



University of Colorado
1981-1982 Catalog

General Information

ACADEMIC CALENDAR BOULDER CAMPUS¹

Summer Session 1981

- June 5 (Fri.)*—Registration.
June 8 (Mon.)—Classes begin (7:30 a.m.).
July 3, 4 (Fri., Sat.)—Independence Day holidays.
July 9, 10 (Thurs., Fri.)—Final examinations for first five-week term.²
July 13 (Mon.)—Registration for second five-week term. Ten-week classes meet.
July 14 (Tues.)—Classes begin for second five-week term (7:30 a.m.).
Aug. 13, 14 (Thurs., Fri.)—Final examinations for ten-week, eight-week, and second five-week terms.²
Aug. 15 (Sat.)—Commencement. Academic school year of 1980-81 ends.

Fall Semester 1981

- Aug. 26, 27 (Wed., Thurs.)*—Academic year begins. Faculty members report for departmental and academic duties. New student registration and orientation.
Aug. 31 (Mon.)—Schedule distribution.
Sept. 1 (Tues.)—Drop/add day.
Sept. 2 (Wed.)—Classes begin (8 a.m.).
Sept. 7 (Mon.)—Labor Day holiday.
Nov. 26, 27, 28 (Thurs., Fri., Sat.)—Thanksgiving holidays.
Nov. 30 (Mon.)—Classes resume (8 a.m.).
Dec. 12 (Sat.) through Dec. 18 (Fri.)—Final examination period of six days.²
Dec. 19 (Sat.)—First day of winter vacation. Commencement.

Spring Semester 1982

- Jan. 14 (Thurs.)*—New student registration and orientation.
Jan. 18 (Mon.)—Schedule distribution.
Jan. 19 (Tues.)—Drop/add day.
Jan. 20 (Wed.)—Classes begin (8 a.m.).
Mar. 22 (Mon.) through Mar. 27 (Sat.)—Spring vacation.
Mar. 29 (Mon.)—Classes resume (8 a.m.).
May 12 (Wed.) through May 18 (Tues.)—Final examination period of six days.²
May 21 (Fri.)—Commencement.

Summer Session 1982

- June 4 (Fri.)*—Registration.
June 7 (Mon.)—Classes begin (7:30 a.m.).
July 5 (Mon.)—Independence Day holiday.
July 8, 9 (Thurs., Fri.)—Final examinations for first five-week term.²
July 12 (Mon.)—Registration for second five-week term. Ten-week classes meet.
July 13 (Tues.)—Classes begin for second five-week term (7:30 a.m.).
Aug. 12, 13 (Thurs., Fri.)—Final examinations for ten-week, eight-week, and second five-week terms.²
Aug. 14 (Sat.)—Commencement. Academic year of 1981-82 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 Health Sciences 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 (Colorado Springs,
Denver Campuses)

¹Calendar is tentative and subject to revision.
²The University Calendar Committee requests make-up time be provided to students who may be absent for religious reasons.

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:

Registration Section
Office of Student Administrative Services
Campus Box B-7
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 Registration Section (address as above) or from the Health Sciences Center in Denver at the address below.

Admissions Office
University of Colorado Health Sciences 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 \$60 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 at Boulder is an affirmative action/equal opportunity employer and institution and does not discriminate on the basis of race, sex, creed, color, age, national origin, or individual handicap, or veteran status in any aspect of employment or services. The institution's educational programs, activities, and services offered to students and/or employees are administered on a nondiscriminatory basis subject to the provisions of all civil rights laws and statutes. For information about these provisions or equity, discrimination, or fairness, consult the Affirmative Action Office in Regent Administrative Center, Room 206, or telephone 492-6706.

Location, Surroundings, Climate

Boulder is an attractive university community of more than 80,000 population. The city is northwest of Denver and is linked to the Colorado capital by a 25-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

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

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 Health Sciences 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.

Important Information for Freshman and Undergraduate Transfer Applicants

Students from other countries see section on Foreign Students.

1. To be *considered* for admission, applicants must submit complete and official credentials as required by the University of Colorado. No part of any previous record may be disregarded. Credentials submitted for admission become the permanent property of the University.

2. To be granted admission, an applicant must reflect in a moral and ethical sense a personal background acceptable to the University. The University reserves the right to deny admission to any applicant whose total credentials reflect an inability to assume those obligations of performance and behavior deemed essential and relevant to any of its lawful missions, processes, and functions as an educational institution.

3. The University Board of Regents reserves the right to establish enrollment limitations for all academic areas.

4. Freshman and transfer applicants will receive mail notification of admission status. Applicants notified of "Admissions Eligibility" will be sent the appropriate forms to confirm their intent to enroll. "Admissions Eligibility" does *not* guarantee enrollment. The confirmation form and the designated deposit must be returned before the enrollment limitation for the applicant's program is reached. The required *non-refundable* confirmation fee will be returned only in the event that it is received after the enrollment limitation is reached.

5. *Admission to the University of Colorado does not constitute a guarantee that a student will have com-*

plete selection of courses, nor does it guarantee future transfer and admission into any other professional program, college, or school within the University system. For example, if the student's educational goal is in an allied health field or a professional school, admission to a preprofessional area of study does *not* assure admission to a professional program such as child health associate, dental hygiene, journalism, medical technology, nursing, pharmacy, physical therapy, or teacher certification. As another example, if a student is admitted to a major in the College of Arts and Sciences and desires a transfer later to a high demand area such as the College of Business, College of Engineering, or College of Environmental Design, there is no guarantee that the transfer can be made.

A new and separate application must be submitted at the appropriate time for admission *consideration* to any professional program or for a change of college or school. The allied health fields, business, engineering, and environmental design are particularly limited in enrollment because of the great demand for admission. Quality of academic achievement, results of special qualifying examinations, state residency, and personal interviews (in some cases) may determine admission in these areas.

The University of Colorado, Boulder, offers elementary and secondary teacher certification programs. Each student seeking certification must have a major field either in Arts and Sciences or in another school or college at the University which offers majors pertinent to teaching at either the elementary school level or the secondary school level. After 1981-82, the School of Education will no longer award a B.S. degree in education but will continue to offer Colorado teacher certification in both elementary and secondary education programs.

Freshmen apply for one of the following colleges:

- College of Arts and Sciences
- College of Business and Administration
- College of Engineering and Applied Science
- College of Environmental Design (fall term only)
- College of Music (audition required)

FRESHMAN CRITERIA, TEST SCORES, AND CLASS RANK (RESIDENT AND NONRESIDENT) FOR PRIORITY ADMISSIONS CONSIDERATION

1. *College of Arts and Sciences:* (a) Upper 50th percentile of the high school graduating class at the 6th, 7th, or final semester; and (b) a combined SAT score of 1000 or above (with an *expected* minimum verbal score of 450) or a composite ACT score of 23 or above (with an *expected* minimum average score of 21 on the nonmathematics portion of the ACT—an average of the English, social science, and natural science portions); and (c) completion of all recommended high school units as follows:

	Semester Hours
English (including at least one year of college preparatory composition)	3
Foreign language (high school level proficiency in the same classical or modern language)	3
History	1
Mathematics (college preparatory)	2

Natural science	2
Social science (including additional history)	1
Academic electives	3
Total	15

Important Note. In the College of Arts and Sciences, three college semesters of the same language are required for graduation with either 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 language study will be required.

2. *College of Business and Administration and College of Environmental Design:* (a) upper 30th percentile of the high school graduating class at the end of the 6th, 7th, or final semester; and (b) a combined SAT score of 1050 or a composite ACT score of 25 or above; and (c) completion of all recommended high school units as follows:

COLLEGE OF BUSINESS AND ADMINISTRATION	Semester Hours
English (at least two years of college preparatory composition)	4
Mathematics (including at least two years of algebra and one of geometry)	3
Natural sciences (laboratory-science type course)	2
Social sciences (including history)	2
Academic electives (areas such as foreign languages, additional courses in English, mathematics, and natural or social sciences. May include up to two credits in business areas)	4
Total	15

COLLEGE OF ENVIRONMENTAL DESIGN	Semester Hours
English (literature, composition, ¹ grammar)	3
Mathematics (college preparatory)	2
Physics	1
Biology	1
Social studies, foreign language, history	5
Additional English, academic electives	4
Total	16

Important Note. Because of the sequentially structured curriculum in environmental design, freshmen must begin this field of study during the fall semester.

3. *College of Engineering and Applied Science:* (a) Upper 25th percentile of the high school graduating class at the end of the 6th, 7th, or final semester; and (b) a combined SAT score of 1100 or above or a composite ACT score of 27 or above; and (c) completion of all recommended high school units as follows:

	Semester Hours
English (English composition, literature, grammar)	4
Algebra	2
Geometry	1
Trigonometry and solid geometry	1
Natural sciences (physics and chemistry recommended)	2
Social studies and humanities (foreign languages and additional units of English, history, and literature are included in the humanities)	3
Academic electives	3
Total	16

Important Note. An engineering 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.

4. *College of Music:* (a) Upper 50th percentile of the high school graduating class at the end of the 6th, 7th, or final semester; and (b) a combined SAT score of 1000 or above or a composite ACT score of 23 or above; and (c) achievement of a pass on the music audition; and (d) completion of all recommended high school units as follows:

English	3
Mathematics	}
Foreign language	
Social science	
Physical science	
Theoretical music	
Additional academic electives	4
Total	15

Important Note. It is expected that all music students will have had previous experience in an applied music area. Two years of piano training are recommended. The College of Music on the Boulder Campus requires an audition of all entering undergraduate students. Personal audition dates are January 24, 1981, February 7, 1981, February 28, 1981, March 14, 1981, January 23, 1982, February 6, 1982, February 27, 1982, and March 13, 1982. Also, by contacting the associate dean for undergraduates 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.

INDIVIDUAL CONSIDERATION

All freshman applicants whose records vary in any way from the above criteria are encouraged to submit an autobiographical statement explaining their educational goals and factors that may have had a bearing on their previous academic records. Also, these applicants are encouraged to submit letters of recommendation from high school counselors, head masters, or principals. These materials must accompany the application and should be attached to it. Students who do not meet the priority consideration criteria will be considered on an individual basis by the Admissions Committee which will evaluate their overall academic records, including the quality of the high school program of study and the level of college entrance test scores (SAT or ACT). 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 also be considered individually.

NATIONAL SAT/ACT TESTING DATES, 1980-81

Scholastic Aptitude Test (SAT)

Saturday

November 1, 1980

December 6, 1980

January 24, 1981

April 4, 1981²

May 2, 1981²

June 6, 1981²

¹Two units of composition are strongly recommended.

²Test results will be received too late for applicants who wish to matriculate at the start of the 1981 summer session.

American College Test (ACT)

Saturday

October 18, 1980
December 13, 1980
February 14, 1981¹
March 28, 1981¹
June 13, 1981¹

It is recommended that applicants take the college entrance test at the end of their junior year or early in their senior year. *The University of Colorado accepts either the SAT or the ACT for admission.* Applicants who are not satisfied with their first test score results are urged to retest at the earliest possible date. The University will consider the applicant's highest scores for admission. *Achievement tests are not required.* For further information regarding college entrance tests, applicants should see a high school counselor or write to the following:

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

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

Freshman Admissions Processing

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.

FRESHMAN NOTIFICATION

Twelve to sixteen 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

¹Test results will be received too late for applicants who wish to matriculate at the start of the 1981 summer session.

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 enrollment limits are reached. Confirmation consists of returning the completed confirmation form 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.

Students Not Granted Admission

An applicant who is not granted admission as an entering freshman may wish to consider a transfer to the University after one or two years of study elsewhere (see transfer requirements section). In the best interest of students pursuing educational goals for which they may lack some academic preparation, the University Committee on Admissions often recommends that such applicants complete at least one full year of college-level course work at a college where much personal attention and the appropriate course will prepare the student for an eventual successful experience at the University of Colorado, Boulder.

Transfer Student Admission Guidelines

Applicants are considered transfer students if they have enrolled for any college-level course work, full time or part time, since graduation from high school. College-level course work taken while still in high school does not qualify an applicant as a transfer student. To be *considered* for admission, transfer students must be eligible to return to all collegiate institutions attended, and they must report all previous college work.

TRANSFER ADMISSION REQUIREMENTS

1. *College of Arts and Sciences and College of Music.* Resident transfer students who have attained a cumulative college grade-point average of 2.25 or better and nonresidents who have a cumulative college average of 2.50 or better will be *considered for admission on an individual basis*. Work in progress at the time of application cannot be considered in computing the cumulative average.

2. *College of Business and Administration, College of Engineering and Applied Science, and College of Environmental Design.* Resident transfer students who have attained a cumulative college grade-point average of 2.75 or better and nonresidents who have a cumulative college average of 3.0 or better will be *considered for admission on an individual basis*. Work in progress cannot be considered in computing the cumulative average.

Important Note. It is important to emphasize that transfer students are selected for admission on an individual basis. A good college grade-point average is *not*, by itself, a guarantee of admission because the

courses a student has taken in college are as important as the grade-point average. Furthermore, grade-point average requirements may vary from term to term depending on the quality of the applicant pool and the number of transfer spaces available for a given college or school. Finally, certain schools and colleges have additional requirements, for example:

1. The College of Music requires an audition of all entering freshmen and undergraduate transfer students. Personal audition dates are January 24, 1981, February 7, 1981, February 28, 1981, and March 14, 1981. In lieu of the personal audition, applicants may substitute tape recordings (about 10 minutes in length on 7½ ips monaural). Interested students should write to the College of Music on the Boulder Campus for audition applications.

2. The School of Pharmacy considers applications for the fall semester *only*. Applications must be submitted to the Office of Admissions with a \$10 nonrefundable processing fee and official transcripts by *March 1, 1980* for fall 1980 admission. The Pharmacy College Admission Test (PCAT) is recommended for all applicants and should be completed not later than *February 1981* for fall 1981 admission. The PCAT test report must be mailed directly to the School of Pharmacy. For additional information contact the University of Colorado, School of Pharmacy, Ekeley W181 (Campus Box 297), Boulder, Colorado 80309.

3. The College of Engineering and the College of Environmental Design require a high school transcript and SAT or ACT test scores *in addition* to all college transcripts.

4. The College of Engineering expects a transfer applicant to have taken a curriculum in college which prepares one for advanced work in engineering. For example, it is expected that transfer students will have completed some college-level work in calculus, physics, chemistry, etc.

5. The School of Nursing at the University of Colorado Health Sciences 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 pre-nursing college-level course work by the time they plan to enter the program. Students ready to enter the nursing program must apply directly to the School of Nursing, C-288, University of Colorado Health Sciences Center, 4200 East 9th Avenue, Denver, Colorado 80220.

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

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 with a request for a change of major.

Transfer students are urged to read application materials carefully to be certain they submit all necessary credentials. Failure to do so could delay or hinder admission.

TRANSFER OF COLLEGE-LEVEL CREDIT

The Admissions Office 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 and 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 the University of Colorado.

The Admissions Office 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 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. The University 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.

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, Boulder, *must accompany the application* and is nonrefundable.

Because of enrollment restrictions at the University of Colorado, 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. Application for admission.
2. The nonrefundable \$10 application processing fee.
3. *Two* official transcripts from each college or university attended.

4. Students who have completed *less than 24* semester hours (or 36 quarter hours) of college work at the time they apply must submit an official high school transcript, or, if not a high school graduate, they must submit *copies* of their certificate of high school equivalency and GED scores, plus an official transcript of any high school work completed. Furthermore, students who have *less than 12* semester hours (18 quarter hours) of college work at the time they apply, 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 College of Arts and Sciences dean's office *within the first year of residency in the college*.

TRANSFER NOTIFICATION AND CONFIRMATION

Twelve to sixteen weeks 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.

Foreign Students

Foreign student applicants are required to contact the Office of International Student Admissions, Regent Administrative Center 125, *before* submitting an application. The foreign student must submit special application forms, follow special procedures, and observe specific deadlines. Please note that persons who have established permanent resident status in the United States and have alien registration numbers are *not* considered foreign students.

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 Dean's Page (unofficial transcript).

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 except during the summer term.

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 gain admission as special students for fall, spring, or summer term without special permission from the Office of Admissions. If they wish to attend as special students, they should submit academic credentials, as well as information regarding English proficiency and financial support to the Office of Admissions. Foreign students who are not studying in the United States and therefore do not have temporary visas generally are not accepted to enter the University as special students for any term, including the summer session. All foreign prospective students are urged to contact the University Office of Admissions *before* application and credentials are submitted.

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 the 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. Students 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 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 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 at any University of Colorado Campus. Regular degree, enrolled, graduate students may audit graduate 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 Office of the 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
Campus Box 103
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 non-refundable.

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—regarded as *F* if not completed within one year

IW—incomplete—regarded as *W* if not completed within one year

IP—in progress—thesis 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 or drop without discredit

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

Explanation of *IW* and *IF*

An *IW* or *IF* is an incomplete grade. Policies with respect to *IW/IF* grades are available in the individual college and school dean's offices.

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 12 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. Students should check with their dean's office to determine requirements.

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 12 days of the semester with no signatures required on the Drop/Add form. Adds are not allowed after the first 12 days of classes. *Individual schools and colleges may have further restrictions on this time period.*

2. After the 12th day of classes, the instructor must sign the drop card, and all courses dropped after this date appear on the permanent record with a grade of *W*. 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. Individual schools and colleges may have further restrictions on this time period.

4. Students who are reported not attending a course for which they are registered *NC* will be administratively dropped and assigned a grade of *W* for that course.

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, refunds of the tuition and fees 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 Veterans' Office, Willard Administrative Center.

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.

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.

Grades of *P*, *H*, *NC*, *Y*, *W*, *IP*, *IW*, and *IF* are not included in the grade-point average.

If the *IF* grade has not been completed within one year, it is regarded as failed and a grade of *F* is automatically calculated in the grade-point average at the end of the one-year grace period.

If a course is repeated, all grades earned are used in determining the grade-point average.

The grade-point average of graduate students includes only courses, credit hours, and credit points accumulated while enrolled in the Graduate School.

The grade-point average does not appear on official transcripts issued from the Office of the University Registrar, but does appear on the Grade Report issued each semester.

Students should consult with their dean's office for explanation of any exceptions made to the University uniform grade-point average.

Grade Reports

Grade reports are normally available for students to pick up from their dean's office within two to three weeks after the end of the semester. Grade reports are not automatically mailed; however, a self-addressed, stamped envelope may be supplied to the dean's office by individual students.

Transcripts

Transcripts of academic record at the University of Colorado (all campuses) may be ordered in person or by mail from the UCB Office of the University Registrar, Campus Box B-7, Transcript Section, Regent Administrative Center 125, Boulder, Colorado 80309. Official transcripts will not be available until approximately four weeks after final examinations. Requests should include the following:

1. Student's full name (include maiden or other name if applicable).
 2. Student number.
 3. Birthdate.
 4. The last term and campus where the student was in attendance.
 5. Whether the current semester grades are to be included when a transcript is ordered near the end of a term.
 6. Agency, college, or individuals to whom transcripts are to be sent. Complete mailing addresses should be included. Transcripts sent to students are labeled "issued to student."
 7. Student's signature. (This is the student's authorization to release the records to the designee.)
- There is no charge for transcripts. Transcripts are prepared only at the student's request. A student having financial obligations to the University that are due and unpaid will not be granted a transcript. Copies of transcripts from other institutions cannot be furnished.

