher. *Spring.* Practical study of vocal and general music in elementary school. Designed for classroom teacher. For education majors only. Hieronymus, McCarthy.

Mus. 410-1. Marching Band Techniques. *Fall—first eight weeks.* Examination of organizational and administrative procedures in the area of the marching band, plotting of the field and assignment of band members, marching and playing techniques. McMillen.

Mus. 411-1. Instrumental Organization and Administration. *Fall—second eight weeks.* Examination of organizational and administrative procedures (band). McKinley.

Mus. 412-2. Teaching the Learning-Disabled Child in the Music Class. *Fall.* McCarthy.

Mus. 413-3/522-2, 3. Brass and Woodwind Pedagogy. *Fall.* Pedagogical problems in connection with teaching wind instruments, as well as survey of solo literature. Prer., 1 sem. of brass study and 1 sem. of woodwind study, or equivalent (1 sem. may be taken as coreq.). Baird, McKinley, McMillen.

Mus. 416-1. Percussion Class and Pedagogy. *Fall, Spring.* Galm.

Mus. 418-1. Introduction to Student Teaching. *Fall, Spring.* Reeves.

Mus. 419-1. Student Teaching Seminar (Choral, Band, Orchestral). *Fall, Spring.* Required of all students in student teaching programs. Hieronymus, Hilligoss, McKinley.

Mus. 513-1. Advanced Conducting—Instrumental. *Spring.* Advanced work in orchestral conducting. Prer., a 1-sem. conducting class or equivalent. Bernstein.

Mus. 515-2. Seminar in the Literature and Performance of Choral Music. *Fall, Spring.* See Choral Music section.

Mus. 610-2. Introduction to Graduate Study. *Fall.* Materials, techniques, and procedures for research in music education. Required of all music graduate students. Sandford.

Mus. 611-2. Foundations of Music Education I. *Fall.* Survey of historical, philosophical, psychological, and aesthetic bases of contemporary music education. Reeves.

Mus. 612-2. Foundations of Music Education II. *Spring.* Application of aesthetic, philosophical and psychological principles to administration, supervision and evaluation of programs in music education. Reeves.

Mus. 613-4. Comprehensive Musicianship for Teachers. *Fall.* Application of structural and analytical principles of music to teaching, conducting and performing music for musician-teachers in the schools. Hieronymus.

Mus. 614-2. Teaching Music Through Performance: The Conductor as Educator. *Spring.* McCarthy.

Mus. 615-3. Seminar in Elementary/Secondary/General Classroom Music. *Spring.* Investigation of theoretical bases for deriving objectives in general and classroom music in elementary and secondary schools; current curricula, methods, and materials focused on objectives; evaluative measures in music. Hieronymus.

Mus. 616-2. Psychology of Learning in Music. *Spring.* Reeves.

Mus. 617-2. Directions of Contemporary Aesthetic Education. *Spring.* Hieronymus.

Mus. 619-1 to 3. Selected Studies in Music Education. *Fall, Spring.* May be repeated for additional credit. With consent of instructor and chairman of music education division.

These courses are available only to Doctor of Philosophy (music education) candidates.

Mus. 710-3. Research Literature and Techniques I (Historical and Philosophical). *Fall.* Sandford.

Mus. 711-3. Research Literature and Techniques II (Survey and Experimental). *Fall.* Study and analysis of procedures as applied to significant research in music education. Reeves.

Mus. 712-2. Research Practicum in Music Education. *Fall, Spring.* McCarthy.

Mus. 713-2. Contemporary Issues in College Teaching. *Spring.* Sandford.

Mus. 714-2. Administration of Higher Education in Music. *Spring.* Imig.

ORGAN AND CHURCH MUSIC

Mus. 226-2. Service Playing Techniques. *Fall.* Methodology of playing for a church service including directing from the console, modulation, accompanying, and hymn playing. Vollstedt.

Mus. 326-2, 327-2. Improvisation. *Fall, Spring.*

Mus. 424/524-3, 425/525-3. Church Music. *Fall, Spring, 1978-79.* Comprehensive study of the philosophy of church music, with an evaluation of both fixed and free liturgies. Practical study of church choral literature, chanting, hymnology, and music in the church school.

Mus. 426/526-2, 427/527-2. Improvisation. *Fall, Spring.*

Mus. 428/528-3, 429/529-3. Organ Survey. *Fall, Spring.* Historical survey of organ music and organ construction, studying both forms of composition and types of organ for which the music was originally written. Trips to various churches in area will give the student an opportunity for first-hand observation.

Mus. 523-2 to 8. Church Music Research. *Fall, Spring.* Vollstedt.

PIANO

Mus. 232-2. Functional Keyboard Techniques. *Fall.* Practical approach to functional keyboard techniques including harmonization, improvisation, transposition, modulation. Prer., consent of instructor. Anstutz.

Mus. 235-3. Piano Pedagogy I. *Spring.* Discussion of teaching philosophies, objectives, and procedures. Examination and evaluation of methods and materials. Practical aspects with which the private teacher is concerned.

Mus. 236-2. Introduction to Accompanying. *Fall.* Includes chamber music for pianists and music-making potentials. Performance required in variety of accompanying roles; critiqued and coached by class and instructor. Graham.

Mus. 334-2. Piano Pedagogy II. *Fall.* Pedagogical principles, student teaching, examination and evaluation of materials for beginners and elementary students. Prer., Mus. 235 or consent of instructor. Wallingford.

Mus. 335-3. Piano Pedagogy II. *Spring.* Observation in private studios and class meetings for summation and discussion. Bibliography and analysis for piano teachers. Prer., Mus. 235 or consent of instructor. Amstutz.

Mus. 432-3. Piano Literature. *Fall.* Survey from 18th century to present. Prer., Mus. 200. Wait.

Mus. 434-3. Piano Pedagogy III. *Fall.* Organization and guidance of piano groups (studio-performance instruction). Supervised teaching in children's laboratory. Duckworth.

Mus. 435-2. Piano Pedagogy III. *Spring.* Practice teaching and observation. Lesson plans and procedures for solving specific problems will be required. Observation in the studios of cooperating Boulder teachers. Prer., Mus. 434 or consent of instructor. Wallingford.

Mus. 436-2. Piano Accompanying. *Fall, Spring.* Discussion and performance of selected art songs and sonata literature with emphasis on performance and preparation procedures. Special projects. May be repeated for additional credit. Prer., consent of instructor. Graham, Parmelee.

Mus. 530-3. Piano Pedagogy—Process of Group Environments. *Fall.* Organization and guidance of piano groups (studio-performance instruction), and classes (keyboard skills instruction). Supervised teaching in college class program. Duckworth.

Mus. 532-2. Seminar: Piano Literature. *Fall.* Keyboard music from earliest known examples through Debussy. Prer., graduate standing with major in piano performance or consent of instructor. Wait.