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. 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 1981-82 have not yet been set. The rates per semester for the 1980-81 school year are as follows:

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

Credit Hours of Enrollment	Resident		Nonresident		Fees	Athl. Fee ²
	Under- graduate	Graduate	Under- graduate	Graduate		
0.0 to 3.0	\$114.00	\$120.00	\$1,675.50	\$1,759.50	\$ 16.05	\$00.00
3.1 to 4.0	152.00	160.00	1,675.50	1,759.50	101.50	10.00
4.1 to 5.0	190.00	200.00	1,675.50	1,759.50	101.50	10.00
5.1 to 6.0	228.00	240.00	1,675.50	1,759.50	106.50	10.00
6.1 to 7.0	266.00	280.00	1,675.50	1,759.50	106.50	10.00
7.1 to 8.0	304.00	320.00	1,675.50	1,759.50	106.50	10.00
8.1 to 9.0	342.00	360.00	1,675.50	1,759.50	106.50	10.00
9.1 to 10.0	381.00	400.00	1,675.50	1,759.50	106.50	10.00
Over 10.0	381.00	400.00	1,675.50	1,759.50	106.50	10.00
Each Credit Hour Over						
18 ¹	25.00	27.00	112.00	117.00		

1. Students making separate registrations on more than one campus of the University for a single term 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. Members of the instructional 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 year on the Boulder Campus without payment of tuition, on a space available basis. 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.

3. Nonresident graduate degree and special students, and nonresident undergraduate special students enrolled for 3 hours or less will pay \$351 and \$336 respectively, plus appropriate fees.

4. Students admitted to "candidacy for degree" will register for and be charged for 10 hours of credit for each full-time term of doctoral dissertation work. For each term of part-time enrollment, students will be charged for 7 hours of credit, except that students not making use of campus facilities may petition the Graduate School for 3-credit-hour status. Continuous registration during the academic year (fall and spring) will be required until completion of the dissertation defense. Doctoral dissertation rates will be charged at the graduate resident and nonresident rates. Nonresident doctoral dissertation students pay 1/15 the applicable full-time rate for each credit hour of enrollment.

5. Nonresident students enrolled as master's "candidate for degree" only to take a comprehensive examination for a master's degree will pay \$120.

6. Insurance is not available unless the student pays full 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 laboratory or other fees for practical 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.

To qualify as an auditor for fall or spring semester, a student must be 21 years of age or older. Students may not be registered for any other University of Colorado courses during the time they are auditing and are not eligible to audit courses if they are under suspension from the University. The Registrar's Office does not keep any record of courses audited; therefore, credit for these courses cannot be established. Auditors may attend as many courses as they wish, (except those courses with laboratories or where equipment is used) provided they have received permission from each instructor. Auditor's cards are issued after classes begin. This card should be presented to the instructor when requesting permission to attend a class.

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

¹A surcharge of 1/15 of the full-time rate is assessed for each credit hour per semester in excess of 18 credit hours.

²Athletic Fee: The Board of Regents has assessed a \$10 per semester fee for all students registered on Boulder Campus to provide support for Women's Intercollegiate Athletics.

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.* Students may enroll in this plan by completing a Tuition Deferral Card, which will be available during class schedule distribution or at the Finance Office. The deadline for submission is 4 p.m. on the 12th day of classes each semester. This plan will allow the student to pay tuition and fees in two installments. At least one-half of the obligation must be paid in the first installment. 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. The Board of Regents reserves the right to revise or eliminate this program at any time.

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

- a. The student may be withdrawn 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 may be subject to withdrawal. The student will also be informed of the appeal procedure.

5. *Reinstatement.* Students who fail to make required payments and who are withdrawn 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 withdrawn 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 director of records, the bursar, 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 withdrawal.

Any student paying a registration deposit with a check not acceptable to the bank may not be sectioned for classes. Any student paying tuition with a check not acceptable to the bank may be subject to withdrawal from the University, a \$5 returned check charge, late charges, and service charges. Any check presented to any department of the University which is returned from the bank unpaid will require payment of the amount due plus a \$5 returned check charge. The student may also be liable for collection costs and prosecution under the Fraudulent Check Laws of the State of Colorado, 18-5-205, CRS 1973. The University of Colorado at Boulder is a member of the Boulder Credit Bureau. Specific inquiries concerning reporting should be directed to the Collections Department of the Bursar's Office.

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, refunds of the full amount of the tuition and fees obligation are made as follows:

- a. Eighty percent during the first 12 class 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.

Students who do not pay tuition and fees in full at the time of withdrawal must contact the Collection Department to arrange for payment.

9. *Drop/Add Tuition Adjustment.* Complete adjustment of tuition and fees will be made on drop/add changes through the first 12 days of classes only. *No refunds will be made for dropping courses after the 12th 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,*

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

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 residence halls provide a wide range of facilities and services which support the physical well-being and the intellectual, cultural, social, and personal growth of single student residents. There are 20 residence halls housing approximately 5,500 single students.

Subject to availability of space, freshman men and women are required to live in the University residence halls for two academic-year semesters (a summer term does not count as an academic semester), unless they are married or live with parents or relatives in the Boulder area and have permission to commute. Requests from freshmen for permission to reside off campus for other reasons will be considered on their merit, taking into account the individual circumstances of the petitioner.

Housing rates per semester in the residence halls for 1980-81 are as follows:¹

Board and single room	\$1,019 to \$1,039
Board and double room	\$880 to \$900

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. (See Residence Halls Agreement for details.)

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 University housing, or about the various residential programs which are offered, 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 Health Sciences 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 1980-81; however, the Board of Regents reserves the right to change the costs for tuition and fees and room and board at any time.

	Resident	Nonresident
Tuition and fees	\$975 ²	\$3,565 ²
Board and room (on campus)	\$1,760 to \$2,028	\$1,760 to \$2,078
Total	\$2,735 to \$3,053	\$5,325 to \$5,643

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 REGULATIONS, MOTOR VEHICLES AND BICYCLES

Students who bring cars to Boulder and live on campus may purchase parking permits which entitle

¹It is expected that rates will be increased for 1981-82.
²Plus \$20 athletic fee. The Regents have assessed a \$10 per semester fee for all students registered on the Boulder Campus to provide support for Women's Intercollegiate athletics.

them to park on campus for fees ranging from \$16 to \$32 per semester.

All bicycles operated or parked on University property must be registered with the University Parking Office. The fee is \$1 for two years. All valid city licenses will be honored, provided the owner reregisters the bicycle with the Parking 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 Office, 1511 University Avenue, 492-7384.

STUDENT FACILITIES AND SERVICES

Counseling Service

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 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 as-

sist 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

The purpose of the financial aid program at the University of Colorado at Boulder is to provide assistance to students who need help in meeting the cost of their education. Students who believe they will require financial aid to enroll are encouraged to submit aid applications. Approximately 11,000 students, or about 52 percent of the student body, annually receive financial aid from federal, state, University, or private sources. In most cases, grants are supplemented by part-time employment (work-study) and/or long-term loans to meet the demonstrated need of recipients.

Financial aid advisers are available to talk with prospective students and their parents regarding the financing of an education at UCB. Students who are unable to visit the office in the Environmental Design Building may call (303) 492-5091.

It is recommended that students who wish to apply for financial aid submit a 1981-82 Family Financial Statement (FFS) to the American College Testing (ACT) Service. A 1981-82 FFS application should be available through local high school counselors or the UCB Office of Financial Aid around January 15, 1981. The preferential filing date for fall and spring semesters (1981-82 academic year) is March 1, 1981. FFS applications received after March 1 will be processed on a rolling basis according to the availability of funds. For students who wish to be considered for UCB aid for the summer session 1981, the FFS must be received by ACT and all discrepancies must be totally resolved by May 1, 1981.

The Office of Financial Aid expects to begin making award/denial announcements in mid-April 1981 for those students who correctly submit an FFS prior to the March 1 preferential filing date. Students should note that financial aid applications will not be processed unless they have been officially admitted to or are currently enrolled at the University of Colorado at Boulder. It is unlikely that the Office of Financial Aid will be able to provide the total amount of aid necessary to meet the full financial need demonstrated by

most high need nonresident students. This is because of federal limitations on the annual and/or cumulative amounts of aid which may be awarded to individual students.

Student Employment Area

The Student Employment Area, as part of the Office of Financial Aid, assists students in seeking part-time positions while attending the University of Colorado. Services for students include part-time employment, work-study, federal summer internships, odd jobs, and temporary employment. Students interested in working should visit the Student Employment Area in the Environmental Design Building.

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.

Liberal Arts Career Program. Counselors are available to assist liberal arts students in making career decisions and finding employment. The counselors make frequent visits with liberal arts employers.

Alumni

The University of Colorado, Boulder, alumni program is maintained by both alumni and University funds. Dues to belong to the Alumni Association are \$15 per year for the first five years out of school and \$25 per year thereafter. All dues are charged on an annual basis and are family memberships if both husband and wife are University of Colorado, Boulder, alumni. Dues are current for 12 months following the date of receipt. All graduates and former students are encouraged to keep their addresses current with the campus alumni office to receive notice of special functions.

Dues-paying members help the Alumni Association in its efforts to insure high quality education at the University of Colorado. These members receive all issues of *The Colorado Alumnus* publication, which keeps alumni current with campus programs and progress as well as news about fellow alumni.

The Alumni Office maintains records of alumni; arranges alumni events at Homecoming, at Commencement, and with local alumni groups throughout the United States; and plans class reunions, awards programs, and interesting trips and tours.

The Alumni Office also arranges programs of continuing education for alumni on campus, in various areas of the country, and during alumni tours. The Alumni Association works closely with the chancellor, faculty members, staff, and students in an effort to foster better communication between the Boulder Campus and the total 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 academically and financially disadvantaged minority students with an environment conducive to academic growth. Since 1967 EOP has been structured into five units: the Asian Americans (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 is designed to improve EOP students' basic educational skills through specially designed curriculum and courses, tutoring, and academic advisement.

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 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 other administrative support.

For more information concerning admission to the University of Colorado through the Educational Opportunity Program, students may call 492-7884, 492-7555, or 492-5123.

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 advisor for Fulbright and other international scholarships.

The Office of International Education maintains a small resource library on foreign study, travel, and work opportunity, including temporary summer jobs, volunteer internships, and career opportunities abroad. International Student Identification Cards and Eurail Passes are also available through the office.

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 Hebrew University in Jerusalem, Israel; the University of Bologna, Italy; Konan University, Japan; the University of Seville, Spain; the National Taiwan University, Taipei, Taiwan; Catholic University of Lima, Peru; and Leningrad State University, U.S.S.R. Engineering and Commercial Spanish students may be particularly interested in programs at ITESM in Monterrey, Mexico. 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 intensive language learning. Students may study beginning/intermediate language in 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; Rennes, France; or Seville, Spain. Special summer programs, e.g., art history in 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.

More information about study abroad programs is available at the Office of International Education or by calling 492-7741.

FOREIGN STUDENT ADVISER

The University of Colorado has welcomed foreign students for many years. Currently more than 500 students from over 60 foreign 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. For further information concerning foreign students, one should call 492-8057 at the Office of International Education.

Ombudsman Office

The Ombudsman Office provides an informal grievance procedure for students who have had difficulty resolving conflicts with faculty or staff. The ombudsman is an unbiased mediator who helps students to document their cases by advising them of current policy and facilitates communication between both parties in a dispute. The office reviews policy and will make recommendations to revise policies which are out of date. The office also offers an information and referral service including information on how to establish Colorado residency, academic requirements, University organizational structure, and deadline dates. Procedural information is published regularly.

Students are encouraged to stop by or call the office if they have questions or don't know where to go for

help. The Ombudsman Office is located in UMC, room 328; telephone, 492-5077.

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 Supplemental Student Insurance Plan.

The student activity 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, academic breaks, and summer session. 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.

Fee-For-Service. There will be a charge of \$5 for the first visit each academic year. In addition, \$5 will be charged for each use of the emergency room, each routine physical examination, and for visits to the specialty clinics.

Veterans Affairs

The Veterans Affairs Office, located in the Willard Administrative Center, assists veterans and veteran dependents in receiving Veterans Administration Educational Benefits. Prospective students are always welcome at this office.

Veterans Educational Benefits, Chapter 34 (G.I. Bill). In order to complete application materials for benefits, the student must be accepted to the University of Colorado at Boulder or admission must be imminent. If the student was discharged from the military before July 1, 1979, a *certified DD 214* is required (certified copies of discharges can be obtained from any County Courthouse without charge); if the student was discharged after this date, *Copy 4 of the DD 214* is required. An application for veterans benefits is completed and a statement of the tentative number of credit hours the veteran expects to take is completed. This and other necessary information allows the Veterans Affairs Office to enroll the student with the Veterans Administration Regional Office (VARO) in order to generate the appropriate monthly payment. Promptness is imperative because it affects the time of the student's payment.

Advance payment may be received at the start of a term if the application materials are submitted to the VARO by the Veterans Affairs Office approximately 60 days preceding the term.

Veterans Contributory Educational Program, Chapter 32. The veteran must have participated in this program while in the service in order to receive benefits. Please read the above paragraph for instructions about the DD 214 and materials required for application.

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 100 percent disabled veterans may also qualify. This office needs the *claim number* that the Veterans Administration assigns to

the student in order to complete paperwork. At each registration each dependent must complete paperwork with this office as described above.

Veterans who entered the service from the state of Colorado during the period August 5, 1964, through May 12, 1975, may be eligible for some state tuition assistance.

The Veterans Affairs Office has a counselor on the staff for providing assistance to students in planning academic schedules in relation to VA regulations. This service is free and confidential. The student is encouraged to stop by this office at any time.

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 (1) a reception desk which acts as a central campus information point; (2) a Fine Arts Center with an art gallery, browsing room, and music listening rooms; (3) a food service which includes a cafeteria, grill, delicatessen, pizza parlor, vending area, and catering operation with several private dining areas; (4) the University Book Center; (5) a conference center and special meeting rooms, including the Glenn Miller ballroom and the Forum Room; (6) a games area with bowling, billiards, and table tennis; (7) attractive lounges; (8) a photography laboratory for individual use; (9) an arts and crafts area offering noncredit classes in macrame, jewelry, pottery, leathercraft, batik, and others; (10) a copy center/sign shop; (11) a computerized ticket service; (12) a flower shop; (13) radio studios; and (14) numerous offices for student organization and student government use.

The UMC has been designated as the official state memorial to those who died in past wars to preserve our democratic freedom. 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

Health Sciences Center in Denver

The University's Health Sciences Center is 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 Health Sciences Center Division of the Graduate School, the University Hospital, 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 at the center are the Florence R. Sabin Wing for Research in Cellular Biology, the Denison Memorial Library, and the Humphreys Postgraduate Center. On the Health Sciences Center campus and cooperating closely with Health Sciences Center functions are the affiliated Webb-Waring Lung Institute, Eleanor

Roosevelt Institute for Cancer Research, the Belle Bonfils Memorial Blood Center, the Barbara Davis Center for Childhood Diabetes, and the Rocky Mountain Multiple Sclerosis Center. Another affiliate of the Health Sciences Center is the Davis Institute at 8th Avenue and Cherokee Street.

More than 1,700 students and trainees enroll annually at the Health Sciences 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, dental hygiene, child health associate program, 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 School of Medicine 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 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 nearly 50 extension courses per year to dentists in Colorado and the region.

The Health Sciences Center completed in 1965 a \$20 million building program which included the construction of University 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. An addition to the School of Nursing was under construction at the center and was scheduled for completion by the fall of 1980.

Colorado Springs Campus

The University of Colorado at Colorado Springs is located on a 400-acre campus on Austin Bluffs Parkway. 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 anthropology, biology, chemistry, distributed studies, economics, English, fine arts, geography and environmental studies, history, mathematics, philosophy, political science, psychology, Spanish, and sociology. A Bachelor of Science degree in chemistry is also offered.

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.

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 42 undergraduate fields and over 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 Urban and Public Policy Research, Center for Urban Transportation Studies, Division of Continuing Education, and Center for Community Development and Design.

Division of Continuing Education

The mission of the Division of Continuing Education of the University of Colorado, Boulder, is to facilitate the dissemination and application of knowledge to the adult community beyond the campus by extending the University's academic resources in response to local, state, regional, and national needs.

The division offers credit and noncredit courses, seminars, workshops, conferences, and related services to over 50,000 persons each year. Boulder faculty frequently are the primary providers of instruction, particularly in the professional fields of law, business, engineering, and pharmacy.

The division, which is self-supporting through tuition and fees, is composed of the following units:

The Dean's Office is responsible for administration, marketing, and coordinating all educational activities designed and taught for the benefit of persons who are not enrolled and considered as regular students on any of the University campuses. Information is available from the Dean's Office and the other units at 970 Aurora Avenue, Boulder, Colorado 80309, (303) 492-5141, and at the Western Colorado Continuing Education Office at Mesa College, Grand Junction, Colorado 81301, (303) 242-5731.

The Center for Conferences and Management/Technical Programs (CCMT) designs, develops, and coordinates short, intensive courses, seminars,

workshops, and conferences for the public and for private organizations. These programs may offer Continuing Education Units (CEU's), although they do not lead to credit for a degree. Programs focus on improving professional and management skills as well as the development of human resources. Services include program development, management, facilitation, housing, meeting space, accounting, and other benefits of University affiliation.

The Center for Lifelong Learning (CLL) offers University-level credit and noncredit classes, certificate programs, and telecommunications courses for students, professionals, and the general adult population interested in off-campus and outreach programs. Credit courses are offered in a wide variety of traditional university disciplines. Self-enrichment and vocational interests are served through the noncredit courses. To satisfy professional licensing and certification requirements, courses are offered in pharmacy, business, law, real estate, and education. Special programs have been developed to serve the needs of the adult population, including the Space Available Voluntary Enrollment (SAVE) program, the Management Development Certificate Program, the Cooperative Real Estate Certificate Program, Independent Study, and Audiovisual College Education (ACE).

The Intensive English Center (IEC) provides full-time, intensive instruction in English as a second language to international students from all parts of the world. The curriculum is designed to prepare adult learners for academic work at colleges or universities in Colorado or elsewhere in the United States. The program follows the calendar of the University of Colorado, Boulder, with two 16-week semesters (fall and spring) and an 8-week summer session. Throughout the year, classes are offered at all levels of English-language proficiency.

Events/Conference Center

The Events/Conference Center (ECC) is a multipurpose facility which opened in November 1979. It provides an attractive, efficient, and comfortable setting for a wide variety of activities, offered for the benefit of the students, staff, and faculty of the University and for the community.

The ECC was designed and is utilized for events such as educational conferences, seminars and meetings, convocations, and commencement ceremonies, as well as cultural, entertainment, and athletic activities that enhance and further the objectives of the University of Colorado.

The main arena of the ECC has a seating capacity ranging from 8,500 to 12,000, depending on event configuration.