Mus. 533-2. Piano Music of the 20th Century. *Spring.* Study of specific contributions to piano literature by such composers as

Schoenberg, Webern, Bartok, Stravinsky, Dallapiccola, Boulez, Stockhausen, Berio, Copland, Crumb, Martirano, and others. Prer., graduate standing or consent of instructor. Wait.

Mus. 534-2, 535-2. Research: Piano Literature and Pedagogy. Fall, Spring. Individual or group research related to piano pedagogy or literature for piano. Prer., consent of instructor.

Mus. 536-2. Piano Accompanying. Fall, Spring. Continuation of Mus. 436. May be repeated for additional credit. Graham, Parmelee.

Mus. 634-3, 635-3. Group Process. Fall, Spring. Student participation in *groups* with two to four individuals (studio-performance instruction); *classes* with five to twelve individuals (keyboard skills instruction); and *seminars* for understanding group theory. Duckworth.

Mus. 638-3. Group/Class Piano in College. Fall. Seminar dealing with educational and musical issues; organization and guidance of *groups* (studio-performance instruction); and *classes* (keyboard skills instruction). Supervised teaching in children's laboratory and college class program. Duckworth.

STRINGS

Mus. 357-1. Viola Pedagogy. Fall, Spring.

Mus. 358-1. Violin Pedagogy. Fall, Spring. Bernstein, Lehnert.

Mus. 359-1. Cello Pedagogy. Fall, Spring. Hillgoss.

THEORY/COMPOSITION

Mus. 100-2, 101-3. Theory I. Fall, Spring. An integrated course in the various elements of music theory, including composition, structural analysis, and principles of two-voice, three-voice, and four-voice writing. Coreq., Mus. 102, 103, and class piano. Eakin, Scott.

Mus. 102-1, 103-1. Theory and Ear Training Lab. I. Fall, Spring. Practice in rhythmic, melodic, harmonic, and contrapuntal sight singing and ear training. Coreq., Mus. 100, 101. Eakin, Scott.

Mus. 108-3. Rudiments of Music. Fall, Spring. Introduction to science and art of music to develop tools used in notating, performing, creating, and listening to music. For nonmusic majors only who have little or no previous schooling in subject. McCarthy.

Mus. 200-3. Theory II. Fall. Continuation of Theory I. Prer., Mus. 100, 101, 102, 103. Coreq., Mus. 202. Eakin, Scott.

Mus. 202-1. Theory and Ear Training Lab. II. Fall. Continuation of Ear Training and Sight Singing I. Prer., Mus. 102, 103. Coreq., Mus. 200. Eakin, Scott.

Mus. 207-2. Instrumentation. Spring. Introductory consideration to all instruments with respect to capabilities, technical and musical, singly and in combination. Scoring for smaller instrumental ensembles.

Mus. 305-2. Elementary Composition. Spring. Creative work in small forms. Prer., Mus. 200, 202. Eakin.

Mus. 307-2. Keyboard Harmony and Improvisation. Spring. Study and drill in triads and seventh chords with emphasis on functional application. Scott.

Mus. 400/500-2. Contemporary Theory. Fall. Study of established theoretical principles applied to advanced and recent idioms. Creative work included. Prer., Mus. 200. Prer. or coreq., Mus. 401, 402. Toensing.

Mus. 401-2. Sixteenth-Century Counterpoint. Spring. Prer., Mus. 200. Effinger.

Mus. 402-2. Eighteenth-Century Counterpoint. Fall. Prer., Mus. 200. Effinger.

Mus. 403/503-2. Scoring and Arranging. Spring. Practical problems, creative arranging, and scoring for various choral and instrumental groups. Prer., Mus. 207. Scott.

Mus. 404-2. Orchestration. Fall. Scoring for chamber and large ensembles. Prer., Mus. 207.

Mus. 406-2. Analysis I. Fall. Selected works through the 18th century. Prer., Mus. 380 or equivalent.

Mus. 407-2. Analysis II. Spring. Selected works of the 19th and early 20th centuries. Prer., Mus. 380 or equivalent.

Mus. 408/508-2. Electronic Music. Fall. Practical approach to composition of electronic music, exploring methods of sound generation, alteration, and combination; emphasizing development

of skill in use of synthesizers and recording equipment. Prer., consent of instructor.

Mus. 501-2. Advanced Counterpoint. Spring. Prer., Mus. 401.

Mus. 502-2. Seminar in Twelve-Tone and Serial Music. Spring. Music of such composers as Schoenberg, Webern, Babbitt, Nono, Stockhausen. Composition exercises using principles derived from analysis of representative works.

Mus. 504-2. Advanced Orchestration. Spring. Scoring for chamber and large ensembles. Prer., Mus. 207. Effinger.

Mus. 505-3. History of Theory. Spring. A study of important theoretical writings from ancient Greece to the present. Eakin.

Mus. 506-3, 507-3. Advanced Analysis I, II. Fall, Spring. Prer., Mus. 406 or 407.

Mus. 509-2. Music of Selected Twentieth-Century Composers. Spring. Musical style of a representative twentieth-century composer, such as Stravinsky, Bartok, Messiaen, Ives, through an analysis of his works.

Mus. 550-2. Theory Pedagogy. Spring. Investigation of resources, materials, and methods useful to teaching theory. Eakin.

Mus. 685-3. Theory Thoroughbass. Spring. For qualified graduate students interested in acquiring technique for realization of figured basses (both keyboard performances and written) from scores of 17th and 18th centuries.

Composition 1 or 2. Fall, Spring. May be repeated for additional credit.

Aero. 395/599. Music Acoustics. Fall. See Aerospace Engineering Sciences.

VOICE

Mus. 144-1. Italian Diction. Fall. Phonetic elements of liturgical Latin and of Italian for singers. Paton.

Mus. 145-1. English Diction. Spring. Clear and expressive use of standard American English in singing. Westwood.

Mus. 244-1. German Lyric Diction. Fall. Orientation to the phonetics of High German by means of International Phonetic Alphabet. Paton.

Mus. 245-1. French Lyric Diction. Spring. Pronunciation of French in singing. Jackson.

Mus. 442/542-2. Opera Workshop. Fall, Spring. Discussion of and practical experience in the production and performance of opera. Work of each semester will culminate in the presentation of operatic scenes and/or chamber opera, according to the abilities of the class. Mus. 442 for students in Bachelor of Music vocal performance curriculum; others by audition. Mus. 542 by audition only. Hata.

Mus. 444/544-2. Vocal Pedagogy. Fall. Comparison of various approaches to the teaching of singing.

Mus. 445/545-2. Repertoire for All Voices. Spring.

Mus. 446-3, 546-2. Art Song. Fall. Study and performance of 18th- and 19th-century lieder. Paton.

Mus. 447-3, 547-2. Art Song. Spring. Study and performance of 20th-century German, French, and American songs. Paton.

BACHELOR OF ARTS IN MUSIC

Mus. 399-1. Junior Research Seminar: Bachelor of Arts in Music. Fall, Spring. Concentration on conceptual aspects of research, the psychology and 'ordering' of a library search that leads to formal paper. Applies student's interests and curricular goals to specific topic; includes preparation of a prospectus for senior thesis. Arneson.

These courses are available only to Doctor of Musical Arts candidates.

Mus. 821-3. Dissertation Project I. (Solo Recital, Choral Concert, Composition.) Fall, Spring.

Mus. 822-3. Dissertation Project II. (Solo Recital, Choral Concert, Composition, Vocal Pedagogy Project.) Fall, Spring.

Mus. 823-3. Dissertation Project III. (Chamber Music Recital, Vocal Pedagogy Project, Choral Project, Composition Recital.) Fall, Spring.

Mus. 824-3. Dissertation Project IV. (Chamber Music Recital, Choral Project, Composition Recital.) Fall, Spring.

Mus. 825-3. Dissertation Project V. (Lecture-Recital, Pedagogy Lecture.) *Fall, Spring.*

Mus. 826-3. Dissertation Project VI. (Lecture-Recital, Pedagogy Lecture.) *Fall, Spring.*

Mus. 827-1. Performance-Related Research Document. *Fall, Spring.* Coreq., Mus. 821.

Mus. 828-1. Performance-Related Research Document. *Fall, Spring.* Coreq., Mus. 822.

Mus. 829-1. Performance-Related Research Document. *Fall, Spring.* Coreq., Mus. 823.

Mus. 830-1. Performance-Related Research Document. *Fall, Spring.* Coreq., Mus. 824.

Mus. 831-3. Repertoire Project. *Fall, Spring.*

Mus. 832-4. Major Document. *Fall, Spring.* For pedagogy majors.

Mus. 833-6. Major Composition. *Fall, Spring.* For composition majors.

ENSEMBLES

Bands. *Fall, Spring.* One hr. credit each sem. Open to all qualified University students.

Bell Ensemble. *Fall, Spring.* One hr. credit each sem. A performing organization using the University's set of 49 Whitechapel bells. Hilty.

Chamber Music Ensemble. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Aaholm, Baird, Bernstein, Hilligoss, Lehnert, Olson, and Roznoy.

Chamber Music (Two-Piano). *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor.

Chamber Orchestra. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Bernstein.

Collegium Musicum. *Fall, Spring.* One hr. credit each sem. The study and performance of Medieval, Renaissance, and Baroque music on historical instruments. Open to all qualified University students with consent of instructor. Sandford.

Repertory Orchestra. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Bernstein.

Symphony Orchestra. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Bernstein.

Percussion Ensemble. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Galm.

Chamber Chorale, Festival Chorus, University Choir, University Singers, Women's Chorus. *Fall, Spring.* One hr. credit each sem. Open to all qualified University students. Byers, Whitten.

University Jazz Ensemble. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor. Foote.

SPECIAL STUDIES

Mus. 480-1 to 3. Special Studies. *Fall, Spring.* Advanced undergraduate studies or special projects in selected areas. For undergraduate music majors only. May be repeated for additional credit.

Mus. 580-1 to 3. Special Studies. *Fall, Spring.* Graduate studies in specific areas and special projects. For Master of Music degree students only. May be repeated for additional credit.

Mus. 680-1 to 3. Special Studies. *Fall, Spring.* Advanced graduate studies in specific areas or special topics. For music doctoral degree students only. May be repeated for additional credit.

School of Pharmacy

BIOPHARMACY

Bi.Ph. 490-4. Anatomy and Pathology. *Fall.* Lect. and lab. Study of human anatomy with emphasis on normal as compared to diseased states. Prer., fourth-year status and EPOB 322.

Bi.Ph. 599-1 to 3. Special Problems in Biopharmacy. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

RECITALS, THESES, AND REQUIRED CLASSES

Mus. 495-2. Senior Thesis: Bachelor of Arts in Music. *Fall, Spring.*

Mus. 496-2 to 4. Church Music Thesis. *Fall, Spring.*

Mus. 497-4. History and Literature Thesis. *Fall, Spring.*

Mus. 498-0. Theory Thesis. *Fall, Spring.*

Mus. 499-0. Senior Recital. *Fall, Spring.*

Mus. 700-4. Master's Composition Thesis. *Fall, Spring.*

Mus. 701-4. Master's Performance Thesis. *Fall, Spring.*

Mus. 702-4. Master's Literature Thesis. *Fall, Spring.*

Mus. 703-2 or 4. Master's Music Education Thesis. *Fall, Spring.*

Mus. 800-0 to 8. Doctor's Thesis. *Fall, Spring.*

Literature Class. *Fall, Spring.* Required for all undergraduate music majors.

Musicology Colloquium. *Fall, Spring.* Required for all graduate students in musicology. Kearns.

APPLIED MUSIC—CLASSES

Undergraduate credit—1 hour each semester. Open only to College of Music majors, unless otherwise indicated in the current *Schedule of Courses*.

Clarinet Class

Cornet Class

Double Reed Class

Early Instruments Class

Flute Class

French Horn Class

Piano Class

String Class

String Bass Class

Trombone Class

Violin and Viola Class

Violoncello Class

Voice Class

APPLIED MUSIC—PRIVATE INSTRUCTION

The courses offered in vocal or instrumental technique and interpretation are listed below. Two 30-minute recitations and 1 hour of literature class each week, plus minimum daily practice as designated by the instructor concerned, are required (4 hours of credit each semester for a major in performance; 3 hours of credit each semester for a major in music education). Place and hour of recitation to be arranged.

Secondary study may be done in class or by private instruction upon designation of the major adviser and approval of the chairman of the division concerned.

Baritone

Bassoon

Clarinet

Cornet

Flute

French Horn

Harp

Organ

Percussion

Piano

Saxophone

String Bass

Trombone

Trumpet

Tuba

Viola

Violin

Violoncello

Voice

Bi.Ph. 949-1 to 3. Independent Study in Biopharmacy. *Fall, Spring.* Study involving library, laboratory, and a report. Prer., consent of instructor.

PHARMACEUTICAL CHEMISTRY

Ph.Ch. 370-3. Pharmaceutical Chemistry I. *Fall.* Lect. and lab. Chemical and physical characteristics of inorganic pharmaceuticals

correlated with a study of physico-chemical principles as applied to pharmaceutical systems. Prer., third-year status.

Ph.Ch. 371-3. Pharmaceutical Chemistry II. *Spring.* Lect. and lab. Continuation of Ph.Ch. 370. Prer., Ph.Ch. 370.

Ph.Ch. 472-3. Pharmaceutical Chemistry III. *Fall.* Lect. Nomenclature and physico-chemical characteristics of organic medicinals with emphasis on structure-activity relationships. Prer., Ph.Ch. 371.

Ph.Ch. 473-3. Pharmaceutical Chemistry IV. *Spring.* Lect. Continuation of Ph.Ch. 472. Prer., Ph.Ch. 472.

Ph.Ch. 562-3. Instrumental Methods of Drug Analysis. *Spring.* Lect. and lab. A survey of the major chromatographic and spectroscopic methods used in organic chemical analysis with emphasis on their applications to the qualitative and quantitative analysis of drugs. Prer., consent of instructor.