Fiske Planetarium and Space-Theatre

The Fiske Planetarium on the Boulder Campus regularly presents astronomically oriented shows designed to entertain as well as inform. It is used as a teaching tool in astronomy classes and by many other departments of the University. In addition, multimedia shows, dance and musical concerts are presented in the

planetarium. Students are employed on a part-time basis to help in the running of the planetarium. Equipped with a Zeiss VI star projector in a 65-foot diameter dome with 213 seats, the Fiske Planetarium is one of the finest planetarium facilities in the world.

Libraries

The University Libraries support the academic study, teaching and research at UCB. The collection of library materials contains over 1,800,000 books, periodicals, audiovisual materials, and maps plus 1,900,000 microforms. The libraries include the central library (Norlin Library) and branch libraries. Within Norlin Library are located the audiovisual, government publications, and life sciences collections in addition to the major resources in humanities and social sciences. The branch libraries include 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; 1.8 million 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 Waiker 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. The changing exhibit hall is used for four or five temporary exhibitions per year, usually of an anthropological nature.

Fine Arts Exhibitions

The Department of Fine Arts sponsors exhibitions of painting, graphic arts, photography, and sculpture from its own collections and from those of major museums, collectors, artists, and galleries throughout the country. The exhibitions are held in the Eve Drewelowe Gallery and the other two University of Colorado Art Galleries, which are all located in the Sibell-Wolle Fine Arts Building.

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

Macky Auditorium

This fine proscenium concert hall seats 2,505. Macky has become the focal point for Artist Series concerts by internationally celebrated soloists and ensembles, community Boulder Philharmonic Orchestra concerts, Program Council sponsored concerts, and lectures and films. Box office telephone is 492-6309 for information on all events.

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, for those current fees-paid students and members. 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.

Speech and Hearing Clinic

The Speech and Hearing Clinic 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, hearing aid evaluations, and auditory training for the hearing-impaired. The clinic and the offices and classrooms for the Department of Communication Disorders and Speech Science are located at Research Laboratory No. 5. Address inquiries to Chairman, Communication Disorders and Speech Science, University of Colorado, Boulder, 80309.

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. Enrollment in ROTC programs is open to both men and women, and courses are open to all students whether or not they are enrolled in ROTC programs. 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, or call:

ARMY: Professor of Military Science, Campus Box 370; 492-6495

NAVY: Professor of Naval Science, Campus Box 374; 492-8287

AIR FORCE: Professor of Air Force Aerospace Studies, Campus Box 371; 492-8357

Theatre

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

The Department of Theatre and Dance presents a major season bill of six to seven productions each academic year. Another four to six productions are staged in the Theatre 300 under the auspices of the Minor Season.

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. It has had 23 years of distinguished history, being one of seven theatre groups in the world that have completed the entire Shakespearean canon of 37 plays.

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 \$60 million. Of this total, the expenditures on the Boulder, Denver, and Colorado Springs campuses are now over \$30 million per year. The sponsored research and instruction program of the Health Sciences Center in Denver totals more than \$30 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

Everly B. Fleischer, Dean

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 all students, no matter how specific and professional their aims, should have sufficient knowledge of other areas to be able to see their own disciplines in the proper perspective. At the same time, all students, no matter how broad and general their educational objectives, should have sufficient grasp of at least one field to enable them 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, Hellems 152. *Students in the college are expected to assume the responsibility for planning their academic programs in accor-*

dance 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 attempt 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 Appeals Committee on Academic Rules and Policies, both in the office of the dean, Hellems 152.

Area Requirements

A liberal arts college has the responsibility of making available to its students a balanced program which will satisfy the legitimate claims of individual interest and aspiration and the need to insure that those who graduate have pursued a directed, coherent educational experience.

Candidates for the liberal arts degree are expected to be literate in their own language, to have at least a minimal acquaintance with a language other than their own, and to be familiar with the subject matter and the methodology of the three broad areas of learning represented by the humanities, the natural sciences, and the social sciences. These expectations generate the requirements of the college.

Each student pursuing a Bachelor of Arts or a Bachelor of Fine Arts degree in the College of Arts and Sciences is required to complete the following area requirements. A student pursuing a Bachelor of Science degree must complete all of the area requirements with the exception of the foreign language requirement.

Each student seeking the B.A., the B.F.A., or the B.S. degree must present two two-semester course combinations in each of the following areas:

1. Humanities
2. Natural science
3. Social science

An area requirement may be satisfied in this college in one of two ways:

1. By taking one lower division combination followed by two upper division courses for which the lower division combination(s) is (are) prerequisite.

2. By taking one lower division combination in one department and one lower division combination in a different department. Course combinations which satisfy these requirements are published each fall and spring semester in the Schedule of Courses.

Each student seeking the B.A., or the B.F.A. degree in the College of Arts and Sciences is required to complete the foreign language requirement in one of the following ways:

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

2. Completion of an appropriate third-semester college course.

3. 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.

Students may not use the pass/fail option for courses taken to fulfill the College of Arts and Sciences area requirements.

Attendance Regulations

The matter of classroom attendance is left to the discretion of the instructor. It is the responsibility of students to determine at the beginning of each semester their 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	French
American studies	Geography
Anthropology	Geology
Asian studies	German
Biological sciences	History
Black studies	Humanities
Central and East European studies	Individually structured
Chemistry	International affairs
Chinese	Italian
Classics	Japanese
Communication	Latin American studies
Communication disorders and speech science	Linguistics
Dance	Mathematics
Distributed studies	Philosophy
Economics	Physics
English	Political science
Environmental conservation	Psychology
Fine arts	Religious studies
	Russian
	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 that do not offer undergraduate majors:

Astro-Geophysics	Film studies
Chicano studies	Experimental studies
Computer science	Women studies
Comparative literature	

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 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. Arts and sciences courses offered by the University's Boulder Division of Continuing Education carry 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 and studio 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 if the following conditions are fulfilled:

1. The student has completed all area and major requirements of the College of Arts and Sciences.
2. The student has completed at least 30 hours of liberal arts course work offered in the College of Arts and Sciences.
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. Students who wish to earn two degrees should notify the office of the dean as soon as they have decided on this degree option. Specific graduation requirements will be determined on the basis of when *formal* notification of double degree status occurs.

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 18 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.

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. A maximum of 8 hours of such credit will count towards graduation. 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 Center for Interdisciplinary Studies, Ketchum 226, or the staff in Darley Commons 207, Williams Village.

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. Completion of the last 30 hours in University of Colorado courses on the Boulder Campus 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.

For specific information concerning the B.F.A. degree, see the departmental listing for Fine Arts or Theatre and Dance. Information regarding the B.S. degree may be found under the Physical Education and Recreation Department. Students are subject to the general degree requirements in effect at the time they first enter the College of Arts and Sciences.

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
	15 hours		46 credit points

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

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

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 they have taken at least 30 hours at the University of Colorado at Boulder and if their cumulative grade-point average is 3.75 or higher, both at the University of Colorado and in all collegiate work completed. The average includes all grades except *P* and *H*.

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 this catalog or contact the Honors Program, Norlin Library.

Independent Study

With the approval of the department, students may register for independent study. No more than 8 hours of independent study may be credited toward the major and no 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 not register for more than 8 hours of independent study credit during any term. All independent study courses are numbered in the 900 series. Lower division credit is assigned 910 through 929. Upper division credit is assigned 930-949.

Investigation Paper

See Senior Thesis.

Limitations on Course Work

1. Students may take not more than 45 hours in any one department. Note exceptions for the Bachelor of Fine Arts degree and the Bachelor of Science degrees.
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 activities courses (physical education, applied music, and ensembles).
 - c. Up to 6 hours in approved ROTC courses.

Majors

All students pursuing a B.A. or B.F.A. degree must declare a major. As soon as the student has determined a major (certainly no later than the beginning of the junior year), formal application must be made to the department or program. Admission to certain majors may be limited, and students are advised to consult with departmental advisers regarding criteria for admission.

Departments are responsible for the advising of their majors and also for the certification of the completion of the student's 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 the 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 attempted.
4. Eighteen hours of upper division courses in the major, all with grades of C or higher.
5. Special requirements as stipulated by the major department.
6. No more than 8 hours of independent study may be credited toward the minimum requirements in the major.
7. Students are subject to those major requirements in effect at the time the student formally declares a major.

Pass/Fail

Students in the College of Arts and Sciences *may not* use the pass/fail option for courses taken to fulfill the area requirements, courses used to satisfy the foreign language requirement, 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 Programs

FARRAND COLLEGE

Farrand College is a two-year residential college for freshman and sophomore students committed to an integrated and personalized education in the liberal arts. This coeducational college brings 400 students who share a similar philosophy and pursuit of knowledge together in a learning community. The curriculum and the program are designed to foster and strengthen the attainment of a liberal education by students who wish to share a more structured approach to these goals:

1. To be able to express themselves clearly in the English language in speech and writing.
2. To have a historical perspective of their own culture through study of previous civilizations as reflected in their history, philosophy, literature, religion, art, and music.
3. To understand and use the methods of inquiry employed by the natural sciences.
4. To become familiar, through acquaintance with the social sciences, with what mankind has learned and is learning about living together.
5. To have an understanding of the mathematics that underlie basic fields of study and the uses of mathematics in our contemporary culture.
6. To be able to make moral choices based upon a considered system of values.

Housed in Farrand Hall, Farrand College students share a common living environment that enables them to carry the exchange of ideas into their personal, everyday lives. There are frequent opportunities for informal dialogue between faculty and students, developing and sustaining a mutual respect for the interests and concerns of both. At the same time, because Farrand is located within the central campus of the

University, there is a free flow for students from courses held in Farrand to classes in other buildings throughout the campus. Students experience the advantages of both the small, liberal arts college and the large university. Required freshman and sophomore seminars limited to twenty students are taught within the college, as well as many recitation sections that accompany lectures in the required courses.

The faculty of Farrand College, drawn from the College of Arts and Sciences, combine professional competence with demonstrated concern for the personal growth and development of students. They are dedicated to preparing students for a lifetime of living both as productive individuals who combine intellectual understanding with skills and as citizens with an analytical understanding of the contemporary economic, political, and moral issues upon which they must make decisions.

The students in Farrand College are asked to work closely with academic advisers and counselors in planning their undergraduate program and assessing the strengths and abilities that should shape their goals for the future. They also participate in determining rules and procedures for self-government and planning educational policy.

The required curriculum for Farrand College includes (1) the Freshman Seminar, stressing writing and speaking and providing tutorial instruction; (2) the Sophomore Seminar, emphasizing an innovative approach to traditional disciplines or interdisciplinary study; (3) Interdisciplinary Approach to the Humanities, a two-semester sequence exploring the history of ideas as expressed in literature, music, and the visual arts; (4) Interdisciplinary Approach to the Social Sciences, integrating the methods of inquiry employed by psychology, sociology, economics, political science, anthropology, and geography in exploring a current social problem; (5) Mathematics for a Modern World, including a basic introduction to computer science and the computer's function in the technology of our culture *or* the mathematics requirements for the student's major. In addition, students who are nonscience majors will have the option of fulfilling the natural science area requirement for the College of Arts and Sciences through Special sections of science courses for nonscience majors. Science and health science students will take their natural science courses outside of Farrand College.

Any student admitted to the University of Colorado at Boulder is eligible for admission. While students in Farrand College are primarily drawn from the College of Arts and Sciences, students in the Colleges of Business, Music, Environmental Design, and Engineering are welcome. The structured liberal arts offered by Farrand College are a valuable background for students in vocational or professional academic programs at the University. There is a modest charge for participation in Farrand College in addition to regular tuition and room and board fees.

SEWALL HALL

The Residential Academic Program at Sewall Hall provides qualified academically committed freshmen

with the opportunity to participate in a unique residential community experience at the University of Colorado at Boulder. Limited to 320 students, this coeducational program combines many of the advantages of a small liberal arts college with the vast resources of the University.

Students who live in Sewall take one Sewall seminar each semester. These seminars are limited to 20 students; vary in content with emphasis in the natural sciences, social sciences, humanities, and fine arts; and stress critical inquiry and creative participation. In addition to the seminars, many of the large lecture classes at the University offer special laboratory and recitation sections for Sewall students.

The director of the Sewall program, who is a member of the University faculty, provides academic assistance to the students in planning their individual programs, in choosing courses, and in making contact with their major departments. The director also offers personal counseling and helps students find the proper University resources to help them with their problems.

Participants in the Residential Academic Program are centrally involved in the regular campus life, take the majority of their classes with the rest of the University, and are encouraged to join in all-University activities. The major emphasis at Sewall is participation—in classes, in student government, in special programs and performances, and in creative projects. Students and faculty, administrators and staff, enjoy close working relationships.

All entering freshmen accepted at the University of Colorado at Boulder are welcome to apply for the Residential Academic Program. Applications will be included in the housing materials sent to all freshmen upon admission. Applications will be considered in the order in which they are received. Thus, prompt application is recommended. There is a modest charge for participation in the program in addition to regular tuition and room-and-board fees. Students who have academic questions should address them to the Director, Residential Academic Program, Sewall Hall, Boulder, Colorado, 80309.

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 who are still below a 2.0 cumulative average after exercising their semester of probation will be dismissed and will not be able to register for University of Colorado daytime courses during the regular academic year, September to June.

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 Divi-

sion 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). Dismissed students pursuing this option will have two semesters after reenrollment to bring their University of Colorado average up to 2.0 or they will be dismissed again.

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

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.

Students pursuing the Individually Structured Major must complete a Senior Thesis. For further information see the section on the Individually Structured Major.

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.

Withdrawal Procedure

See the General Information section. Students who are permitted to withdraw after the 10th week of a fall or spring semester will normally not be allowed to register for the following spring or fall semester.

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 major 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 which 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 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. 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	3

<i>Black Studies</i>	<i>Semester Hours</i>
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>	<i>Semester Hours</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

<i>Fine Arts History</i>	<i>Semester Hours</i>
F.A. Hist. 404. The Art of the Ancient Near East	3
F.A. Hist. 406. The Art of Islam	3
F.A. Hist. 407. Byzantine Art	3

F.A. Hist. 461. The Art of Ancient Egypt	3
F.A. Hist. 470. Art of Africa and Oceania	3

<i>Geography</i>	<i>Semester Hours</i>
Geog. 384. Geography of the Middle East	3

<i>History</i>	<i>Semester Hours</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>Political Science</i>	<i>Semester Hours</i>
P.Sc. 222. Introduction to International Relations	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 in 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>	<i>Semester Hours</i>
R.St. 196. Jesus and the New Testament	3
R.St. 260. World Religions: Western	3
R.St. 264. Traditional African Religions	3
R.St. 410. Biblical Judaism	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.

ANTHROPOLOGY

Office in Hellems Building, Room 90
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).

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. Inquiries concerning applications should be directed to the graduate secretary. Completed applications are reviewed at least twice each year, usually in February and May. 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.

To qualify for a graduate degree all students must complete at least three seminars, one each from any of the following four categories: Cultural Anthropology (Anth. 601), Physical Anthropology (Anth. 602), Archaeology (Anth. 603), or Anthropological Linguistics (Anth. 604, 586, or 578).

Other specific course requirements will be established through a qualifying interview and consultation with the department chairman and an academic adviser.

M.A. students are normally expected to write a thesis (Plan I); exceptions to this (Plan II) require approval of the chairman.

Students may have prime specialties in any of the major subfields of anthropology: archaeology, cultural, physical, and linguistic anthropology. In general the department expects graduate students to retain a breadth of competence in anthropology through the master's degree with specialization intensifying with progress toward the Ph.D. degree.

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

ARTS AND SCIENCES

College Expository Writing Program (CEWP)

Office in Hellems Building, Room 115

The College Expository Writing Program is designed to teach University students the skills of written dis-

course 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).

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 Center for Interdisciplinary Studies, Ketchum 226.

ASIAN STUDIES

*Office in Hellems 34A
Professor Joyce Lebra, Adviser*

The University of Colorado, through its various departments and the Asian Studies Committee, offers a broad interdisciplinary, undergraduate major in Asian studies. In addition, a number of departments (i.e., fine arts, history, philosophy, political science, and theatre and dance) offer graduate training with an emphasis on Asia.

Students planning to major in Asian studies are encouraged to consider study abroad in Asia. The University offers year-long programs in Kobe, Japan, and Taipei, Taiwan. For further information, contact the program adviser.

BACHELOR'S DEGREE REQUIREMENTS

A student majoring in Asian studies may choose one of two options:

Option 1: Complete a total of 41 hours, consisting of (a) 20 hours (two years) of Chinese or Japanese language; and (b) 21 hours of non-language courses, at least 9 of which are upper division, including Asian Studies 499.

Option 2: Complete a total of 36 hours of Asian Studies courses, at least 21 hours of which are upper division, including Asian Studies 499.

Under either option, the major must fulfill the following general requirements:

1. Satisfaction of the general requirements for the Bachelor of Arts degree in the College of Arts and Sciences.

2. A grade of C or higher in all course work taken to fulfill major requirements.

3. At least two courses each, in the social sciences (e.g. economics, anthropology, political science), and in the humanities (e.g. fine arts, literature, philosophy, religious studies and theatre and dance) concerning Asia.

Honors. 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.

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. 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. Ethnography of China, Japan, and Korea	3

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

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

<i>Fine Arts History</i>	
F.A. Hist. 284. Introduction to Asian Art	3
F.A. Hist. 405. Art of India and Southeast Asia	3
F.A. Hist. 474. The Arts of Japan	3
F.A. Hist. 475. The Arts of China	3
F.A. Hist. 560. Graduate Seminar: Selected Topics in Art History (Asian Arts)	3

<i>History</i>	
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. 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 Asian 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. 478/578. Modern India	3
Hist. 671. Readings in Chinese History	3
Hist. 676. Readings in Modern Indian History	3

Hist. 772. Seminar: Modern Chinese History	3
Hist. 776. Seminar: Modern Japanese History	3

<i>Oriental and Slavic Languages and Literatures</i>	
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. 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. 483. Survey of Chinese Literature I	3
Chin. 484. Survey of Chinese Literature II	3
Chin. 486. Chinese Prose	3
Jap. 101. Beginning Japanese	5
Jap. 102. Beginning Japanese	5
Jap. 211. Second-Year Japanese	5
Jap. 212. Second-Year Japanese	5
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. 483. Survey of Japanese Literature I	3
Jap. 484. Survey of Japanese Literature II	3
Jap. 485. Survey of Japanese Literature III	3

<i>Philosophy</i>	
Phil. 310. Chinese Philosophy	3
Phil. 489. Comparative Oriental and Western Philosophies	3
Phil. 597. Seminar: Comparative Philosophy	3

<i>Political Science</i>	
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. 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. 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

<i>Religious Studies</i>	
R.St. 262. World Religions: Eastern	3
R.St. 320. Hinduism	3
R.St. 330. Indian Buddhism	3
R.St. 340. Japanese Religions	3
R.St. 351. Religion and the Arts (Eastern)	3
R.St. 360. Islam	3
R.St. 370. Zen	3
R.St. 385. Chinese Religion	3
R.St. 420. Hindu Vedanta	3
R.St. 440. Chinese and Japanese Buddhist Scriptures	3
R.St. 485. Taoism	3
R.St. 489. Sufism	3

<i>Theatre and Dance</i>	
Thtr. 472. Theatre of Asia	3
Thtr. 572. Problems in Asian Theatre	3
Thtr. 672. Seminar: Asian Theatre	3

ASTRO-GEOPHYSICS

Office in Duane E 226
Professor Peter S. Conti, Chairman

Although an undergraduate major is not offered in astro-geophysics, it may be used as a 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 observational and theoretical astrophysics, plasma physics, astrophysical and geophysical fluid dynamics, planetary physics, solar physics, and geophysics. 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.