Ph.Ch. 563-3. Techniques in Pharmaceutical Synthesis. *Fall.* Lect. and lab. Application of synthetic procedures in the preparation of various medicinals and their intermediates. Prer., consent of instructor.

Ph.Ch. 564-3. Medicinal Chemistry. *Spring.* Lect. The synthesis, chemistry and structure-activity relationships of some important organic medicinal compounds. Prer., consent of instructor.

Ph.Ch. 568-1. Seminar in Pharmaceutical Sciences. *Fall, Spring.* Conference. Discussions concerned with current literature and research in the pharmaceutical sciences. Required of all graduate students. Prer., graduate standing.

Ph.Ch. 569-1 to 3. Special Problems in Pharmaceutical Chemistry. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

Ph.Ch. 664-1 to 3. Advanced Topics in Pharmaceutical Chemistry. *Fall, Spring.* Conference. A special topic of current interest in pharmaceutical chemistry will be considered each semester; course may be repeated for credit with instructor's consent. Prer., consent of instructor.

Ph.Ch. 665-3. Pharmaceutical Analysis. *Fall.* Lect. and lab. Instrumental analytical methods as applied to drug evaluation and assay. Prer., Ph.Ch. 562 and consent of instructor.

Ph.Ch. 667-3. Organic Pharmaceutical Synthesis. *Spring.* Lab. The synthesis of some selected organic pharmaceutical compounds. Prer., Ph.Ch. 563 and consent of instructor.

Ph.Ch. 700-4 to 6. Master's Thesis.

Ph.Ch. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Ph.Ch. 949-1 to 3. Independent Study in Pharmaceutical Chemistry. *Fall, Spring.* Study involving library, laboratory and a report. Prer., consent of instructor.

PHARMACOLOGY

Ph.Cl. 340-4. Pharmacology I. *Fall.* Lect. and lab. Natural and synthetic drugs used in the chemotherapy of microbial and related infections. Prer. or coreq., third-year status and Chem. 481.

Ph.Cl. 341-3. Pharmacology II. *Spring.* Lect. Actions, uses, and toxic effects of drugs with emphasis on hormones, vitamins, metals and chemotherapeutic agents. Prer. or coreq., Ph.Cl. 340, EPOB 322 and Chem. 482.

Ph.Cl. 442-4. Pharmacology III. *Fall.* Lect. and lab. Mechanism of action, toxicity and side-effects of drugs acting on the central and autonomic nervous systems. Prer., Ph.Cl. 341, EPOB 322 and Chem. 482.

Ph.Cl. 443-4. Pharmacology IV. *Spring.* Lect. and lab. Continuation of Ph.Cl. 442 with consideration of drugs acting on the cardiovascular, respiratory, gastrointestinal and urinary systems. A study of general toxicology is included. Prer., Ph.Cl. 442.

Ph.Cl. 540-3. Advanced Pharmacology. *Fall.* Lect. A study of the more advanced aspects of pharmacology. Prer., Ph.Cl. 443 or consent of instructor.

Ph.Cl. 541-3. Psychopharmacology. *Spring.* Lect. Psychedelic agents and drugs used in the treatment of mental illness. Prer., Ph.Cl. 443 or consent of instructor.

Ph.Cl. 542-2. Drug Metabolism. *Fall.* Lect. and discussion. A study of enzyme systems involved in drug metabolism with special emphasis on the roles of hepatic microsomal monooxygenases in drug and steroid metabolism and their relevance in carcinogenicity, mutagenicity, teratogenicity, and toxicity. Open to undergraduate

and graduate students with advanced training in molecular biology and biochemistry. Prer., consent of instructor.

Ph.Cl. 545-1 or 2. Pharmacology Laboratory. *Fall, Spring.* Lab. Introduction to techniques and procedures available in pharmacological research including the analysis of experimental data. Prer., consent of instructor.

Ph.Cl. 546-3. Biological Assay Methods. *Spring.* Lect. and lab. Biological methods used for detection and assay of various drugs. Prer., consent of instructor.

Ph. Cl. 547-3. Behavioral Pharmacogenetics. *Fall, Spring.* Lect. Each term selected topics will be considered and may include behavioral and biochemical genetics, pharmacogenetics and neurochemistry. Course may be repeated to include different topics. Prer., consent of instructor.

Ph.Cl. 548-1. Seminar in Pharmaceutical Sciences. *Fall, Spring.* Conference. Discussions concerned with current literature and research in the pharmaceutical sciences. Required of all graduate students. Prer., graduate standing.

Ph.Cl. 549-1 to 3. Special Problems in Pharmacology. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

Ph.Cl. 643-3. Drug Mechanisms. *Spring.* Lect. and lab. Current concepts relative to mechanisms involved in the response of cells to drugs. Prer., Ph.Cl. 540 or consent of instructor.

Ph.Cl. 644-1 to 3. Advanced Topics in Pharmacology. *Fall, Spring.* Conference. A special topic of current interest in pharmacology will be considered each semester and the course may be repeated for credit with instructor's consent.

Ph.Cl. 700-4 to 6. Master's Thesis.

Ph.Cl. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Ph.Cl. 949-1 to 3. Independent Study in Pharmacology. *Fall, Spring.* Study involving library, laboratory and a report. Prer., consent of instructor.

PHARMACY

Phar. 305-2. Pharmacy Orientation. *Fall.* Lect. and rec. Introduction to pharmacy profession with emphasis on medical terminology, calculations, organization of the profession and the pharmacist's role in health care delivery. Prer., third-year status.

Phar. 306-1. Survey of Prescription Procedures. *Spring.* Conference. Introduction to the elements of modern prescription procedures. Prer., Phar. 305.

Phar. 308-3. Pharmaceutics I. *Spring.* Lect. and rec. Introduction to the principles of biopharmaceutics-pharmacokinetics. Prer., Phar. 305 and Ph.Ch. 370.

Phar. 410-4. Pharmaceutics II. *Fall.* Lect. and lab. Continuation of Phar. 308 with emphasis on the official dosage forms. Prer., Phar. 308 and Ph.Ch. 371.

Phar. 411-4. Pharmaceutics III. *Spring.* Lect., rec. and lab. Theoretical and practical techniques related to the formulation, preparation and dispensing of modern pharmaceuticals. Prer., Phar. 410.

Phar. 412-3. Clinical Pharmacy I. *Fall.* Lect. and rec. Consideration of pharmacotherapeutics in the clinical management of diseased states. Prer., fifth-year status.

Phar. 413-3. Clinical Pharmacy II. *Spring.* Lect. and rec. Consideration of medicinal agents in relationship to their use in clinical practice with emphasis on non-prescription drugs. Prer., Phar. 412.

Phar. 417-3. Manufacturing Pharmacy. *Fall, Spring.* Lect. and lab. Preparation of pharmaceuticals utilizing techniques and equipment suitable for quantity production. Prer., fourth-year status and consent of instructor.