Departmental Requirements

Those wishing to pursue graduate work in astro-geophysics 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. The Graduate Record Examination aptitude tests and advanced test in physics are used in place of a qualifying examination, and this examination normally is taken before the time of entry into Graduate School.

Preliminary Examination. Students starting work in the Department of Astro-Geophysics will be given a written preliminary 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. A student failing this examination must show evidence by the end of the first year that 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.

Preliminary 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 pass the preliminary examination described under Master's Degree and a comprehensive examination which is designed to test the student's scientific judgment and initiative as well as mastery of the knowledge and skills necessary for research. Students entering the department are supplied with a detailed description of the examinations.

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
Professor Charles Southwick, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The department offers a major in environmental, population, and organismic (EPO) biology, and a distributed studies major. Students selecting either major area must report to the departmental office for lists of requirements and assignment to an academic adviser. Courses in mathematics, chemistry, and physics are required.

Courses acceptable toward the minimum of 35 semester hours required for an undergraduate major in EPO biology may include up to 12 semester hours of certain biological courses offered in other departments. An inclusive list may be obtained in the department office.

For an introductory course in biology, science majors should enroll for either EPOB 121-123 and 122-124 or MCDB 105-106. 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 121-123, 122-124.

GRADUATE DEGREE PROGRAMS

Students wishing to pursue graduate work in EPO biology leading to candidacy for advanced degrees may obtain a preliminary application for admission and a listing of faculty and their research areas directly from the EPO Biology office. For general requirements for advanced degrees, consult 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. There are special laboratories within the department 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.

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 University Museum, the Institute of Arctic and Alpine Research, and the Institute of Behavioral Genetics.

Biology—Molecular, Cellular, and Developmental

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

BACHELOR'S DEGREE REQUIREMENTS

	<i>Semester Hours</i>
MCDB 106-106 or EPOB 121-123, 122-124	8
MCDB 312	4
MCDB 384	4
MCDB 461 or 462	4
Cchem. 103-106 or Chem. 107-108	10
Chem. 331-332 or Chem. 335-336	8-10
Chem. 481-482	6
Phys. 111 or 301 and Phys. 112 or 302	8-10
Math. 130, Math. 230	8-10
Electives in MCDB, EPOB, or related subjects to be approved by department	10-25

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, biosynthesis 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 end 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.

BIBLIOGRAPHY

Office in Norlin Library, Room N 233
Assistant Professor Mildred Nilon

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.

BLACK STUDIES PROGRAM

Office in Woodbury Building, Room 302

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

Music, Art, Religion, Dance

Bl.St. 240. Afro-American 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. 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.

CHICANO STUDIES

Office in Ketchum Building, Room 11
Associate Professor Reyes Ramos, 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.

This department encourages students to include in their studies the Study Abroad programs offered in Mexico in order to gain deeper understanding of the culture and attitudes of Mexico and their carry-over into the United States, especially the Southwest. Students interested in study abroad will find further information under the section on Special Educational Opportunities or they may consult the Office of International Education.

CENTER FOR INTERDISCIPLINARY STUDIES

Office in Ketchum Building, Room 128
Professor Hazel E. Barnes, Director

The Center for Interdisciplinary Studies creates and offers interdisciplinary courses and programs in the major areas of learning: humanities, natural sciences, and social sciences. It also sponsors interdisciplinary programs and courses, taught by faculty of other departments in the college.

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 Arlan D. Norman, Chairman

Professor Bert Tolbert, Associate Chairman

BACHELOR'S DEGREE REQUIREMENTS

There are three ways for a student to earn a major through the Department of Chemistry: (1) as a chemistry major, (2) with a biochemistry option, and (3) as a distributed studies major with primary area of study in chemistry. 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.

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. A minimum of 33 semester hours in chemistry is required for a degree. Chemistry majors concentrating in physical chemistry should take the entire physical chemistry sequence: Chem. 451, 452, 453, and 455. All students, but especially students intending to enter graduate school in chemistry, should take additional advanced courses. Recommended courses include Independent Study, Chem. 943; a third semester of physical chemistry; Inorganic Chemistry, Chem. 401 or 501; Biochemistry, Chem. 481 and 482 Advanced Analytical Chemistry; and Advanced Organic Chemistry, Chem. 531.

Students majoring in chemistry with a *biochemistry option* must present credits in the following courses or their equivalents: Chem. 103 and 106 (or 107, 108); 331 and 332 (or 335, 336); 450 or 451, 452 or 453; 481, 482, and 486; Phys. 111, 112, and 114; Math. 130, 230, and

240; MCDB 105, 106 or EPOB 121, 123, 122, 124, and MCDB 384 or EPOB 383. All biochemistry option students, and especially students intending to enter graduate school in the biological sciences, should take additional advanced courses. Especially recommended are Independent Study, Chem. 943; Analytical Chemistry, Chem. 418; Physical Chemistry Laboratory, Chem. 454 or 455; Advanced Organic Chemistry, Chem. 531; Biochemistry, Chem. 483; Advanced Biochemistry, Chem. 587, 588; and courses in the biology departments such as EPOB 322, MCDB 312, 412, 444, 471 and 483.

Distributed Studies (Chemistry Primary Area). The following courses or their equivalents are required for a distributed studies (chemistry) major. (Register at the Innovative Education Office, Ketchum 226.)

1. General Chemistry: Chem. 103 and 106, 10 credit hours. Chem. 100, 101, 102, and 104 may *not* be substituted for these requirements nor included in the 30-hour requirement of item 4 below.

2. Organic Chemistry: Chem. 331 and 332, 8 credit hours.

3. Physical Chemistry: Chem. 450 or 451.

4. Additional chemistry credit hours to make a total of 30 hours.

ACS Certification. The American Chemical Society maintains a certification program in which a student graduating with a specified minimum program is certified to the Society upon graduation. To be certified, a graduate must satisfy additional graduation requirements as follows: *For Chemistry Majors.* Chem. 401 or Chem. 481 and one additional 400- or 500-level course in chemistry, physics, mathematics, molecular biology, engineering, or geochemistry. The combination 401 plus 481 will satisfy this requirement. See departmental advisers for requirements for biochemistry options.

Chemistry Honors Program. Opportunity is provided for qualified chemistry majors, including those with the biochemistry option, to participate in the Chemistry Honors Program and graduate with honors (*cum laude*, *magna cum laude*, or *summa cum laude*) in chemistry. Students interested in the Honors Program should contact the Departmental Honors Adviser during their junior year.

Transfer students who plan to take a regular or biochemistry option major must complete at the Boulder campus a minimum of 9 credit hours of upper division work covering at least two of the subdisciplines: organic, physical, analytical, inorganic, and biochemistry.

A more detailed listing of the bachelor's degree requirements, together with advising information and alternate course options, is available at the Chemistry Department Office.

GRADUATE DEGREE PROGRAMS

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. Copies of more detailed rules are distributed to graduate students.

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.

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, but no thesis.

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. Candidates must also pass a final Ph.D. oral examination at the time of completion of their work.

CLASSICS

*Office in Education Building, Room 320F, Campus Box 248
Professor Ernst A. Fredricksmeyer, Acting Chairman*

BACHELOR'S DEGREE REQUIREMENTS

The major in classics is individually structured, upon consultation with the undergraduate adviser, to reflect the student's interests in the field. Major programs can be arranged with a concentration on either Latin or Greek or a combination of the two, or a broadly based program in classical antiquities (mythology, literature, philosophy and religion, art, archaeology, history). The candidate for the degree must present a minimum of 36 credit hours plus the equivalent of two college years of either Greek or Latin. Prospective majors should consult the undergraduate adviser and the departmental major list.

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 Donald K. Darnell, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The program in communication has both humanistic and social scientific concerns. Major areas of undergraduate and graduate emphasis are interpersonal, organizational, and public communication.

Students should indicate as soon as possible their desire or intent to major in communication. Admission to the major and to upper division courses in communication will be limited. Current information about quotas and admission criteria may be obtained from the departmental office.

Majors must present a minimum of 30 semester hours, including specific requirements for graduation. However, some programs within the communication field may require additional hours. All students becoming majors in the department after January 1, 1978, must receive a grade of *C* in all required courses. 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. All graduate 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.

All graduate applicants are encouraged to submit scores from the Graduate Record Examination. GRE scores are required if the applicant's cumulative grade-point average is below 3.0.

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 admitted to the graduate program, an adviser and committee will be selected not later than the beginning of the student's second semester (or second summer session) in residence. The adviser and committee have 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 the 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, Graduate School section of this catalog.

COMMUNICATION DISORDERS AND SPEECH SCIENCE

Office on Observatory Hill

Professor Richard H. Sweetman, Chairman

BACHELOR'S DEGREE REQUIREMENTS

The Bachelor of Arts degree with a major in communication disorders and speech science provides a broad general education, develops concepts basic to human communication and normal language processes, and provides necessary 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.

(All courses offered in Sequence 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 342. Introduction to Human Anatomy (Prer., EPOB 121 and 122)	4
Phon. 304. General Phonetics	3

Spring

Phon. 305. Physiological Phonetics	4
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SEQUENCE B (SOPHOMORE OR JUNIOR YEAR)

Fall

Aero. 395. Descriptive 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 a B.A. degree in communication disorders and speech science and need not be taken in its entirety.)

SEQUENCE D (SENIOR YEAR)

Fall

CDSS 370. Manual Communication I	2
CDSS 407. Articulatory Phonetics	2
CDSS 469. Observation and Cotherapy	1

Spring

CDSS 371. Manual Communication II	2
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-Language-Hearing Association (ASHA).

Students wishing to emphasize phonetics studies should contact the Department of Communication Disorders and Speech Science.

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 in communication disorders places heavy emphasis upon clinical training and experiences. The program leads to certification by ASHA and the Colorado State Department of Education. Students having an undergraduate degree in speech pathology and audiology can expect to spend two calendar years to complete 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.

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 expected that students will have some professional experience before entering the program, and that they will 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.

Speech and Hearing Clinic

The Speech and Hearing Clinic has a twofold purpose. It provides facilities for the training of undergraduate and graduate students, and it provides speech and hearing evaluation and remediation services for the Boulder community. Any student of the

University or any 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 evaluations, lipreading instruction, hearing aid evaluations, and auditory training for the hearing-impaired. The Speech and Hearing Clinic, as well as the office and classrooms for the Department of Communication Disorders and Speech Science, are located on Observatory Hill. Address inquiries to Chairman, Communication Disorders and Speech Science, Campus Box 121, University of Colorado, Boulder, 80309.

COMPARATIVE LITERATURE

Office in Woodbury, Room 205

Assistant Professor Kaye Howe, Chairperson

Although comparative literature is a graduate program, undergraduates should be aware that 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.

CONFLICT AND PEACE STUDIES

Office in Muenzinger E229

Assistant Professor Elaine Yarbrough, Director

Conflict and Peace Studies is a multidisciplinary concentration of courses, seminars, field work, and independent study possibilities centering on 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.

Because of the intrinsically international nature of Conflict and Peace Studies, students are encouraged to consider a program of study abroad to gain an understanding of intercultural relations. For information on study abroad, consult the Office of International Education.

DISTRIBUTED STUDIES PROGRAM

Students working toward the B.A. degree may elect a two- or three-area major in the distributed studies

program. Those students wishing to pursue a two-area major must complete 30 hours of course work in each department; 15 hours in each department must be upper division course work. Students must have a 2.0 grade-point average and 30 hours of C grade or better, including the 15 hours of upper division course work in each department.

In a two-area major, each department must approve the student's program, and therefore either department may deny the student's proposal.

Students pursuing a three-area major must designate one area as primary and the other areas as secondary. In the primary area, 30 hours of work including 15 hours of upper division work must be completed. A grade-point average of 2.0 in the primary area and 30 hours of C grade or better, including the 15 hours of upper division work, is required.

In the secondary areas the student must complete 15 hours in each of the departments, including 8 hours of upper division work in each department. A grade-point average of 2.0 is required in each of the secondary areas, as well as 15 hours of C grade or better, including the 8 hours of upper division work in each department.

Language Courses

No first-year course in a foreign language (101-102) or English language (composition) may be used in satisfaction of the requirements of the distributed studies major.

The areas which may be used in the program are limited to those in which a departmental major for the B.A. is offered. Astro-geophysics, comparative literature, and computer science are also acceptable as either primary or secondary areas.

For guidelines and application forms, consult the Center for Interdisciplinary Studies, Ketchum 226.

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.

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. Applicants who seem likely to succeed in the program may be admitted provisionally even if they do not meet all of the above requirements, but these exceptions must be approved by the dean of the Graduate School.

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 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.
- d. No thesis requirement.

3. Examinations:

- a. Comprehensive-Final Examination: 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 candidate's last semester of residence while he is still taking courses, provided that he is making satisfactory progress.

(1) Plan I candidates must take an oral examination covering the dissertation and other work presented for the degree. (See Rules of the Graduate School for details concerning coverage of work not done in formal courses and seminars in economics.)

(2) Plan II candidates will be examined in two fields. (Ph.D. comprehensive examinations are acceptable substitutes.) In each of the fields 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 fields may be individually structured to meet a particular need provided the candidate's plan is approved by the student's adviser and the campus departmental graduate adviser. An individually structured field may be based wholly or partly upon the candidate's work in an Economics Internship (Econ. 698). If a field is based wholly on an economics internship the examination for that field may be oral, written, or both, at the option of the examining committee. Otherwise, the examination in each field consists of a three-hour written examination. Candidates ordinarily present two fields based on regular course work in economics at the University of Colorado; deviations from this are limited to *one* of the following options:

- (i) One of the fields may be outside the discipline of economics *or*
- (ii) Course credits for one field may be transferred from another university *or*
- (iii) One of the fields may be based wholly or partly upon an economics internship.

- b. 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.

4. Other Requirements:

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

5. 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:

- (a) Completion of at least 6 hours in general economic development (Econ. 577, 478 and 677).
- (b) Completion of at least 9 hours from at least two of the following allied fields:
 - Agricultural and rural economics
 - Resources and environment
 - International trade and finance
 - Comparative economics
 - Other field studies approved by the Development Program Committee.
- (c) In place of the two separate field examinations, successful completion of a two-part comprehensive examination covering material from sections (a) and (b) 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 (a) and (b), 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 and at least one from the allied fields.

6. 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.

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 Hellems Building, Room 101
Professor James R. Kincaid, 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-education program. Since requirements for education and English make a very tight schedule, students should seek early advising to complete their college requirements.

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. 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). 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

August 31, 1981—Required meeting of all new graduate students with graduate director; 10 a.m., Hellems 125.

October, 1981—Comprehensive examination for the Ph.D. degree by prior arrangement with the director of graduate studies.

November 18, 19, 1981—Written part of the final examination for the M.A. degree.

March, 1982—Comprehensive examination for the Ph.D. degree by prior arrangement with the director of graduate studies.

March 12, 13, 1982—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

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 10 areas: biology, computer science, economics, English, geography, geology, physics, political science, quantitative methods, and sociology.

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

Required Courses (29-31 hours from the following)

Econ. 201. Principles of Economics I	3
Econ. 202. Principles of Economics II	3
EPOB 121/123. General Biology I (with laboratory)	4
EPOB 122/124. General Biology II (with laboratory)	4
EPOB 302. Principles of Ecology	3
Geog. 100. Environmental Systems—Climate and Vegetation	4
Geog. 101. Environmental Systems—Landforms and Soils	4
Geog. 341. Conservation Practice and Resource Management	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 352. Classification of Flowering Plants (with laboratory)	4
EPOB 409. Biometry	3
Geog. 301. Geographical Techniques	3
Geog. 305. Cartography I	3
Geog. 306. Map Interpretation	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

Elective Courses (9 hours; select any courses from this group)

Econ. 453. Natural Resources Economics	3
Econ. 454. Environmental Economics	3
EPOB 361. Entomology (with laboratory)	4
EPOB 315. Introduction to Arctic and Alpine Environments (same as Geog. 330)	3
EPOB 403. Limnology	3
EPOB 410-414. Advanced Ecology	3
EPOB 475. Ornithology	3
EPOB 476. 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
Geol. 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
Soc. 220. Introduction to Demography and Human Ecology	3

EXPERIMENTAL STUDIES

The Experimental Studies Program offers 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 Center for Interdisciplinary Studies, Ketchum 226.

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 the study of film should consult the film studies listing in the current *Schedule of Courses* and its supplement issue each semester.

Information on the Study Abroad Program, Inter-University Center for Critical and Film Studies in Paris, may be obtained at the Office of International Education, 492-7741.

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 Sibell-Wolle Fine Arts Building, Room N196A
Professor Jerry W. Kunkel, Chairperson

BACHELOR'S DEGREE REQUIREMENTS

Majors are available for the B.A. and B.F.A. degrees in art education, art history, and studio arts. Students are encouraged to consult with an undergraduate adviser in the department in order to obtain advice and current information concerning the program.

ART EDUCATION: 41-45 SEMESTER HOURS IN THE MAJOR

<i>Required Courses</i>	<i>Semester Hours</i>
Any two of the lower division art history 280 series	6
Any two of the upper division art history 400 series	6
F.A. 100 or 101. Basic Drawing	2 or 3
F.A. 120 or 121. Basic Painting	2 or 3
F.A. 150 or 151. Basic Sculpture	2 or 3
F.A. 216. Beginning Photo I	6
F.A. 288. First-Year Ceramics	3
F.A. 377. Jewelry Design	3
F.A. 364. Art in the Elementary Schools	2
F.A. 366. Art Materials Workshop	2
F.A. 367. Art Materials Workshop-Fibers	2
F.A. 368. Art in the Secondary Schools	2
F.A. 369. Practicum in Art Teaching (twice)	2
Studio concentration (consult department for combinations)	6-9
Mus. 183. Introduction to Music	3
Thtr. 270. Introduction to Theatre	3
Teacher Education Program (see School of Education)	

ART HISTORY: 34-45 SEMESTER HOURS IN THE MAJOR REQUIRED

<i>Required Courses</i>	<i>Semester Hours</i>
Any two of the following: F.A. 100 or 101, F.A. 120 or 121, F.A. 150 or 151	4-6
Any four lower division art history (280 series)	12
Any six upper division art history	18

STUDIO ARTS: 31-45 SEMESTER HOURS IN THE MAJOR REQUIRED

<i>Required Courses</i>	<i>Semester Hours</i>
F.A. 100 or 101. Basic Drawing	2 or 3
F.A. 120 or 121. Basic Painting	2 or 3
F.A. 150 or 151. Basic Sculpture	2 or 3
Any three lower division art history (280 series)	9
Any two upper division art history	6
Upper division FA/FAH elective (minimum)	10

BACHELOR OF FINE ARTS DEGREE REQUIREMENTS

The B.F.A. (a professional degree) is offered in art education, art history, and studio arts. Application to the B.F.A. program is required for art education and studio arts.