Phar. 420-2. Ambulatory Care I. *Fall, Spring.* Clinical experience in drug monitoring and review systems in ambulatory care setting. Prer., fifth-year status.

Phar. 421-2. Ambulatory Care II. *Fall, Spring.* An extension of Phar. 420. Prer., Phar. 420.

Phar. 422-2. Community Pharmacy. *Fall, Spring.* Experience in community pharmacy practice with emphasis on the clinical approach to everyday problems. Prer., fifth-year status.

Phar. 423-2. Hospital Pharmacy. *Fall, Spring.* Student involvement in institutionalized pharmacy practice with emphasis on drug distribution and delivery systems. Prer., fifth-year status.

Phar. 424-2. Drug Information-Poison Control. *Fall, Spring.* Supervised student involvement in the management of human cases of exposure to toxic substances where information is provided via phone. Prer., fifth-year status.

Phar. 425-2. Geriatric Care. *Fall, Spring.* Experience in drug monitoring and review systems for patients in extended care facilities. Prer., fifth-year status.

Phar. 426-2. Hospital Care. *Fall, Spring.* Clinical experience in the area of in-patient pharmacy services. Prer., fifth-year status.

Phar. 427-2. Specialty Care. *Fall, Spring.* Clinical experience with physician preceptors in the specialty areas of medicine. Prer., fifth-year status.

Phar. 428-2. Industrial Pharmacy. *Fall, Spring.* Observations and conferences with supervisors relative to the operations involved in the industrial manufacture of pharmaceuticals. Prer., fifth-year status.

Phar. 429-2. Clinical Pharmacy Projects. *Fall, Spring.* Projects may include drug-related research or experience with medical service representatives. Prer., fifth-year status.

Phar. 430-2. Radiopharmacy. *Fall, Spring.* Experience in the use of radioisotopes in clinical procedures. Prer., fifth-year status.

Phar. 517-3. Pharmaceutical Production. *Fall.* Conference and lab. Advanced techniques and current research on problems and developments in the industrial manufacture of pharmaceuticals. Prer., Phar. 417 or consent of instructor.

Phar. 518-1. Seminar in Pharmaceutical Sciences. *Fall, Spring.* Conference. Discussions concerned with current literature and research in the pharmaceutical sciences. Required of all graduate students. Prer., graduate standing.

Phar. 519-1 to 3. Special Problems in Pharmaceutics. *Fall, Spring.* Research problems involving dosage form design, biopharmaceutics and pharmacokinetics. Prer., graduate standing and consent of instructor.

Phar. 700-4 to 6. Master's Thesis.

Phar. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Phar. 949-1 to 3. Independent Study in Pharmaceutics. *Fall, Spring.* Study involving library, laboratory and a report. Prer., consent of instructor.

PHARMACY ADMINISTRATION

Ph.Ad. 381-3. Laws of Pharmacy. *Fall.* Lect. and rec. State and federal statutes and regulatory decisions governing the practice of pharmacy with emphasis on the common law principles and ethics of the profession. Prer., third-year status.

Ph.Ad. 483-3. Pharmacy Financial Management. *Spring.* Lect., rec. The application of accounting principles and financial analysis to the management of a pharmacy. Prer., fourth-year status.

Ph.Ad. 486-3. Pharmacy Management. *Fall.* Lect. and rec. Management, marketing and merchandising problems that must be considered in the successful operation of a pharmacy. Prer., fifth-year status.

Ph.Ad. 487-3. Pharmacy Management Seminar. *Spring.* Conference. Seminar case studies in the operation of pharmacies. Prer., Ph.Ad. 486.

Ph.Ad. 581-3. Pharmaceutical Management. *Spring.* Conference. Selected topics on current research and contemporary problems in the field of pharmacy management and marketing. Prer., consent of instructor.

Ph.Ad. 582-3. Drug and Cosmetic Law. *Fall.* Conference. Study of the history and evolution of laws and regulations that control the distribution of drugs, cosmetics and poisonous chemicals. Prer., consent of instructor.

Ph.Ad. 583-3. Hospital Pharmacy Administration. *Spring.* Conference. Hospital organization and the relationship of the departmental components to the pharmacy with emphasis on the managerial operations of a hospital pharmacy. Prer., consent of instructor.

Ph.Ad. 589-1 to 3. Special Problems in Pharmacy Administration. *Fall, Spring.* Individual investigations in pharmacy marketing, retailing and management. Prer., graduate standing and consent of instructor.

Ph.Ad. 700-4 to 6. Master's Thesis.

Ph.Ad. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

Ph.Ad. 949-1 to 3. Independent Study in Pharmacy Administration. *Fall, Spring.* Study involving library, research, and a report. Prer., consent of instructor.

Graduate School of Public Affairs

PUBLIC ADMINISTRATION

P.Ad. 500-3. Fundamentals of Public Administration. Governmental systems; philosophy and basic concepts of public administration. Open only to graduate students who have not had an introductory course in public administration.

P.Ad. 502-3. Statistics for Public Administrators. Provides a basic foundation for the use of statistical analysis in public administration: organizing and presenting data, descriptive statistics, probability, inferential statistics, survey methods, and computer procedures. Prer., proficiency in high school algebra.

P.Ad. 503-3. Introduction to Quantitative Decision Models. Survey of quantitative aids for decision makers: decision theory, linear and goal programming, simulation, and other management science techniques. Emphasis is on evaluation of strengths and limitations of the techniques when applied to problems. Suggested prer., P.Ad. 502.

P.Ad. 504-3. Organization Theory and Administrative Behavior. The study of roles, structure, motivation, morale, performance, decision making, evaluation, and innovation in the management of public organizations.

P.Ad. 505-3. Financial Administration and Policy Formulation. Introduction to financial administration and policy formulation, with a general study of the principal structures and processes involved; analysis of specific problems through supervised research; principles and politics of public resources allocation, budgetary systems, taxation, intergovernmental finance, and debt management.

P.Ad. 506-3. Advanced Analysis of State Government and Administration. Present-day national, state, and interstate relations; judicial processes and problems; the future of state governments,

with special attention given to administrative organization and reorganization; state finances; and major state issues and services.

P.Ad. 507-3. Human Resources Management. The nature of work, relationships between man and organizations, systems and processes for human resource management, manpower planning, collective bargaining, and strategies for human resource development.

P.Ad. 508-3. Organizational Impact of Perceptions and Behavior. Development of perceptual fields within individuals and groups, and their effects on organizations. Analysis of resultant attitudes, actions, and behavior in individual and group contexts.

P.Ad. 510-3. Urban Administration. Study of public and quasi-public organizations which formulate and implement governmental policies in urban communities; theories of organizational behavior and change; effects of agency structure and interagency relations on performance, intergovernmental relationships; problems of bureaucratic performance.

P.Ad. 512-3. City Management. Examination of public administration and city management, historical development and critical issues, government institutions, municipal structure and operations, ethics, and professionalism. Prer., consent of instructor.