1. Students in each area (art education, art history, or studio arts) must complete the B.A. requirements for the area *plus* an additional 5 to 12 hours of FA/FAH electives: 50-67 hours *in the major*.

2. Students should apply for the B.F.A. program (art education or studio arts) when they are at least first-semester juniors. In addition, students should have completed a minimum of 25 semester hours in the major.

3. The B.F.A. review is held in April and November. Portfolios are presented by the students for faculty review. Students are notified by mail of the faculty decision to either accept or defer their application.

4. Students must be in attendance at UCB when they apply for the B.F.A.

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 B.A./B.F.A. candidate must complete a minimum of 9/15 hours of fine arts course work 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.

The student must arrange for a *Statement of Major Status* with the Department of Fine Arts during his 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.

Students should be aware that work left in studios and/or exhibited in the Sibell-Wolle 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 artists, museums, collectors, and galleries throughout the country. The exhibitions are held in the Eve Drewelow Gallery and the other two University of Colorado Art Galleries, which are all located in the Sibell-Wolle Fine Arts Building.

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 Collection. 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 African, Asian, European, Islamic, Medieval, North American, Oceanic, and Pre-Columbian 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 PROGRAMS

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 (Art Education) or 20 examples (Studio) of their creative work. Acceptance in the program is based on an evaluation of these as well as a review of undergraduate scholastic achievement.

Master of Arts Degree (Art Education)

Prerequisites. The following are required for admission to regular graduate status:

1. The baccalaureate degree in art or art education from an approved college or school of art and valid certification for teaching art (see 3 below).
2. At least 30 semester hours of acceptable work in art, including a background course in the history of art.
3. Some teaching experience should precede the beginning of 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 with the approval of the art education faculty.

4. Students may be required to complete a qualifying examination early in the graduate program to assist the faculty in advising.

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 specified course work in areas of the Fine Arts Department; up to 6 hours may be devoted to a minor in an academic area approved by the art education faculty adviser. The student must include in his program a minimum of 6 hours in F.A. 564-565 (Seminar in Art Education). It is expected the student will enroll in the Seminar in Art Education *each time* it is offered throughout his graduate program. For those students electing Plan I (degree *with* thesis), 4 hours of F.A. 700 (Master's Thesis) are required within the 24-hour minimum. Students who have been approved for a Plan II program (*without* thesis) will substitute 6 hours of course work beyond the minimum 24 hours in lieu of the thesis enrollment.

A typical minimum program might appear as follows:

<i>Plan I</i>	<i>Plan II</i>
F.A. 564 - 6 cr. hrs. (Seminar)	F.A. 564 - 6 cr. hrs. (Seminar)
F.A. 568 - 3 cr. hrs. (Current Issues)	F.A. 568 - 3 cr. hrs. (Current Issues)
F.A. 700 - 4 cr. hrs. (Thesis)	Studio electives - 9-15 cr. hrs.
Studio electives - 5-12 cr. hrs.	Minor (optional) - 6 cr. hrs.
Minor (optional) - 6 cr. hrs.	Independent Study (Art Education - Research) - 6 cr. hrs.

Examinations. A written comprehensive-final examination of approximately three hours in the field of art education and general theory of art must be taken not more than one semester in advance of the graduation date for those students approved for *Plan II*. For students on *Plan I* the final examination will be oral and must be scheduled during the semester in which the student expects to graduate; this oral examination will deal primarily with the thesis.

Thesis. The thesis must comply in all mechanical features with the specifications of the Graduate School and be approved by the designated faculty adviser and the thesis committee.

Nonthesis (Plan II). With the specific approval of the art education faculty, the student may substitute a nonthesis research study for the written thesis requirement. This approval must be granted in writing on the appropriate Fine Arts Department form. Unless the approval is received, it is assumed the student will pursue Plan I and complete a written thesis. A nonthesis project will only be approved if the student can satisfactorily show his research project cannot be appropriately reported in regular thesis form.

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/fine arts history courses must be at the 500 level or above. F.A. 503 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. Nonstudio 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, with the exception of the thesis 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 year-end review.

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 may select a different adviser at the end of the first semester of graduate work.

When a student has completed at least 24 semester hours of graduate-level work, he or she will be reviewed by a committee of the graduate faculty. At the time of this review the student will be required to submit to the committee (1) examples of his or her studio work and (2) a written statement concerning 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 nonstudio 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.

Thesis Requirement. M.F.A. degree candidates must enroll in F.A. 750 (Master of Fine Arts Creative Thesis) during the final semester. M.F.A. creative thesis work may have been produced earlier in the candidate's program as well as during the creative thesis enrollment. It must take the form of original creative work of acceptable professional standards. The candidate is expected to exhibit proficiency in at least two areas. Concurrent with the exhibition of the candidate's creative work will be an oral comprehensive examination and a brief critical written statement concerning the work. The written statement must be presented in a form consistent with the requirements specified by the Department of Fine Arts and must be accompanied by 6 to 10 slides of work selected from the exhibition by the thesis committee. The slides become part of the Slide Collection which is housed in the Department of Fine Arts. The thesis committee may retain a piece of work from the exhibition for the permanent thesis collection of the department.

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 Andréé 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. 202 or 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 major in business French is also available (see departmental guidelines). 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 Chambéry 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 is available. For further information 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. See the department's guidelines for M.A. candidates.

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 soon 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 of the Environment (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 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 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. Graduate-level course work at the Boulder Campus may be combined with graduate courses offered at the Denver and Colorado Springs campuses. 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.

Master's and Doctor's Degrees

All incoming graduate students are requested to consult with a departmental adviser to outline their academic programs 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. All entering graduate students fulfill a preliminary evaluation requirement, which consists of completing, with an average of *B* or better, three courses: a proseminar in physical geography, a proseminar in human geography, and Geog. 615, no later than the second semester of residency. When the individual's schedule permits, the student should attempt to complete the requirement during the first semester of residency. When a student has a full-time job and cannot take three courses by the end of the second semester of residency, the same evaluation rules will apply, but only after the student has had opportunity to take the three requisite courses.

A preliminary evaluation committee recommends methods of deficiency removal, if any, and whether the student is recommended for continuation toward an advanced degree after the three required courses are completed. Courses taken prior to official admission into the degree program may not be used to satisfy the preliminary evaluation requirement. Consult the department for additional details.

GEOLOGICAL SCIENCES

*Office in Geology Building, Room 205A
Professor Erle Kauffman, Chairman*

BACHELOR'S DEGREE REQUIREMENTS

Students who wish to major in the geological sciences (Major Code 129) must apply to the department for admittance. Application is normally made late in the sophomore year, after the student has completed the following courses with a grade-point average of 2.3 or better:

1. Geol. 101-102/153-201, plus:
2. Any four of the following courses:
 - (a) Chem. 103
 - (b) Chem. 106
 - (c) Math. 130
 - (d) Math. 230
 - (e) Phys. 111
 - (f) Phys. 112-114 (laboratory)
 - (g) EPOB 121-123 (laboratory)
 - (h) EPOB 122-124 (laboratory)

Because the number of majors is limited, even successful completion of these requirements will not guarantee acceptance into the program; top applicants will be admitted until the limit is reached. Once in the program, students must maintain minimum academic standards (a 2.0 average in all geology courses and a 2.0 average in the additional courses in mathematics and allied sciences that are required for the major) or risk being dropped from the program.

Students who are interested in the geological sciences but have not been admitted to the major program should register for the pregeology program (Major Code 164).

Transfer students who are accepted directly into the major program must satisfactorily complete a minimum of 12 semester hours of advanced work (300 level or above) in the Department of Geological Sciences in Boulder, if they wish to obtain a degree in geology from the University of Colorado at Boulder. Before registering for the first time, or within the first week of the semester, such students must see a member of the departmental Academic Progress Committee so as to have previous course work in geology, mathematics, and allied sciences evaluated.

The major program contains five curriculum options, all leading to a B.A. degree in the geological sciences. A student should select an option appropriate to the student's interests and objectives. Information on the curriculum options and other departmental requirements 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 3 hours of Geol. 970 under the supervision of the advisory committee, or 5 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 a program in Germany for undergraduate students. 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.

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, students wishing to use such courses 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 Hellem's Building, Room 204
Professor George Pilcher, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Students majoring in history must complete a minimum of 30 semester hours of history courses with a grade of C or better. Not more than 45 semester hours in history will apply to the 124-semester hour requirement for the Bachelor of Arts degree. A student must have a grade-point average of at least 2.0 in the major in order to graduate.

All history majors must complete Hist. 151-152 (6 semester hours) and one of the following course sequences: Hist. 101-102, 103-104, 105-106, 141-142, or 181-182 (6 semester hours each). Any one of these course sequences will satisfy the first-year social science requirement of the College of Arts and Sciences.

All majors must also complete one course at the 300 level titled Selected Readings or Research Seminar. Senior history majors may substitute a 600-level course titled Readings or a 700-level course titled Research Seminar for this requirement.

A history major must also complete a minimum of 18 semester hours of upper division (300-400 level) course work in history.

Completion of course work for the major in history will not automatically satisfy the second year social science requirement of the College of Arts and Sciences.

Transfer students majoring in history must complete at least 12 semester hours of upper division history courses at the University of Colorado at Boulder.

Students may receive credit for Hist. 101-102 and/or 151-152 by advanced placement.

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 a broad liberal arts education 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. A total of 30 credit hours and dissertation is required for the degree. 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 doctoral candidates.

HONORS PROGRAM (CENTER FOR INTERDISCIPLINARY STUDIES)

Office in Norlin Library
Professor Walter Weir, Program Chairman

The Honors Program at the University of Colorado is designed to provide special educational opportunities for particularly able and highly motivated students. It is open to well-prepared freshmen as well as to students who enter the program at a later stage. The Honors Program offers a guide to a carefully constructed curriculum in the liberal arts, thoughtful advising, close contact with faculty and with other honors students, and an opportunity to write an honors thesis, outside the student's major, under close supervision. Students will become conversant with the humanities, the social sciences, and the natural sciences.

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.

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 30 honors courses in a wide variety of areas are offered; each course is limited to an enrollment of 15 students. Candidates are required to take the honors course in Science and Values and the Senior Colloquium and to write a Senior Thesis.

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 in Norlin Library, either in person or by mail. 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 3.3, no student who shows ability and promise is excluded from consideration.

HUMANITIES

Office in Ketchum Building, Room 128
Assistant Professor Nancy Hill, 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. 940) for a maximum of 6 semester hours of credit. Guidelines and proposal applications, as well as advising, are available in the Center for Interdisciplinary Studies Office, Ketchum 226.

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):

	<i>Semester Hours</i>
Anth. 461. 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 1914	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 Relations	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, university-level 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 Hellem 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. 462. Ethnography of the American Southwest	3
Anth. 463. Ethnography of Mexico and Central America	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
Geog. 381. Latin America	3
Hist. 181. History of Latin America: The Colonial Experience	3
Hist. 182. 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. 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. 412. Women in Spanish-American Literature	3
Span. 420. Hispanic Culture	3
Span. 422. Mexican Literature	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
Professor Allan Taylor, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Majors in linguistics must complete a total of 45 hours of study in general linguistics, a natural language, and appropriate language-related electives. Language study, and some or all elective hours, may be taken in other departments. The three-way division of the major is intentional. The hours in general linguistics are intended to give the student the basic theory which underlies the scientific study of language. The study of a natural language is intended to give the student a self-conscious awareness of the phenomena which linguistic science describes and seeks to explain. The language-related electives are intended to acquaint the student with other theoretical or disciplinary perspectives on the phenomena which linguistics studies.

Requirements

1. Satisfaction of the regular college requirements for the Bachelor of Arts degree.
2. Completion of the following courses in general linguistics with a grade of C or better.

	<i>Semester Hours</i>
Ling. 100. Language	3
Ling. 200. Introduction to Linguistic Science	3

Ling. 330. Linguistic Analysis	3
Ling. 401. The Nature of Grammars	3
One course from each of the following pairs:	
Ling. 343. Semantics	
OR	
Ling. 350. Language and the Public Interest	3
Ling. 493. Linguistic Phonetics	
OR	
Ling. 460. Phonology of English for Teachers of English to Speakers of Other Languages	3
Ling. 497. Introduction to Diachronic Linguistics	
OR	
A course in the history of a particular language	3
Ling. 440. Introduction to Transformational-Generative Grammar	
OR	
Ling. 461. English Structure for Teachers of English to Speakers of Other Languages	3

3. Completion with a grade of C or better of a minimum of 15 hours of study of a natural language. All hours offered in satisfaction of this requirement must be in a single language and at the 200 level or above. Students selecting English must include the following courses: Engl. 485, Ling. 460, 461. All courses not specifically listed here must be approved in advance by the undergraduate adviser.

4. Completion of any courses which are prerequisite to electives to be offered in the major.

5. Completion of elective courses to be offered in the major with a grade of C or better. A large number of courses appropriate to this area of the major are taught in various university schools, departments, and programs, such as anthropology, communication, communication disorders and speech science, computer science, education, linguistics, modern languages, philosophy, sociology, and psychology. A list of suggested courses, periodically updated, is available from the undergraduate adviser. In any case, courses submitted in satisfaction of this requirement must have the prior approval of the undergraduate adviser. A total of 6 hours of elective courses are required, except as specified below.

For students choosing English to satisfy the natural language requirement, Ling. 460 and 461 also satisfy 6 hours of the general linguistics requirement. Such students must take a total of 12 hours of approved electives to fulfill the total of 45 hours for the major.

Depending on the choice of courses, a student can finish the B.A. in linguistics with either a theoretical or an applied emphasis. Since there is a great deal of latitude for individual choice, students majoring in linguistics should consult the undergraduate adviser at the beginning of each registration period.

Language study and some other 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 the matter 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. 200 (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.

2. The following courses, or equivalents:

Semester Hours

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 18 hours which will include (a) 4 to 6 thesis hours, (b) at least 6 hours of courses designated Ling. in this catalog, and (c) up to 6 hours of electives approved in advance by the graduate adviser.

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. 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

The department ordinarily admits to the Ph.D. program only students who have completed the M.A. in linguistics or in another field, although a student without the M.A. might be admitted to the Ph.D. program in some special cases. In any event, the department reserves the right to require that any individual student satisfy all the M.A. requirements through Plan I before acceptance into 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. (subject to possible reevaluation and readjustment by the student's committee) follow. All of the requirements, and the Graduate School language requirement, must be satisfied before the student will be admitted to the comprehensive examination.

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.

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 nonintroductory 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:

- a. 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.
- b. 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.
- c. The student may present a master's degree in anthropology, psychology, sociology, mathematics, or computer science.
- d. 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 nonintroductory courses. This knowledge may be demonstrated in one of the following ways:

- a. 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. 633, 634, 641, 642, 643, 697.

5. Three 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. Normally the dissertation will be directed by a member of the Linguistics Department. If the student wishes to write under the direction of someone outside the department, the topic and director must be approved by the department chairman. The dissertation committee, which is selected by the student, consists of the director and four additional members. At least one member of the committee, but no more than two, must be chosen from outside the Department of Linguistics. This committee will meet formally with the candidate to consider a dissertation prospectus no later than one year after the student's formal advancement to candidacy. The prospectus will normally consist of a review of the literature relevant to the topic and a description of the research plan and expected results. The final form of the prospectus must be approved formally (with amendments as necessary) by the entire dissertation committee. The same committee will usually serve as the examining committee for the dissertation defense.

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.

MATHEMATICS

Office in Engineering Classroom Building, Room 2-38
Professor Daniel W. Stroock, 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 (Math. 587 may not be counted in these 6 hours).

Mathematics majors may *not* use mathematics courses to satisfy either the humanities or the natural sciences requirement of the college.

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, offered through the College of Engineering and Applied Science, should see elsewhere in this catalog under the heading Applied Mathematics.

Information on the various options for both the B.A. and B.S. degrees is available from the department.

Students should obtain a major requirement sheet from the Mathematics Department office.

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 or in distributed studies with mathematics as one area 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 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. 651-3. Studies in Medieval Literature.
F.A. Hist. 506-3. Art of Islam.
F.A. Hist. 507-3. Byzantine Art. (Clas. 520)
F.A. Hist. 578-3. Romanesque Art.
F.A. Hist. 579-3. Gothic Art.
Fr. 525-3. Medieval and Renaissance Readings.
Ger. 524-3. Early German Literature.
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. Problems in Medieval History.
Hist. 723-3. Latin Paleography. (General Classics 723.)
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. 521-3. Introduction to Middle High German.
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, Huse); plant taxonomy and phyto-geography 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, Campus Box 218, 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. 940-variable credit. Independent Study.
Anth. 950-variable credit. Guided Study.
Anth. 960-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 467/567-2 to 4. Biology of Mollusks.
EPOB 940-1 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. 940-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. 950-variable credit. Independent Study.
Geol. 960-variable credit. Research.
Geol. 700-4 to 6. Master's Thesis.
Geol. 800-0 to 8 (16 to 24 maximum). Doctor's Thesis.

MUSIC

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

Mus. 183-3. Appreciation of Music.
Mus. 275-3. Introduction to American Music.
Mus. 276-3. Music and Drama (1000-1970).
Mus. 277-3. World Music.
Mus. 382-3. Music Literature I.
Mus. 383-3. Music Literature II.
Mus. 464-3. History of Jazz.
Mus. 489-3. Latin American Music.
Mus. 379-3. 20th-Century Music and Media.

ORIENTAL AND SLAVIC LANGUAGES AND LITERATURES

Office in McKenna Building, Room 16

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. At present Chinese or Japanese is required for Asian Studies majors concentrating on China or Japan, 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) 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 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.

All students planning a major in either Chinese or Japanese 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 Kobe, Japan, and Taipei, Taiwan. 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, contact the department.

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.

Students studying Russian are encouraged to consider the possibility of participating in the study abroad program in the U.S.S.R. through CU. Information on this program can be obtained through the Office of International Education.

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 Helms Building, Room 169, Campus Box 232
Associate Professor Jerry Martin, 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), Metaphysics and Epistemology (Phil. 335), Ethical Theory (Phil. 302), a logic course (Phil. 244 or 444), Twentieth-Century Philosophy (Phil. 404), and one course concerned with a single philosopher (or a substitute as approved by the student's adviser).

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, 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.

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.

The department offers four special M.A. programs: in Comparative East/West Philosophy, History and Philosophy of Science, Policy and Decision Assessment, and Major Philosophies: Traditional and Modern. These programs are described in the *Graduate Program in Philosophy* folder.

Beyond the required course work and examinations for the Ph.D., a diversified faculty provides opportunity for a wide range of specializations in the dissertation project. The department makes available a limited number of teaching assistantships and assists with job placement. The Ph.D. program is described in the *Graduate Program in Philosophy* folder.

PHYSICAL EDUCATION

Office in Temporary Building 1, Room 113
Professor Waldean A. Robichaux, Chairman

BACHELOR'S DEGREE REQUIREMENTS (B.S.P.E.)