P.Ad. 513-3. Municipal Services I. Description and analysis of fire, police, public works, utilities, wastewater treatment, and city engineering. New approaches and problem solving. Prer., consent of instructor.

P.Ad. 514-3. Municipal Services II. Description and analysis of city planning, transportation, housing, parks, recreation, leisure services, and code enforcement. New problems and approaches. Prer., consent of instructor.

P.Ad. 521-3. The Politics of Urban Management. Examination of the politics of urban and public management: citizen participation

in administrative decisions, managerial competition for limited resources, long-range planning in a political system, and the conflicts between urban politics and administrative efficiency.

P.Ad. 535-3. Seminar: National Resources Policy and Administration. (P.Sc. 535.) Resources in the American economy; consideration of constitutional, political, and geographic factors in the development of resources policy; organizational procedures and programs for the administration and development of natural resources; selected topics.

P.Ad. 536-3. Intergovernmental Relations. (P.Sc. 536.) Investigation and analysis of the American federal system, including its constitutional, political, and administrative characteristics. Problems considered include federal-state relations, state-local relations, regionalism, interstate cooperation, and grants-in-aid.

P.Ad. 545-3. Administration of Public Works. (C.E. 545.) A descriptive course concerned with the administration of the engineering and planning of urban public works; comparison of modern methodologies. Prer., graduate status in civil engineering, public administration, or consent of instructor.

P.Ad. 550-3. Governmental Accounting. Accounting for government administrators, including use of accounting systems by the public managers; accounting theories and principles, basic accounting methods, such as double accounting trial balances, financial statements, and their analysis.

P.Ad. 570-3. Introduction to Systems. Overview of systems ranging from general system theory to the application of systems technology. Includes an introduction to information systems, process flowcharting, data standards, system security and confidentiality, simulation models, and geocoding.

P.Ad. 580-3. Management-Labor Relations in the Public Sector. A survey course in public sector management-labor relations, including: historical development; theories of labor relations; analysis of labor organizations; legal basis for public labor relations; overview of negotiations; analysis of contract implementation; development and resolution of disputes.

P.Ad. 598-3. Special Problems in Public Administration. A study of special problems relevant to public administration taught by highly qualified persons in the particular problem area. Each semester a different problem of high impact is studied.

P.Ad. 599-3, 6. Independent Study. Affords students the opportunity to do independent, creative work. Prer., consent of adviser.

P.Ad. 600-3 to 6. Field Study in Public Administration. For students who have not had administrative experience. Completion of studies and reports while engaged in full-time or part-time administrative traineeships in government agencies or in government-related organizations. Consent of instructor required.

P.Ad. 601-3. Administrative Analysis. Analysis, diagnosis, and evaluation of administrative organizations and operations at various governmental levels; appropriateness of organizations and operations in relation to goals. Students work directly with government agencies in making analyses, evaluations, and recommendations.

P.Ad. 603-3. Statistical Analysis. Develops basic competence in the application of advanced statistical techniques to public problems and the use of computers for data analysis: correlational methods, multiple regression, topics in multivariate analysis. Prer., P.Ad. 502 or equivalent.

P.Ad. 606-3. Public Management Communication Systems. (C.T. 606.) The responsibilities of complex public agencies in maintaining effective communication systems, internal and external; the nature of the systems and problem areas.

P.Ad. 608-3. Organization Development. A study of the dynamics involved in managing and facilitating change in organizations by applying behavioral science knowledge. Emphasizes cognitive and experiential learning. Prer., P.Ad. 504 or consent of instructor.

P.Ad. 609-3. Group Dynamics. In-depth study of the patterns of forces relating to group interactions and effectiveness. A survey of the literature relating to group cohesiveness, power and influences, decision making, communications, leadership and performance, and motivational processes in groups.

P.Ad. 613-3. Application of Quantitative Decision Models. The use of analytic models as an aid to judgment and improved decision making. Examination of models from operations research, economics, mathematics, and psychology. Prer., P.Ad. 503.

P.Ad. 615-3. Applied Behavioral Sciences in Public Organizations. A seminar for advanced students: a practicum for developing diagnostic and intervention skills in organizational development; review of the literature and an examination of topics relating behavioral sciences to public organizations. Prer., P.Ad. 504 and 608 or equivalent.

P.Ad. 620-3. Legal Environment of Public Administration. Examination of the role of law in society and its impact on the administration of public affairs; special concerns of the law in administrative procedures, administrative adjudication, and the rights of individuals and groups.

P.Ad. 622-3. Seminar: Analysis of Public Processes and Priorities. Systematic analysis of the machinery of processes for establishing public policy and the resultant outcomes in an important public program area; involves national, state, and local governments. Process development of the problem, planning, legislation, budgeting and financing, implementation, and evaluation. Prer., P.Ad. 505 or consent of instructor.

P.Ad. 623-3. Intergovernmental Fiscal Relationships in the Federal System. Fiscal roles and interactions among national, state, and local governments; significance of existing systems for achievement of public objectives; analytical review of data; reports on sharing of revenue sources and of expenditure functions. Emphasizes intergovernmental grants systems.

P.Ad. 624-3. Governmental Budgeting Techniques. Practical budget methods for administrators and technicians in local, state, and federal governments. Budgeting systems and methods of budget planning, preparation, review, execution, and performance evaluation. Instruction is augmented by individual problems and group exercises.

P.Ad. 630-3. Seminar: Environmental Management. An examination of federal, state, and local environmental legislation; the development of environmental management in the public sector, approaches in organizing for environmental management, strategies for environmental management; and selected topics. Open to graduate students in other disciplines.

P.Ad. 631-3. Analysis of Environmental Policy. Examination of theories and concepts of environmental analysis, analytic techniques in environmental decision making, models and simulations in environmental planning, and selected environmental policy problems.

P.Ad. 653-3. Public Policy Analysis and Evaluation. Training in systematic analysis of policy and program evaluation problems, using the case method. Covers benefit-cost and cost effectiveness analysis, present values, and treatment of multiple criteria in public sector program analysis. Prer., P.Ad. 505 and quantitative methods.

P.Ad. 670-3. Seminar: Classic Literature of Public Administration. Study of the contribution of landmark publications to the evolution of the theory and practice of public administration. Prer., P.Ad. 500 or consent of instructor.

P.Ad. 680-3. Negotiations. An in-depth study of labor-management negotiations in the public sector, the theories of collective negotiations, political and economic basis of negotiations, behavioral aspects of bargaining, strategies for effective bargaining. Prer., P.Ad. 580.

P.Ad. 683-3. Current Issues in Management-Labor Relations. An analysis of current issues and trends in management-labor relations in the public sector. Prer., P.Ad. 580.

P.Ad. 696-3. Seminar: Ethics and Professionalism in the Public Service. Social responsibility, ethical problems, and professionalism in public administration.

P.Ad. 697-3. Public Science Policy and Administration. Intensive examination of issues concerning the organization of and procedures for formulating and implementing science policy.

P.Ad. 700-3. Master's Thesis or Project Report.