Kinesiology Program

Three Degree Plans: Exercise Science, Motor Behavior, and Sports Humanities. The primary aim of the kinesiology program is to provide students with a scholarly understanding of the multidimensional aspects of the study of human movement. The three program plans do not include teacher preparation. Generally students wishing to prepare for graduate work or careers utilizing a strong background in physical education should choose one of these program plans. Students pursuing these degree plans are strongly urged to include the College of Arts and Sciences foreign language requirement.

Combined Major

This degree plan allows a student to combine physical education courses with a minimum of 18 semester hours of course work in other areas or disciplines. Courses may be chosen from anthropology, biology, business, communication, dance, fine arts, history, journalism, philosophy, psychology, recreation, health sciences, and sociology. (No foreign language requirement.) The student's program must be planned in consultation with a physical education adviser. Double majors can be undertaken.

Semester hours 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 the College of Arts and Sciences Area Requirements, General and Major Requirements, and Scholastic Dismissal.

A minimum of 32 and a maximum of 50 semester hours of credit in physical education may be counted towards the B.S.P.E. degree. The specific courses that may be counted to meet the above requirements are determined by the Department of Physical Education and Recreation and the dean of the College of Arts and Sciences. Information regarding the specific requirements of the various curricula options may be obtained from the departmental office.

Teacher Certification

The teacher certification program emphasizes the knowledge, skill, and experience necessary for teaching physical education, health, and special physical education. Courses can be added for coaching and athletic training. Specializations are available for different levels of teaching (elementary, secondary, or both). (No foreign language requirement.) A 2.5 grade-point average is required for admission to all methods courses. Teacher certification in dance can be undertaken (see Department of Theatre and Dance for specific course requirements).

Education Courses Required

Physical education majors who have been accepted into the teacher education program must take certain required courses in teacher education 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 requirements prior to their final year. During the junior year students should check with their major adviser and the School of Education concerning the Teacher Education Program. A 2.5 grade-point average is required for admission to student teaching.

GRADUATE DEGREE PROGRAM

To obtain materials for application and for any additional information, address inquiries to the graduate committee 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 or recreation equivalent to the undergraduate major in physical education at the University of Colorado or make up undergraduate deficiencies.

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 degree is not 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. 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.

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

Each student seeking the B.A., the B.F.A., or the B.S. degree must present two two-semester course combinations in each of the following areas: humanities, natural science, and social science. An area requirement may be satisfied in this college in one of two ways: (1) by taking one first-year course combination from the College List followed by one second-year combination for which the first-year combination is prerequisite; or (2) by taking one first-year combination in

one department and one first-year combination in a different department.

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 Leisure and Recreation	3
Rec. 401. Program Planning	3
Rec. 490. Research and Evaluation in Physical Education and Recreation	3
<i>Requirements for Recreation Options</i>	
<i>Community Recreation</i>	
Rec. 212. Recreation Leadership Skills	3
Rec. 310. Principles of Community Recreation	3
Rec. 317. Fieldwork in Community Recreation ¹	1-4
Rec. 403. Park and Recreation Areas and Facilities	3
Rec. 405. Management and Evaluation	3
Rec. 410. Administration of Community Recreation	3
Rec. 418. Internship in Community Recreation ¹	10
Rec. 440. Financial Management	3
P.E. 502. Legal Aspects of Physical Education and Recreation	3
Rec. 441. Independent Study in Community Recreation	1-3
Five nonrecreation upper division courses to be decided in consultation with community recreation adviser. A minimum of two separate experiences and 3 credit hours is required in fieldwork.	
<i>Outdoor Recreation</i>	
Rec. 320. Principles of Outdoor Recreation	3
Rec. 337. Fieldwork in Outdoor Recreation ¹	1-4
Rec. 403. Park and Recreation Areas and Facilities	3
Rec. 405. Management and Evaluation	3
Rec. 420. Management of State and Federal Parks and Recreation	3
Rec. 440. Financial Management of Parks and Recreation	3
Rec. 442. Planning of State and Federal Parks and Recreation	3
Rec. 428. Internship in Outdoor Recreation ¹	10
Rec. 942. Independent Study in Outdoor Recreation	1-3
Five nonrecreation upper division courses to be decided in consultation with outdoor recreation adviser. A minimum of 2 credit hours is required in fieldwork.	
<i>Therapeutic Recreation</i>	
Rec. 212. Recreation Leadership Skills	3
Rec. 330. Principles of Therapeutic Recreation	3
Rec. 337. Fieldwork in Therapeutic Recreation ¹	1-4
Rec. 430. Techniques of Therapeutic Recreation	3
Rec. 434. Clinical and Community Aspects of Therapeutic Recreation	3
Rec. 438. Internship in Therapeutic Recreation ¹	10
P.E. 448. Gerontology in Physical Education and Recreation .	3
Rec. 943. Independent Study in Therapeutic Recreation	1-3
Five nonrecreation upper division courses to be decided in consultation with therapeutic recreation adviser. Two 2-credit hour experiences are required in fieldwork.	

¹Recreation major status and preregistration approval are needed for all fieldwork and internships.

Commercial Recreation (Limited Enrollment)

Rec. 340. Principles of Commercial Recreation	3
Rec. 337. Fieldwork in Commercial Recreation'	1-4
Rec. 405. Organization and Evaluation in Recreation	3
Rec. 440. Financial Management in Recreation	3
Rec. 448. Internship in Commercial Recreation'	10
Rec. 944. Independent Study in Commercial Recreation	1-3
Econ. 201, 202. Principles of Economics	3,3
Acct. 200. Introduction to Accounting (Financial Aspects)	3
Mktg. 300. Principles of Marketing	3
Fin. 305. Basic Finance	3
Org. Mg. 330. Introduction to Management Organization	3
B.Law. 300. Business Law	3

A minimum of 2 credit hours is required in fieldwork.

All courses applied to the major must show a grade of C or better (cannot be taken *pass/fail*).

PHYSICS

Office in Duane 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 physics. *Plan 2* (minimum of 36 hours of physics courses) is intended for students who desire an undergraduate concentration in astrophysics, atmospheric physics, or geophysics, or who want to combine a physics major with work in other areas such as applied mathematics, biophysics, chemical physics, environmental sciences, 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 division 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 (divisional) 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 divisional 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. 301 and then decides upon a physics major to go directly into Phys. 112. Similarly, it is not essential for students who have completed Phys. 302 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 divisional adviser, usually *prior* to the junior year. These interdisciplinary courses must be approved by the Arts and Sciences Advising Committee; *it is therefore imperative that students in Plan 2 be in close contact with their advisers.* Astro-Geophysics courses numbered 300 or above are acceptable to meet the Plan 2 interdisciplinary requirement.

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.

'Recreation major status and preregistration approval are needed for all fieldwork and internship.

Combinations of courses which are recommended for meeting the College of Arts and Sciences area requirements are Phys. 101 and 102, Phys. 111 and 112, Phys. 301 and 302, A.G. 111 and 112, and A.G. 113 and 114; a more extensive list of possibilities is published in the *Schedule of Courses*.

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, and low temperature physics. 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, chemical physics, geophysics, and mathematical physics are offered jointly with the Departments of Electrical Engineering, 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 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.

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. A student who fails the comprehensive examination on his first attempt may take the examination once more a year later.

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.

Final Examination. The final examination is oral and covers the thesis.

POLITICAL SCIENCE

Office in Ketchum Building, Room 106

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. A minimum of 21 hours must be in upper division courses. No more than 45 hours in political science courses will count toward the 124 hours the College of Arts and Sciences requires for graduation. All undergraduate transfer students majoring in political science must accumulate a minimum of 45 grade points in upper division political science courses at the University of Colorado in order to qualify for the B.A. degree.

Specific Requirements

1. At least 9 hours must be in the following lower division courses:

- P.Sc. 110 (or 101 and 102)
- P.Sc. 201 (or 211 and 212), or 202
- P.Sc. 222
- P.Sc. 240

Political science majors are not permitted the pass/fail option in any of the above courses. Majors 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).

2. At least 6 hours of upper division courses must be taken in each of the three primary fields: American, International-Comparative, and Theory. No course may be used in satisfaction of more than one field requirement.

3. P.Sc. 439, History of Political Philosophy, is required. Political science majors are not permitted the pass/fail option for this course.

4. The following specific courses are required in related fields: Econ. 201 and 202, Principles of Economics. These two courses are in addition to the 36 hours required for a major in political science and must be passed with a grade of *C* or better. Political science majors are not permitted the pass/fail option for these two courses.

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, with grades of *C* or better: P.Sc. 110 (or 101/102); P.Sc. 210; P.Sc. 432; Econ. 201 and 202.

3. At least one upper division course is required, with grade of *C* or better, in political theory and in the international/comparative field.

4. At least five courses from the following list, (with grade of *C* or better), 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

State Government

P.Sc. 402. Legislatures and Legislation	3
P.Sc. 406. State Government and Administration	3

Federal

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. 437. Public Priorities: Revenues and Program Expenditures	3
P.Sc. 456. Bureaucratic Power in American Politics	3

Law

P.Sc. 248. Introduction to the American Legal Process	3
P.Sc. 446. Administrative Law	3
P.Sc. 447. Constitutional Law I	3
P.Sc. 448. Constitutional Law II	3
P.Sc. 449. The Judicial System	3

Other Departments

Econ. 421. Public Finance I	3
Econ. 422. Public Finance II	3

5. A three-semester sequence must be completed, with grade of *C* or better, in two of the following three areas:

Accounting — Acct. 200, 202, 322 (or 480) 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.

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

Minimum requirements for admission to the graduate program in political science are 18 semester hours of work in the subject, 9 hours of which must be in upper division courses. 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

Students desiring a graduate major in political science should present 18 semester hours of undergraduate 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 hourly requirements for the degree.

Political science is divided into seven fields: (1) American Government and Politics, (2) Comparative Politics, (3) International Relations, (4) Public Administration, (5) Law and Politics, (6) Political Philosophy, and (7) Empirical Theory and Research Methods. Students shall concentrate in any one of the fields and offer 3 semester hours of work in regularly scheduled political science seminars in each of three areas defined as follows: American, including (1), (4), and (5) above; International, including (2) and (3) above; and Theory, including (6) and (7) above.

Students are responsible for familiarizing themselves with all degree requirements, some of which are outlined in the Graduate School section of this catalog. In brief, the degree requirements include a minimum of 25 semester hours of graduate credit, encompassing (a) at least 21 semester hours at the 500 level or above, to include at least 12 semester hours of work in regularly scheduled political science seminars; and (b) 4 semester hours for the M.A. thesis. Students may offer up to 6 hours in (1) P.Sc. 599 and/or P.Sc. 699, and (2) up to 6 hours in a cognate discipline (graduate seminar, senior undergraduate course, or independent study), but not more than a total of 9 hours may be in (1) and (2) combined. These 9 semester hours may not be substituted for required seminars. The student must take work from at least four members of the graduate faculty.

Students shall select a faculty adviser from among the regular members of this department's graduate faculty at the earliest possible date, but no later than the end of the second week of the second semester of residence. The faculty adviser must have general competence¹ in the student's primary field of emphasis and will serve as the first reader of the M.A. thesis. The second reader, who shall likewise have general competence in the topic of the M.A. thesis, must be associated intimately with the thesis from its inception and in no case after the student begins writing. The completed draft of the thesis must be in the hands of the second reader, and of other readers if appropriate, at least four weeks prior to the Comprehensive Examination.

The purpose of the thesis is to build on mastery of the substantive materials for the chosen topic in order to apply one or more conceptual/analytic devices to those materials and to end with a sophisticated, systematic conclusion.

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 examination will be oral and last approximately two hours. It will concentrate on the student's field of emphasis as well as the M.A. thesis. The Comprehensive Examination Committee will have three members, including the faculty adviser (in the chair) and the second reader of the thesis. At least two committee members must be chosen from among regular members of the graduate faculty of this department, in consultation with the faculty adviser; the third committee member may be a Graduate Faculty representative from a cognate discipline. Satisfaction of the examination requires the affirmative vote of each of three committee members.

M.A. comprehensive examinations shall normally not be given during the summer months. In exceptional circumstances, a student may petition the Graduate Curriculum Committee of the department, showing cause why this rule should be waived. Such a petition shall be received no later than April 15.

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

¹Someone whose areas of general competence in given fields are those listed as either (1) or (2) on the current Faculty Field Roster which is available from the political science departmental office.

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.

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.

RELIGIOUS STUDIES

Office in Woodbury Building, Room 205
Professor Robert C. Lester, Chairman

Religious studies is a humanistic discipline, centrally concerned with the history and phenomenology of religions and religious experience. 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.

SOCIOLOGY

Office in Hellems Building, Room 290
Professor Blaine E. Mercer, 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. Pass/fail grades are not acceptable in satisfying the 30 semester hours for a sociology major. Not more than 8 semester hours of independent study may be counted toward the 30 semester hours in the major and not more than 16 hours may be counted toward the bachelor's degree.

Courses required for the major are Introduction to Sociology I and II (Soc. 211 and 212), plus one of the following 6-credit-hour courses: Research Methods in Sociology (Soc. 463) and Field Experience in Sociology (Soc. 464). Students should contact the departmental office for further clarification of major requirements.

For the purpose of course selection in relation to a graduate student's declaration of the major areas of concentration, a student is advised to consider the following groupings of courses which are classified into four areas: Theory, Methods, Institutions, and Applications. Courses that can be taken in each area are:

Theory: 500, 501, 515, 516, 519, 523, 527, 532, 540, 565, 576, 615, 616, 640.

Methods: 502, 503, 504, 505, 506, 507, 510, 603, 611, 663.

Institutions: 508, 526, 547, 555, 561, 567, 577, 586, 587, 588, 589.
Applications: 535, 546, 569, 583, 584, 599, 626, 689.

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 3.0 (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.

Master's Degree

The department offers the M.A. degree in two general types: (1) an in-transit M.A. for students in the Ph.D. program who have satisfied course requirements (24 hours) and passed the Ph.D. comprehensive examination (or an M.A. comprehensive final examination) or have written an M.A. thesis; (2) an emphasis in applied sociology (now being developed by the department Graduate Committee), designed as a shorter program preparing students for work in areas of human services, computer science, evaluation research, conflict management, and basic social research methods. Requirements include a certain number of graduate-level courses taken on the Boulder campus, an internship, and a comprehensive examination or thesis.

For information on the special programs currently available, contact the graduate secretary of the department and obtain the *Graduate Handbook* of the department.

The Doctorate

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 at Boulder.

2. The following required courses must be included in the 54 hours minimum: 6 semester hours of sociological theory (Soc. 500 and 501); 6 semester hours of methods and statistics (Soc. 502 and 503); and 3 semester hours of research practicum (Soc. 504, 505, 506, 507).

3. Before a student accumulates 24 hours of graduate credit in the department, he or she 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, 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 (at the 200 level or above), 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 International Spanish for the Professions is offered with the same requirement

as paragraph 1, except that 12 hours in business Spanish courses (303-304, 406-407) will be substituted for the literature courses. (See department for additional requirements. This is a controlled enrollment program with limited space. The student must apply for admission at the beginning of the fourth semester.)

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 wishing to receive teaching certification in Spanish must have completed 6 credits chosen from Span. 305, 405, 408.

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 or credit earned in CU Study Abroad programs 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 communication 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 written and oral final examination 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 Daniel S. P. Yang, Chairman

BACHELOR'S DEGREE REQUIREMENTS

Majors are available for the B.A. and B.F.A. degrees 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. 181-188. Dance Techniques: Ballet	2
Dnce. 191-198. Dance Techniques: Modern	12
Dnce. 197. Recreational Dance Forms	1
Dnce. 214. Improvisation	2
Dnce. 290. Beginning Composition	3
Dnce. 380. Musical Accompaniment for Dance	3
Dnce. 413. Children's Dance	3
or	
Dnce. 415. Methods of Teaching Dance	3
Dnce. 390. Intermediate Dance Composition	3
or	
Dnce. 490. Advanced Dance Composition	3
Dnce. 491. History and Philosophy of Dance	3
Dnce. 492. Dance in the 20th Century	3
Dnce. 493. Performance Events	2
	37

A minimum of 3 credits 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 I/II	3
Thtr. 276. Stagecraft	3
Thtr. 377. Costuming	3
Thtr. 474. Directing	3
Thtr. 479. Theatre Practice (Music Theatre)	3
Thtr. 483. Touring Theatre — Dance	3-12
Thtr. 486. Lighting Design	3

A teacher's certification program in dance (Bachelor of Science in Physical Education degree) is offered by the Department of Physical Education in cooperation with the Dance Division. All dance courses are taught by the faculty of the Dance Division. It is essential that students wishing to pursue the Bachelor of Science degree plan their programs in consultation with an academic adviser in the Physical Education Department and the Dance Division.

Theatre

Majors must complete a minimum of 45 semester credits, as follows:

	<i>Semester Hours</i>
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
Thtr. 474. Directing	3
Electives in theatre (up to 5 credits may be practicums)	11
Electives in dance/and interpretation	9
Electives in dramatic literature	6
(The 6 credits from dramatic literature shall be from the following: Engl. 130, Engl. 397, Engl. 398, Engl. 431-437, or any approved foreign language dramatic literature.)	

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. The requirements for the B.F.A. in Theatre are listed below. Students should contact the Dance Division office for information concerning requirements for the B.F.A. in dance.

Requirements for the Bachelor of Fine Arts Degree in Theatre

The B.F.A. in Theatre offers preprofessional training to a limited number of highly talented students aiming at professional careers. Admission will be limited not only in terms of student capacity but also to insure the type of individual attention necessary for effective training. Interested students should identify themselves as early as possible and formal application should be made at the beginning of the third semester. Selection will be based on talent, academic record, motivation, letters of recommendation, and audition-interviews. Only applicants currently enrolled in the departmental program will be considered. All normal college requirements must be met and the program assumes a normal total of 124 credits for graduation.

The major requirements consist of a basic core of 30 credits in theatre, 3 credits in interpretation, and 2 credits in dance followed by a specialized sequence which meets the approval of the officially designated B.F.A. advisers in acting, costuming, or technical theatre, resulting in total theatre credits of 58-67 plus additional requirements outside theatre but related to the area of concentration.

The B.F.A. basic core curriculum is as follows:

	<i>Semester Hours</i>
Thtr. 270. Introduction to Theatre	3
Thtr. 273. Acting I	3
Thtr. 276. Stagecraft	3
Thtr. 482. History of Costume I	3
or	
Thtr. 487. History of Costume II	3
Thtr. 474. Directing	3
Thtr. 471. History of Theatre I	3
Thtr. 481. History of Theatre II	3
Thtr. 472. Theatre of Asia	3
Thtr. 321. Practicum in Costume	1
Thtr. 322. Practicum in Technical Theatre	1
Thtr. 323. Practicum in Management	1
Thtr. 324. Practicum in Acting	1
Thtr. 327. Practicum in Makeup	1
Intp. 250. Introduction to Interpretation	3
Dnce. Dance technique at appropriate level	2

The advanced sequence of specialization must be cleared at all stages with the appropriate B.F.A. adviser. The general pattern of advanced sequence requirements will be explained by the adviser, who will also determine what modifications are in the best interest of meeting the developmental needs of the individual student.

The general pattern of advanced sequence requirements is as follows:

<i>Theatre Performance</i>	<i>Semester Hours</i>
Dnce. Dance Technique	1
Intp. 350. Oral Interpretation of Literature: Poetry	3
Intp. 352. Voice	3
Intp. 452. Dramatic Interpretation: Tragedy	3
Intp. 453. Dramatic Interpretation: Comedy	3
Thtr. 373. Acting II	3
Thtr. 473. Acting III	3
Thtr. 484. Acting IV	3
Thtr. 424. Practicums in Acting and Interpretation (Must include regular season, summer repertory, senior project)	7

Theatre Technical Production

Thtr. 482. History of Costume I	3
or (whichever not taken in core)	
Thtr. 487. History of Costume II	3
or	
Thtr. 376. Advanced Stagecraft	3
Thtr. 377. Costume	3
Thtr. 476. Scene Design	3
Thtr. 477. Costume Design	3
Thtr. 486. Lighting	3
Thtr. 421. Practicum in Costume	3
or	
Thtr. 422. Practicum in Technical Theatre	3
(Must include basic design, rendering, construction, design, senior project)	

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 upon entrance. 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 designated so that a degree plan may be designed prior to the end of the first semester of 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.

Plan I With Thesis. After any undergraduate deficiencies have been removed, students under Plan I must normally earn 30 semester hours, all of which must be at the 500 level or above. Four to 6 thesis credit hours may be counted toward the 30-hour requirement.

Plan II With Project (Creative and/or Analytical). After any undergraduate deficiencies have been

removed, students under Plan II must earn 30 semester hours, all of which must be at the 500 level or above. Three project credit hours must be counted toward the 30 hours.

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.

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. In addition, the program encourages the integration of women's perspectives in the traditional curriculum. Students should consult the *Schedule of Courses* or the Women Studies brochure for a complete listing of classes in women studies and cross-listed courses in other departments and programs. There are two options available to students interested in concentrating on women studies. A student may develop an Individually Structured Major with a faculty advisory committee and approval of the dean of the College of Arts and Sciences. The program also offers a Certificate Program in Women Studies which requires a minimum of 24 hours in women studies: 12 hours in women studies core courses, 6 hours in cross-listed humanities courses, and 6 hours in cross-listed social sciences courses. The women studies director should be consulted in developing either option. The program offers research materials, a library for university and community use, as well as colloquia, workshops, and other cultural and educational events. *Frontiers: A Journal of Women Studies* is published in association with the program.

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 Health Sciences 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 student 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 both to their state schools and to 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. Since traditionally there are more applicants for these programs than there are spaces available, many 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. Other fields (child health associate, dental hygiene, medical technology, nursing, pharmacy, physical therapy, etc.) do not require an undergraduate degree. 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. 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 department 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 current 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. This information may change without notice. Students are therefore advised to obtain current requirements on the programs and admission requirements from the Health Sciences Advising Office from the specific prehealth adviser listed, or from the program office at the Health Sciences Center. 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 121 and 123, 122 and 124 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 121 and 123, 122, and 124 or MCDB 105, 106)	2

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 121 and 123, 122 and 124 or MCDB 105, 106)	2
Physics, general (with laboratory)	2

¹For especially qualified students, Chem. 107, 108 may be substituted.
²For chemistry majors, Chem. 335, 336 will be substituted.

Mathematics (minimum college algebra and trigonometry)	2
Genetics	1
Literature	2
Expository writing	1

Application normally between junior and senior years with deadline December 1. 25 positions open. Dental Admission Test required.

HEALTH ADMINISTRATION

Requires baccalaureate or advanced degree with a well-balanced undergraduate program. Prerequisites are financial accounting, microeconomics, and basic statistics. Graduate Record Examination is required. The selection committee is seeking candidates with (1) at least 500 on the verbal and 500 on the quantitative sections of the GRE; (2) undergraduate grade-point average of at least 3.0; and (3) some health care experience.

Application deadlines: (1) preapplication — December 31; (2) full application — February 28.

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 121 and 123, 122 and 124 or MCDB 105, 106)	2
Physics, general, with laboratory	2
Mathematics (minimum college algebra and trigonometry)	2
Literature	2
Expository writing	1

Application normally between junior and senior years with 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. Admission is usually limited to Colorado and Wyoming residents and to Native Americans from states adjacent to Colorado.

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 and immunology (Normally EPOB 340. Students may substitute EPOB 440 with instructor's permission.) Remaining credits from general biology (EPOB 121 and 123, 122 and 124 or MCDB 105, 106), physiology, anatomy, histology, or embryology	16
Mathematics. College algebra; familiarity with the principles of calculus is desirable	5-10

Recommended:

Physics, with laboratory (usually Phys. 301, 302), 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. University of Colorado students who are Colorado residents have priority for the program. Minimum science GPA 2.75. 21 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 121 and 123, 122 and 124 or MCDB 105, 106)	8
Microbiology (EPOB 340)	3

Human anatomy (EPOB 324)	3
Chemistry (Chem. 101 and 102, Chem. 103 and 104, or Chem. 103, 106, 331)	8
Physiology (EPOB 343)	6
Sociology, general (Soc. 211)	3
General psychology (Psy. 100)	3
Developmental psychology (Psych. 264, 466, or 468 plus Psych. 230, 415, or 445)	6
Anthropology (Anth. 104)	3
English composition (A & S 100, 101, 102, or 103)	3
Humanities (two-semester sequence in literature, philosophy, art, music, foreign language, dance, fine art, humanities, political science, history, or theater)	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.

<i>Required</i>	<i>Semester Hours</i>
Chemistry, general (Chem. 103, 106)	10
Chemistry, organic (Chem. 331, 332)	8
Biology, general, with laboratory (EPOB 121 and 123, 122 and 124, or MCDB 105, 106)	8
Mathematics (college algebra and trigonometry or calculus)	5
Physics, general, with laboratory (Phys. 301)	5
Economics, micro (Econ. 202)	3
English composition	6
Communication, verbal	3
General education (20 semester hours)	
Psychology and/or sociology	6-8
Humanities	6-8
Natural or social sciences	6-8

Application during sophomore year, deadline March 1 or until quota is filled; 70 positions open. For prepharmacy advising, consult the School of Pharmacy, Ekeley Building, West 181.

PHYSICAL THERAPY

Minimum 90 semester hours required. The professional program at the Health Sciences Center constitutes the senior year.

<i>Required</i>	<i>Semester Hours</i>
Biological sciences	14
General biology (EPOB 121 and 123, 122 and 124 or MCDB 105, 106)	
Anatomy (human preferred—EPOB 342)	
Physiology (human preferred—EPOB 343) (prer., 1 yr. of chemistry)	
Humanities (3 hrs. must be in English composition)	12
Psychology	6
Social science	6
Kinesiology (P.E. 454)	3
Physics, general (recommended content to include mechanics, heat, electricity, magnetism, sound, heat and labs, usually Phys. 301, 302)	8
Chemistry, general, with laboratory (Chem. 101-102)	8

Only Colorado and WICHE students are eligible for the program. Application will be accepted in the junior year after completion of at least 75 hours and the majority of the prerequisite courses. The deadline for applications is January 2 for entrance in June of the same year. 32 positions available. Minimum GPA 2.5. For advising consult the Department of Physical Education.

¹For especially qualified students, Chem. 107, 108 may be substituted.

²For chemistry majors, Chem. 335, 336 will be substituted.

³Because of Boulder Campus course differences, number of hours does not agree exactly with School of Nursing publications.

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 Conference and Management/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	International business
Banking	Investments
Information systems	Management accounting
Consumer credit and mortgage financing	Management consulting
Credit administration	Marketing management
Financial management	Marketing research
Industrial selling and purchasing	Minerals land management
Insurance	Office management
	Operations research

Personnel management	Selling and sales management
Production management	Traffic management
Public accounting	Transportation
Real estate	Wholesaling
Retailing	

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*.

Beta Gamma Sigma

Membership in Beta Gamma Sigma is an honor which must be earned through outstanding scholastic achievement. Such membership is one of the highest scholastic honors that a student in a school of business or management can attain.

To be eligible for Beta Gamma Sigma membership, a student must rank in the top 5 percent of his or her junior class, the top 10 percent of his or her senior class, or rank in the top 20 percent of those students receiving master's degrees. Also, students completing all requirements for the doctoral degree conferred by a business school are eligible for Beta Gamma Sigma. It should be noted that Beta Gamma Sigma chapters may be chartered only in those schools of business and management accredited by the American Assembly of Collegiate Schools of Business.

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:

AIIESEC, 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. Graduate students also honor the outstanding teacher of the year.

ACADEMIC POLICIES—UNDERGRADUATE

The academic policies, rules, and regulations of the college are given below. All students are responsible for knowing and following the provisions set forth in this catalog. Any questions concerning those provisions are to be directed to the college office. The college cannot assume responsibility for problems resulting from a student's failure to follow the policies stated in the catalog or from misadvice given by someone other than a staff member of the college. Similarly, students are responsible for all deadlines, rules, and regulations stated in the *Schedule of Courses*.

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. Students are responsible for being aware of their academic standing at all times and late grades and/or notification does not waive this responsibility. 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, all courses must be listed on the student's dean's page by the Office of Admissions and Records. 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 business 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 must have prior approval in writing by the Office of Undergraduate Studies.

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

The college reserves the discretion of accepting or rejecting all special sources of credit which do not have prior approval of the dean. A maximum of 6 hours of theory physical education, recreation, or dance credits can be accepted toward graduation.

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 of the Dean.

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.

NO CREDIT

Because of space limitations, business classes may not be taken on a no credit basis.

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 and Records, 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.

Grading and Point System

See the General Information section for University-wide grading system and pass/fail policy.

Students in the college may not use courses taken on a pass/fail basis to satisfy required business or non-business courses, or business elective courses. Non-business electives only may be taken on a pass/fail basis. A maximum of 16 hours of pass/fail credit may be applied toward the B.S. degree in business; transfer students may take 1 hour of pass/fail for every 8 hours completed at this institution. Pass/fail determination must be made within the first two weeks of the semester 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. Completion of two units of algebra and two units of English composition is strongly recommended.

Intrauniversity Transfer

Students who wish to transfer to business from another college or school of the University must apply formally 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. 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 and have a senior audit *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 four required area of emphasis courses.

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. Algebra for Social Science and Business	3
Math. 108. Calculus for Social Science and Business	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
Natural science	3
Nonbusiness electives	6
	30
<i>Sophomore Year</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>	
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
<i>Senior Year</i>	
B.Ad. 450, 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. A 2.0 average is required for the four required area courses.

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. Courses in English composition, speech, and ethics and logic are desirable. Courses in statistics and information systems, beyond the required College of Business core courses, are highly recommended.

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

A doctoral program only is offered in conjunction with the School of Education. Consult the School of Education graduate adviser for information concerning the program.

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

<i>Recommended Elective Courses</i>	<i>Semester Hours</i>
Fin. 440. International Financial Management	3
Fin. 434. Security Analysis	3
Fin. 453. Bank Management	3
R.Es. 454. Real Estate Finance	3
Ins. 434. 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 and Q.M. 201, and I.S. 215.

<i>Required Courses: (12 Hours)</i>	<i>Semester Hours</i>
I.S. 350. Database and Information Systems	3
I.S. 465. Systems Analysis and Design	3
I.S. 470. Computerware	3
Q.M. 330. Operations Research	3

International Business

In recent years, companies have completely re-oriented 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.

Students should note that B.Ad. 440 is offered only in the spring semester and the prerequisite is 6 hours of the required courses.

<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
Tr.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. No required

courses (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

Area of Emphasis Courses—College of Business

The following courses comprise the area of emphasis.

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

Organization Management

The organization management curriculum provides the foundation for careers in supervision and general management in a wide variety of organizations. It develops understanding and skill in management practice. The emphasis is on combining both the human resources and the appropriate operations technologies into productive organizations.

<i>Required Courses</i>	<i>Semester Hours</i>
<i>(The following two courses)</i>	
Or.Mg. 335. Managing Individuals and Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3
<i>(At least one of the following)</i>	
PHR 434. Labor and Employee Relations	3
PHR 438. Personnel Administration: Employment	3
<i>(At least one of the following)</i>	
Pr.Mg. 440. Planning and Control Systems in Production and Operations Management	3
Tr.Mg. 450. Transportation Operation and Management	3

Recommended Electives in Addition to the Above

PHR 439. Personnel Administration: Legal and Social Issues ..	3
PHR 441. Personnel Administration: Planning, Development and Compensation	3
Pr.Mg. 444. Work Design, Measurement and Productivity Management	3
Pr.Mg. 447. Policy Analysis in Production and Operations Management	3
Pr.Mg. 460. Purchasing and Materials Management	3
B.Ad. 470. Small Business—Management and Operation	3

Personnel-Human Resources Management

Personnel-human resources management offers opportunities for students to develop professional competence in the areas of personnel administration and labor relations. Students gain understanding and skill in developing and implementing personnel systems including recruitment, selection, evaluation, training and motivation of employees, and union-management relations.

<i>Required Courses</i>	<i>Semester Hours</i>
<i>(The following four courses)</i>	
PHR 434. Labor and Employee Relations	3
PHR 438. Personnel Administration: Employment	3
PHR 439. Personnel Administration: Legal and Social Issues	3
PHR 441. Personnel Administration: Planning, Development, and Compensation	3

Recommended Electives

Or.Mg. 335. Managing Individuals and Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3
Pr.Mg. 444. Work Design, Measurement, and Productivity Management	3
Acct. 332. Cost Accounting	3
L.S. 350. Database and Information Systems	3
Q.M. 300. Intermediate Statistics	3
Soc. 478. Sociology of Work Organization	3
Econ. 161. Labor Economics	3
Psych. 485. Principles of Psychological Testing	3
Psych. 487. Personality Assessment	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.

The outlook for jobs in this area continues to be strong in the 1980s. This placement is aided by the student chapter of the American Production and Inventory Control Society and work intern programs provided to qualified students. Participation in live case research and consulting projects with local organizations is usually an integral part of this course of study.

Students whose major areas of emphasis are information systems, transportation management, or engineering will find the production management 400-level courses to be particularly well related to their course 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, Measurement, and Productivity Management	3
Q.M. 330. Operations Research	3
I.S. 215. Data Processing	3
Mk. 485. Physical Distribution	3
Tr.Mg. 450. Transportation and Operations Management	3

Recommended Electives

I.S. 350. Database and Information Systems	3
Or.Mg. 335. Managing Individuals and Work Groups	3
Or.Mg. 437. Managing Complex Organizations	3
PHR 434. Labor and Employee Relations	3
PHR 438. Personnel Administration: Employment	3
PHR 441. Personnel Administration: Planning, Development, and Compensation	3
Acct. 332. Cost Accounting	3
Q.M. 300. Intermediate Statistics	3

Students planning to take the APICS (American Production and Inventory Control Society) or NAPM (National Association for Purchasing Management) certification examinations should consult with an adviser to determine which elective courses should be taken.

Public Agency Administration

Public agency administration is designed for a career in management of governmental or other nonprofit 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.

Required Courses Semester Hours

Acct. 480. Business and Governmental Budgeting and Control	3
PHR 438. Personnel Administration: Employment	3
O.Ad. 440. Principles of Office Management	3
Q.M. 330. Operations Research	3

Real Estate

Real estate requires knowledge of real estate investing, 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. All classes are not offered every semester and students must plan their schedules carefully.

Required Courses Semester Hours

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:

Semester Hours

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 is 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
PHR 438. Personnel Administration: Employment	3
Mk. 480. Marketing Policies and Strategies	3

Recommended Electives

The fourth course may be selected from the following.

PHR 434. Labor and Employee Relations	3
Pr.Mg. 440. Production and Inventory Planning and Control	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.

<i>Required Courses</i>	<i>Semester Hours</i>
(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
 <i>Recommended Electives</i>	
PHR 434. Labor and Employee Relations	3
PHR 438. Personnel Administration: Employment	3
Tr.Mg. 451. Survey of Transportation: Law and Freight Claims	3
Pr.Mg. 460. Purchasing and Materials Management	3
B.Ad. 470. Small Business—Management and Operation	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.

Students desiring to transfer from combined programs to the College of Business must apply and will be considered as intra-university transfers.

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 science, finance, international business, marketing, mineral land management, production operations management, organizational behavior, personnel-human resources, 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	<u>12</u>
	48

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 and Master of Science 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 master's courses are offered in Boulder. Evening master's 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.

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, two official transcripts from *each* college attended, and a \$20 nonrefundable application fee should be in the Office of Graduate Studies, Graduate School of Business Administration, by March 1 for summer, by April 1 for fall admission, and by October 1 for spring admission. Applications received after these dates will receive lower priority.

Personal interviews are not required or encouraged.

BACKGROUND REQUIREMENTS

Students applying for graduate programs in business need not have taken their undergraduate degrees in business. For those students the M.B.A. or M.S. degree programs provide a series of 3-semester-hour fundamental background courses. These include: B.Ad. 501 (Acct.); B.Ad. 502 (Stat.); B.Ad. 503 (Mkt.); B.Ad. 504 (Mgt. and Org.); B.Ad. 505 (Fin.); B.Ad. 506 (Bus. Law); B.Ad. 507 (Mgt. Sci.); and Econ. 405 (Macro and Micro Econ.). In addition, all graduate students are required to take either B.Ad. 500 (Sources of Information and Research Methods—1 semester hour) or pass a qualifying examination. These fundamental courses do not carry graduate credit, nor may they be used to satisfy requirements for the bachelor's degree in business. They are open only to admitted graduate business students.

Graduate students possessing an undergraduate degree in business must be prepared to present the following acceptable course work in order to waive the relevant graduate fundamental course:

Semester Hours

Introduction to Accounting (Financial/Managerial)	6
Statistics	by qualifying examination only
Principles of Marketing	3
Introduction to Management and Organization	3
Finance	3
Business Law	3
Operations Research	3
Principles of Economics (Macro/Micro)	6

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.

Students entering any of the graduate programs are required to take either B.Ad. 502 (Fundamentals of Business Statistics) or to pass satisfactorily a qualifying examination covering this subject matter.

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	
6	6
b. <i>Business and Its Environment</i>	
B.Ad. 610. Business, Government, and Society	3
c. <i>Analysis and Control</i>	
B.Ad. 615. Business and Economic Analysis	3
B.Ad. 620. Administrative Controls	3
(Accounting students should substitute Acct. 533)	
d. <i>Human Factors</i>	
B.Ad. 640. Organizational Behavior	3
e. <i>Planning and Policy</i>	
B.Ad. 650. Administrative Policy	3
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.

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 either I.S. 565 or 570.

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 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 Jensen
Finance	Professor Melicher
Management Science	Professor Plane
Marketing	Professor Cateora
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	Personnel-human
Finance	resources management
Management science	Production and operations
Marketing	management
Organization management	Transportation management

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 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. A minimum of 16 hours must be at the 600 level.

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.

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 appropriate 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. A comprehensive examination is not required for students pursuing the Master of Business Administration degree program. 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.

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.