P.Ad. 701-3, 702-3. Foundation/Survey Seminar. Basic seminar for all students in the doctoral program. Major areas in public administration are covered: financial and economic policy; policy, program, and process analysis; organization theory, behavior, and development; human resources management; public policy issues; intergovernmental relations; values and ethics.

URBAN AFFAIRS

U.A. 500-3. Research Methods. Overview of research designs, methods, techniques, and reports, emphasizing limitations and potentials for using scientific research for public policy-making; applied and theoretical perspectives applicable to planning, evaluation, public management, and policy-making.

U.A. 501-3. Introduction to Urban Affairs. An interdisciplinary examination of the problems in urban settings; analysis of urban systems within expanding metropolitan and regional settings; and examination of functional problem areas and the adequacy of institutional responses to crime, housing, and discrimination in employment.

U.A. 505-3. Financial Administration and Policy Formulation. Introduction to financial administration and policy formulation: the principal structures and processes involved, including public resource allocation, budgetary systems, taxation, intergovernmental finance and debt management. Analysis of specific problems through supervised research.

U.A. 509-3. Seminar: Metropolitan Areas. (P.Sc. 509.) Intensive analysis of and research in major aspects of government in metropolitan areas.

U.A. 510-3. Urban Administration. Study of the public and quasi-public organizations which formulate and implement governmental policies in urban communities, theories of organizational behavior and change, effects of agency structure and interagency relations on performance, intergovernmental relationships, and problems of bureaucratic performance.

U.A. 521-3. The Politics of Urban Management. Examination of the politics of urban and public management. Citizen participation in administrative decisions, managerial competition for limited urban resources, long-range planning in political systems, and the conflicts between urban politics and administrative efficiency.

U.A. 525-3. Urban Economics. (Econ. 525.) Research on the economics of urban problems. Selected topics: poverty, housing, discrimination, land use, urban financing, and transportation.

U.A. 536-3. Intergovernmental Relations. (P.Sc. 536.) Investigation and analysis of the American federal system, including its constitutional, political, and administrative characteristics. Problems considered include federal-state relations, state-local relations, regionalism, interstate cooperation, and grants-in-aid.

U.A. 540-3. Minority Groups in Urban Society. Analysis of the social, economic, and political aspects of minorities in urban society and the bureaucratic responses to their needs. Special emphasis on the forces of change in the Black, Chicano, and Native American communities.

CRIMINAL JUSTICE ADMINISTRATION

C.J. 500-3. Law and Social Control. A general introduction to the nature of law, legal institutions, and legal processes as one of many systems of social control; consideration of various theories of interpretation, application, and enforcement of law; the structure and function of legal institutions.

C.J. 610-3. Administration of Criminal Justice. Analysis of policy and decision-making practices of agencies in the entire criminal justice system, from detection of crime and arrest of suspects through prosecution, adjudication, sentencing, and imprisonment, to release.

C.J. 604-3. Survey of Civil Law. A survey course on the law of contracts, torts, corporations, natural resources, uniform commercial code, domestic relations, wills, estates, and labor relations.

C.J. 605-3. Civil Procedure. A survey course on the Colorado Rules of Civil Procedure and the related federal rules. Includes the drafting of procedural instruments and forms.

C.J. 620-3. Criminal Justice Policy. Analysis and evaluation. Techniques for assessing the probability and desirability of future possible states of society, particularly of social control systems, will be considered in relation to the goals of the criminal justice system.

C.J. 630-3. Seminar: Police Administration. The role of the police in a rapidly changing society; relationship between police services, the courts, and correctional administration.

C.J. 631-3. Seminar: Specific Problems in the Criminal Justice System. Analysis of specific topics relating to the criminal justice process.

C.J. 632-3. Research in the Criminal Justice Process. Examination of current research in criminal justice; problems in the implementation of research findings.

C.J. 640-3. Seminar: Correctional Administration. Contemporary correctional practice and its evolution; development of correctional programs; alternatives to incarceration, probation, jails, prisons, and parole.

C.J. 641-3. Community-Based Corrections. Theory and practice of probation and parole; examination of efforts to create mixtures of institutional settings and normal community life.

C.J. 642-3. Juvenile Justice Administration. Policies and practices of agencies in processing young persons through the juvenile court system; trends in juvenile justice; examination of disposition of cases by probation, foster home placement, training schools, and transfer to adult correction programs.

C.J. 650-3. Nature and Causes of Crime. Survey of theories of crime causation ranging through biological, psychological, sociological, cultural, and political theories; close attention to the problems inherent in the study of crime from a cause of crime perspective.

C.J. 660-3. Seminar: Judicial Administration and Organization. An analysis of judicial organization, court administration, and criminal court judges as participants in the operation of the criminal justice process. Attention is also given to the prosecutor and public defender.

C.J. 670-3. Comparative Criminal Justice. Seminar on the different criminal justice systems in the world. Emphasis is on the British and Continental systems. Analysis is made of other systems, such as Scandinavia, U.S.S.R., China, and the African nations.

HEALTH ADMINISTRATION

H.A. 601-3. Medical Care Organization. An introduction to the structure and function of the medical care delivery system: values, needs, and utilization; issues in health care manpower, institutions, and system organization; public policy, reimbursement, and regulation; international comparisons; community and organizational considerations.

H.A. 602-3. Health Economics. Intensive analysis of issues in health economics, with emphasis on microeconomic considerations. Discussions will focus on the demand, supply, distribution, and production of health services; inflation; and the economics of health care policy.

H.A. 620-3. Health Sciences. An introduction to concepts of holistic health, high level wellness, and disease: terminology; interventions of health and medical care; epidemiological methods for explaining disease phenomena, planning, and evaluating health services.

H.A. 622-2. Health Planning I. Introduction to a variety of theoretical models useful in health planning. Planning theory is correlated with planning methodology. Data collection, analysis, and interpretation are viewed in a planning context. The student is prepared for the summer planning residency which permits application of planning theory and skills.

H.A. 623-3. Health Planning II. Primary focus is institution-based health planning: formulating long-range plans for an individual institution, relating these plans to other health institutions in the community, and assisting in the development of area-wide health plans.

H.A. 624-3. Health Planning III. The primary focus of this course is area-wide health planning: developing an area-wide health plan, relating this plan to the needs of consumers and providers of health care, and developing a broad base of community support for health planning. Prer., H.A. 623.

H.A. 644-2. Legal Problems in Health Care Administration. Legal issues experienced by the health administrator. Emphasis on malpractice, informed consent, medical staff appointments, directors' and administrators' liability, medical records, and refusal of treatment.

H.A. 670-3. Institutional Management I. Examination of the structure, organization, and management of health care institutions including ownership, administration, professional and nonprofessional departments, and personnel.

H.A. 671-3. Institutional Management II. Designed for students preparing for graduation, this course will help students to review material from all previous H.A. courses and integrate various aspects of the curriculum through seminars in which students will be encouraged to actively participate, often in a role-planning situation. Prer., H.A. 670.

RESERVE OFFICER TRAINING CORPS

AIR FORCE AEROSPACE STUDIES

Air 101-1. U.S. Military Forces I. One 1-hr. lect.-rec. and one 1-hr. lab. per wk. A survey course describing strategic offensive/defensive, general purpose, and aerospace support functions of U.S. military forces. Laboratory involves a study of Air Force customs and courtesies, drill and ceremonies, career opportunities, and life and work of an Air Force junior officer.

Air 102-1. U.S. Military Forces II. A continuation of Air 101. One 1-hr. lect.-rec. and one 1-hr. lab. per wk. plus assigned project reports.

Air 201-1. Development of Air Power I. One 1-hr. lect.-rec. and one 1-hr. lab. per wk. Introduction to the development of airpower, management and use of aerospace power today, and use of future manned aircraft and space craft. The laboratory period introduces the student to leadership experiences in a practical, supervised training laboratory, which includes field trips to Air Force installations.

Air 202-1. Development of Air Power II. A continuation of Air 201. One 1-hr. lect.-rec. and one 1-hr. lab. per wk.

Air 301-3. Air Force Management and Leadership I. Two 1½-hr. seminars plus one 1-hr. lab. per wk. Individual motivation and behavioral processes, leadership, communication and group dynamics are studied and applied in actual case studies. Communicative skills development is stressed. Laboratory provides opportunity for application and testing of management/leadership training.

Air 302-3. Air Force Management and Leadership II. Two 1½-hr. seminars and 1-hr. lab. per wk. A continuation of Air 301. Basic managerial processes are emphasized, while group discussions, case studies, and role playing as learning devices are employed. Emphasis on communicative skills development is continued.

Air 401-3. National Security Forces in Contemporary American Society. Two 1½-hr. seminars and one 1-hr. lab. per wk. Air 401 focuses on the armed forces as an integral part of society. Special themes include: societal attitudes, military law, professionalism, and U.S. defense strategy, while developing communicative skills.

Air 402-3. National Security Forces in Contemporary American Society II. Two 1½-hr. seminars and a 1-hr. lab. per wk. A continuation of Air 401. Special themes include: defense strategy and conflict management, formulation/implementation of U.S. defense policy, and organizational factors and case studies in policy-making. Communicative skill development is continued.

MILITARY SCIENCE (U.S. ARMY)

M.S. 101-1. Introduction to Military Science. Develops the history of ROTC and the traditions and origins of the U.S. military in today's world. Also examines the opportunities and alternatives available in the military (emphasis on the Army) and illustrates the specific ways an academic major can be used to best advantage.

M.S. 102-1. Career Paths Through Military Science. Analysis of the officer personnel management system, to include opportunities and organizations of officer specialties within each branch. Subjects such as professional development and military benefits are also included.

M.S. 201-1. Introduction to Organizational Leadership. Develops a foundation for understanding the theoretical framework for analyzing human behavior in relation to the basic problems of military leadership and management.

M.S. 202-2. A Contingency Approach to Military Leadership. Analyzes the behavioral complexities of leadership found in today's military organizations. The emphasis is on small group interactions. Topics include group processes, current issues, and leadership styles and development.

M.S. 301-2. A Contingency Approach to Military Management. Introduces students to a systematic approach to managing task groups in the U. S. Army. Practical exercises are included to demonstrate the difficulties in small group coordination, problem-solving, and decision-making in the context of management by objectives.

M.S. 302-3. Control Aspects of Small Unit Operations. Designed to provide the student with an extensive exposure to the principles of small unit tactics and operations. Classroom and field training exercises are used to present small unit tactics and operations techniques, including land navigation, communication and leadership skills.

M.S. 401-1. Seminar: Officer Development. Discusses subjects which prepare the student to make a smooth transition into the U.S. Army. Topics include customs and courtesies of the service, financial planning, promotion policies, and personnel management.

M.S. 402-3. National Security Organization, Policies, and Problems. Designed to familiarize the student with U.S. national security organizations and policies, current defense issues, and the status of our military posture.

M.S. 405-1. Military Justice. Survey of the principles and procedures of military justice, stressing its use as a leadership tool for military leaders.

M.S. 499-1 to 3. Independent Study. Prer., written consent of instructor.

NAVAL SCIENCE

N.S. 101-2. Introduction to Naval Organization and Ship Design. *Fall.* Introduction to the structure and principles of naval organization. Principles of ship design and construction are discussed, with an emphasis on quantitative treatment of stability and buoyancy.

N.S. 102-3. Naval Ship Systems. *Spring.* A detailed study of ship propulsion and related auxiliary systems. Emphasis placed on fossil-fueled and nuclear steam and gas turbine systems. Design constraints imposed by unique marine environment stressed. Prer., N.S. 101 or consent of instructor.

N.S. 201-3. Weapons Systems Analysis. *Fall.* An introduction to the theoretical concepts upon which modern naval weapons systems are designed and constructed. Specific areas of study include the physics of underwater sound propagation, pulse radar theory, automatic tracking principles, and fundamentals of missile guidance.

N.S. 202-2. Seminar: Seapower and Maritime Affairs. *Spring.* A study of the importance of seapower in international affairs including naval, maritime, and other commercial uses of the seas.

N.S. 301-3. Navigation. *Fall.* Theory and practical application in the art of navigation: charts, publications, piloting, dead reckoning, navigation aids and instruments, time, celestial coordinate systems, sextant use, complete sight reduction methods, electronic fixing, and voyage planning.

N.S. 302-3. Naval Operations. *Spring.* Thorough examination of the Inland and International Rules of the Nautical Road, including court interpretations; principles of relative motion and vector analysis with the maneuvering board; shiphandling procedures, weather, communications, and tactical operations.

N.S. 307-3. Evolution of Warfare I. *Fall.* A study of the evolution of military thought, strategy, tactics and weapons through the American Civil War. An investigation of the economic, psychological, moral, political and technological influences on continuity and change in warfare during important periods in the past.

N.S. 308-3. Evolution of Warfare II. *Spring.* Continuation of N.S. 307. A study of the evolution of military thought, strategy, tactics and weapons from the American Civil War to the present.

N.S. 402-3. Naval Leadership and Military Law. *Spring.* An introduction to the techniques and tools for effective leadership in the military environment. Includes study in military law, leadership, human resources management, and naval administration.

N.S. 407-3. Amphibious Warfare I. *Fall.* A study of the concept of amphibious warfare and the development and evolution of amphibious warfare doctrine and techniques from the Gallipoli operation in World War I through the Peleliu operation in World War II.

N.S. 408-3. Amphibious Warfare II. *Spring.* Continuation of N.S. 407. A study of the evolution of amphibious warfare doctrine and techniques from 1944 to the present. Analysis of current amphibious warfare doctrine.

Faculty

College of Arts and Sciences

ANTHROPOLOGY

BOULOS AYAD, Professor.* B.A., M.A., Ph.D., Cairo University (Egypt); M.A., University of Einshams (Egypt).

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*Graduate School faculty.

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