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	Personnel-human
Finance	resources management
Management science	Production and operations
Marketing	management
Organization management	Transportation management

As background preparation in the particular field, the student must complete two preparatory fundamentals 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 in 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 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 broadly conceived and are designed to encourage study in the cognate disciplines. Candidates' degree programs are prepared in detail 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. 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.
3. Recommendations from not fewer than three persons qualified to advise the committee concerning the applicant's capacity for doctoral study and research.
4. Information obtained from the applicant concerning his or her career objectives.

REQUIREMENTS FOR DEGREE—D.B.A. PROGRAM

Students in the doctoral degree program must fulfill the following requirements.

Prerequisites. Completion 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 counsel with division heads in the various disciplines to determine a major field. Assignments of faculty members working with doctoral students on their programs must be decided upon by the end of the first semester. This is to be coordinated with the division head and the associate dean for Graduate Studies. The committee shall include two members from the student's dissertation field and at least one member from each other field of specialization, with 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.

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.

Advisory (qualifying) examinations, usually in the form of faculty interviews, are normally given prior to enrollment in the program or during the first two months. These examinations are given in the student's major area for the purposes of insuring the candidate's qualifications, progress, and needs in the program. The results of the examination will be used to advise and qualify the candidate for further work at the doctoral level. All students invited to enroll in the program must be advised of the use and intent of this examination from the division head.

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
Administrative policy
Finance

Management science
Marketing
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).

3. Dissertation research methodology: (B.Ad. 790, Doctoral Seminar in Dissertation Research, and the research internship would be expected to provide this competence).

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.

Doctoral students are required to participate in a research internship under the direction of a faculty member. The research internship is decided upon with the student's program committee. Three hours of independent study credit under the direction of a faculty member is given. By the end of the second year, a second 3-hour independent study research effort is also required. The faculty director of this research effort will be mutually decided upon by the faculty member and doctoral student. At the end of each of these research internships, a research paper is presented to the faculty member and to all faculty members in the area of emphasis of the doctoral candidate.

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 per-

formed 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.

All students in the doctoral program are expected to be full-time students on the Boulder campus (at least during residency and prior to completing comprehensive examinations). Courses at the 600 level or above are expected to be taken on the Boulder campus. Doctoral students are expected to be available to participate in colloquia and other informal academic discussions. One year of residency must include two consecutive academic (not summer) semesters on the Boulder campus, the timing to be determined by the student's program committee.

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.

It is recommended that all students be employed in a teaching or research capacity in the College of Business and Administration or the Graduate School of Business Administration. Doctoral students are not encouraged to be employed elsewhere during the two semesters of full-time residency.

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 certification 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.

Scholarships and Awards

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 Assistantship. Awarded each year to an outstanding female graduate student with an emphasis 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.

The Emery and Evelyn Fitzsimmons Stoops Scholarship is awarded yearly to an outstanding student in education. Competition for the award is automatically open to students having a 3.5 or better grade-point average.

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 cer-

tificate seeking student body. Its officers are elected each fall, and they serve as liaison between the students in certification programs 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

Undergraduate students may obtain certification and adviser information in Education 132 (Director of Teacher Education) or Education 247 (Office of Field Experience) or Education 246 (Advising Office).

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.)

Certification

Each state, including Colorado, requires public school teachers to be certified as a qualified teacher by its state Department of Education. Certification requirements vary from state to state and from teaching area to area.

The University of Colorado at Boulder, through the School of Education, offers course work leading to initial certification (Type A) in:

Elementary Education	Science
Secondary Education	Social Studies
Drama	Speech
English	Elementary/Secondary (K-12)
Foreign Language (French, Spanish, German, Russian, Latin)	Art
Mathematics	Health
	Music
	Physical Education

Teacher certification 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 certification is the assumption that all teachers should

1. Possess professional competencies.
2. Possess personal qualities essential to effective teaching.
3. Have a liberal education.
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 outstanding 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, leadership potential, and personal qualities essential for effective teaching.

4. To cooperate with other state, regional, and federal agencies to improve educational programs.

Accreditation

The teacher certification 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.

GENERAL INFORMATION FOR STUDENTS SEEKING TEACHER CERTIFICATION

Admission Procedures

This section applies to all students (with or without baccalaureate degrees) pursuing a teacher certification program. Students who transfer to the University of Colorado from other institutions must meet the requirements for admission as outlined in the General Information section of this catalog.

Students should be aware that quotas have been established for each area of endorsement in teacher certification; therefore, there may be times when not all students who meet minimum requirements will be admitted. An interview often is required prior to admission. Both elementary and secondary students seeking certification will be required to pass screening examinations in prescribed areas. All students should try to complete general education requirements prior to their final year of study.

STUDENTS ENTERING OR CURRENTLY ENROLLED AT THE UNIVERSITY OF COLORADO

Students seeking certification in the School of Education must be enrolled in an undergraduate degree program in one of the colleges or schools of the University. These students should apply for admission to the Teacher Certification Program in the spring semester of their sophomore year, or at least one semester before they plan to begin professional education work. Freshmen at the University should seek advising and other orientation information at the time of

entrance or shortly thereafter. Students should seek advising as soon as they become interested in a Teacher Certification Program. Members of the School of Education faculty will advise these students.

Course work for the Teacher Certification Program at both the elementary and secondary levels may be completed (1) during the junior and senior years, or (2) the course work may be taken in a one-year program in the senior year, or (3) as post-undergraduate work. Students generally apply for the Teacher Certification Program in the spring semester of the sophomore year; however, students may apply anytime after having completed 56 semester hours toward the undergraduate degree. Students must have applied and been accepted into the Teacher Certification Program prior to being admitted in any of the methods courses in the Elementary Teacher Certification Program or T.Ed. 412 in the Secondary Teacher Certification Program. Application forms are available in Education 247.

TRANSFER STUDENTS

Students who transfer to the University of Colorado from another accredited institution must apply for admission through normal University channels. They must enroll in a degree program in one of the colleges or schools of the University and also apply for teacher certification in the School of Education. The last 30 hours of course work for certification *must* be taken while the student is officially enrolled as a student in the University.

FORMER STUDENTS

Former students may reenter the University according to general University policies; however, they must apply for entry into the Teacher Certification Program. Students previously admitted in education programs must also reapply for acceptance in the present certification program.

POSTBACCALAUREATE STUDENTS SEEKING CERTIFICATION

Students who already hold a bachelor's degree and wish to qualify for certification in elementary or secondary teaching must fulfill the same requirements that apply to undergraduate students. Students desiring institutional recommendation for certification must complete at least 30 semester hours of work at the University of Colorado, and possibly as many as 40 semester hours of work may be required. The actual number of required hours will depend on the specific kinds of courses already completed. To complete the certification requirements in one calendar year, students must apply for admission to the Teacher Certification Program no later than February of the spring semester, and all prerequisites must have been met prior to starting the academic year. The certification program involves a combination of courses at the University and off-campus educational experiences in cooperation with the public schools.

State Certification Requirements

Each state has requirements for certifying or licensing teachers. These requirements vary from state to state and change from time to time. Students who are interested in teaching in other states should familiarize themselves with the requirements of those states so that they may plan an appropriate degree program.

REQUIREMENTS FOR TEACHER CERTIFICATION AND FOR THE BACHELOR'S DEGREE IN EDUCATION

The School of Education at the University of Colorado awards a bachelor's degree in education to those students who complete the certification program in elementary or secondary education. Students are admitted to this program if they have met the criteria as set forth in later sections. Grade-point requirements for the certification program may be higher than those required in other colleges or schools.

The last 30 semester hours must be completed while the student is registered in the University. No education courses may be taken *pass/fail* (except student's field experience) or by correspondence.

Even though students will receive their degrees from other colleges or schools of the University, the School of Education may require more course work in a particular field for certification than required by other departments of the University for graduation. The School of Education does not recommend students for certification unless they have completed all required course work in the certification program in which they are enrolled.

General Admission Criteria to the Diploma and Certification Program

For admission to the program, a student must meet the following minimum criteria:

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, the capacity to relate well to others and the potential for leadership.

2. Applicants should have the ability to command the respect of others and direct their learning activities. They should exhibit behavior consistent with moral values and legal requirements expected of teachers.

3. Work experience involving interpersonal relations (such as teachers' aides, camp counselors, etc.) is considered important to prospective teachers and is highly recommended before application to the program.

Elementary Teacher Certification Program

ADMISSION

Students wishing to be certified in elementary education normally apply for admission to the Teacher Certification Program during the second semester of their sophomore year. Such students must have completed (or have in progress), a minimum of 56 semester hours of course work with at least 14 semester hours

completed or in progress at the University of Colorado. They should have maintained a 2.5 overall grade-point average as well as a 2.5 grade-point average on work at the University of Colorado. At the time of admission, students (including those who hold a degree) must provide evidence that they have taken or have courses in progress to fulfill the following minimum portion of their general education requirements:

<i>Subject</i>	<i>Semester Hours</i>
Humanities (including English)	6
Natural sciences	6
Social sciences	6

Before graduation students must have completed all general education requirements for their college or school.

COURSES REQUIRED FOR CERTIFICATION

Since students will receive their degrees in one of the other colleges or schools of the University, they must meet the graduation requirements of that college or school. In the certification program, they must meet the requirements of the School of Education. Education course work may be taken during the junior and senior years or, with careful planning, the program may be completed in a calendar year.

Students applying for student teaching must have completed all education requirements (except those that are part of the student teaching semester) by the beginning of the semester in which student teaching is to be completed.

Required courses for elementary certification are as follows:

	<i>Semester Hours</i>
Comm. 230. Communication Principles in Instruction	2
T.Ed. 309. Foundations of American Education—Elementary	2
T.Ed. 310. Educational Psychology for Elementary School	2
T.Ed. 311. Child Growth and Development	2
T.Ed. 320. Expressive Arts in Elementary School	1-3
T.Ed. 375. School Based Group Tutorial	1
T.Ed. 446. Teaching the Learning Disordered in the Regular Classroom	2
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	2
T.Ed. 423. Methods in Elementary Science	2
T.Ed. 424. Methods in Elementary Social Studies	2
T.Ed. 456. Children's Literature	2
T.Ed. 470. Student Teaching—Elementary School	8

ADMISSION TO ELEMENTARY STUDENT TEACHING

Students applying for student teaching must have met the following criteria:

1. A 2.5 overall grade-point average as well as a 2.5 on all work taken at the University of Colorado.

2. A 2.5 average in the prerequisite sequence of education courses. Only a grade of C or better gives credit. Students desiring to student teach in kindergarten must have completed T.Ed. 435, Kindergarten Education.

3. Completion of all general education requirements.

4. Completion of at least 90 semester hours (including Comm. 230) with passing grades.

5. Passing scores on screening examinations in the prescribed areas.

Since student teaching can be very demanding, students are encouraged not to take courses concurrently with student teaching.

Secondary Education

Students will be enrolled in their degree programs in other colleges and schools of the University and they must meet the graduation requirements of those colleges and schools. For the Teacher Certification Program, they must meet the requirements of the School of Education. The certification program may be completed during the junior and senior years or, with careful planning, it may be combined into a year program.

ADMISSION

Students wishing to be certified in secondary education usually apply for admission to the teacher certification program during the second semester of their sophomore year. They must have completed, or have in progress, a minimum of 56 semester hours of course work, with at least 14 semester hours completed or in progress at the University of Colorado. They should have maintained a 2.5 overall grade-point average as well as a 2.5 grade-point average on work taken at the University of Colorado.

Students must have completed or have in progress the following minimum general education requirements:

<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 sciences	
Social sciences	

Students should also consider the following: it is highly recommended that students have some experience in working with youth; quotas are imposed on the number of students admitted to the secondary education program, therefore, not all who apply may be admitted; students may be required to have an interview with a faculty member or members.

REQUIREMENTS FOR SECONDARY CERTIFICATION

Comm. 230. Communication Principles in Instruction	2
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 the Content Areas	3
T.Ed. 446. Teaching the Learning Disordered in the Regular Classroom	2
T.Ed. 471. Student Teaching—Secondary	8
T.Ed. 472. Elective Assignment—Secondary	4
Methods and materials in teaching field	3

Certain teaching fields require other specific courses beyond the requirements in the major department. Students should check with an education adviser for any specific additional requirements.

ADMISSION TO SECONDARY STUDENT TEACHING

Prior to the semester in which the student plans to do student teaching (usually the first or second semester of the senior year) the student must apply for student teaching in the Office of Field Experience, Education 247. Students must have completed all required courses for certification except the student teaching courses and the elective assignment. They should have met the following admission criteria:

1. A 2.5 overall grade-point average as well as a 2.5 on all work at the University of Colorado.
2. A 2.5 average in their teaching field.
3. A 2.5 average in the prerequisite sequence of education courses.
4. A passing score on the screening examination in the prescribed areas.
5. Completion of all general education requirements.
6. Completion of at least 90 semester hours (including Comm. 230) with passing grades.

Students should plan to devote one full semester to student teaching and the elective assignment. Student teaching is a full-time experience in a public school for eight or nine weeks; therefore, it usually is not possible to take other courses at this time.

K-12 CERTIFICATION

Students in art, music, or physical education may enroll in both elementary and secondary student teaching and the elective assignment. These students may receive certification K-12 in these areas of instruction.

DEGREE ALTERNATIVES

While students will be enrolled in degree programs in other schools and colleges of the University, some degrees are more appropriate than others for those interested in teacher certification. This is especially true for those preparing to teach in the secondary schools. The University offers majors in subjects most commonly taught in the public schools; however, the state gives no teaching certificates in some academic fields. Therefore, students interested in a particular major should consult an adviser in the School of Education about selecting a teaching field.

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 elementary and 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

Any student registered in the Teacher Certification Program 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 Certification Program.

GRADUATE STUDY IN EDUCATION

Graduate study in education at the University of Colorado is administered through the Office of the Associate Dean, School of Education, and all inquiries regarding programs should be directed to the following address:

Associate Dean
School of Education, Campus Box 249
University of Colorado
Boulder, Colorado 80309

A wide range of professional and academic interests is served by these areas. The areas of study are as follows:

Administration, Supervision, and Curriculum Development

Master of Arts
Educational Specialist¹
Doctor of Education
Doctor of Philosophy

Encompasses programs of a general administrative type: principals, central administration, superintendent. This includes various facets of public school and community college administration.

Instruction and Curriculum in the Content Areas

Master of Arts
Educational Specialist¹
Doctor of Education
Doctor of Philosophy

Embraces mathematics and science education, English and social studies education, language arts, reading, and general curriculum studies in elementary and secondary education.

Educational-Psychological Studies

Master of Arts
Educational Specialist¹
Doctor of Philosophy

Includes educational psychology, guidance and counseling, school psychology, special education, and educational technology.

Research and Evaluation Methodology

Doctor of Philosophy

Covers the educational research, evaluation, and statistics area.

Social, Multicultural, and Bilingual Foundations

Master of Arts
Doctor of Philosophy

Emphasizes history and philosophy of education, sociology of education, public policy, experiential education, and bilingual and multicultural education, teaching English as a second language.

Certification at Graduate Level

The University of Colorado at Boulder through the School of Education offers course work leading to certification in the following areas:

Administration	School psychology
Elementary principal	Speech correctionist/language specialist
Junior high school principal	Type B Certification
Secondary school principal	Elementary education
Superintendent	Secondary education
Guidance and counseling	Art, drama, English
Reading teacher and reading specialist	foreign languages
Media specialist	mathematics, music,
Special education	physical education
Educable mentally handicapped	science, social
Educationally handicapped	studies, and speech

Graduate Programs at Three Levels

Graduate study in education is offered at three levels: Master of Arts (M.A.) degree, Specialist in Education (Ed.S.) degree (in limited areas), Doctor of Education (Ed.D. in limited areas), and Doctor of Philosophy (Ph.D.) degrees. Each level is discussed in the following pages. For many study areas, 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, School of Education. 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 test scores for the doctoral degree programs — (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 Education Graduate Office. A doctoral 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 may be applied toward degree requirements. During the summer, 9 semester hours may be taken in a full summer session, 6 hours in a five-week summer term, and 3 hours in a three-week 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 graduate degrees an average of B or better is required in all work taken for the degree. Transferred credits are not included in calculating an average. A mark of C may not be used on a Ph.D. program.

¹The Educational Specialist degree will be awarded only in conjunction with the Colorado Type D or E certificates.

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.

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 of the School of Education. Students may also be suspended from the Graduate School for continued failure to maintain satisfactory progress toward the degree sought.

Experience Required

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 secondary school 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 administration and supervision relating to higher education, college student personnel work, counseling in agency settings, educational research and statistics, educational technology-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 of Arts in Education

The Master of Arts degree is available, comprising one academic year or more of graduate work beyond the bachelor's degree. The minimum residence requirement for the 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). The master's degree must be completed within five years (or six summers) of initial enrollment. The M.A. Plan II (nonthesis) degree requires a minimum of 30 semester hours.

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 Graduate Office in the School of Education.

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 Education Graduate Office for School approval 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 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 in limited areas relating to certification extending one year beyond a master's degree. Areas in which the specialist degree may be earned are: curriculum, administration and supervision, instruction and curriculum in content areas, and education psychological studies. 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.

ADMISSION REQUIREMENTS

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. Students being admitted on a provisional basis must submit Graduate Record Examination scores for the verbal and quantitative sections. 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 area faculty. 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 (Educ. 600). All Ph.D. students must also include at least one course in experimental design and analysis (Educ. 601, 603, or 604), and this is required in some Ed.D. programs. Educ. 503 and 504 may not be used on the doctoral degree plan. 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 Educ. 800 (Thesis) for the Ph.D., and Educ. 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, 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. and Ph.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.

The doctoral programs in business and physical education are cooperative programs between the College of Business and Administration, the Department of Physical Education, and the School of Education. Prospective students should consult both groups for advising.

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 in the School of Education about the various deadlines they must 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 persons of the divisions and director of teacher education. 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 Dean, School of Education.

College of Engineering and Applied Science

William J. Pietenpol, 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. Engineering professional societies have committed themselves to the principle that as mankind gains the ability to build more powerful machines and more useful devices there must be a strong and successful effort to protect natural resources and the environment.

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 Engineering Accreditation Commission: 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. Degrees in applied mathematics and engineering physics are offered by the College of Engineering and Applied Science in cooperation with the mathematics and physics departments of the College of Arts and Sciences. Accreditation by the Engineering Accreditation Commission has not been sought for the programs in applied mathematics and engineering physics in order to allow students maximum flexibility in choosing engineering 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).

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 Architectural Engineers
- American Institute of Chemical Engineers

- American Society of Civil Engineers
- American Society of Mechanical Engineers
- Illumination Engineering Society
- Institute of Electrical and Electronic Engineers
- Society for Industrial and Applied Mathematics
- 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

	Required Units ¹
English (literature, composition, grammar)	4
Algebra	2
Geometry	1
Additional mathematics	1

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.

Natural sciences (physics and chemistry recommended)	2
Social studies and humanities (foreign languages, additional English, history, and literature are included)	3
Electives	<u>3</u>
	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. It is recommended that students take at least two units of a foreign language.

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 may be considered for admission on an individual basis 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.

Intrauniversity transfers within the same campus of the University to the College of Engineering will be considered on an individual basis if both of the following conditions are fulfilled:

1. Enrollment limitations permit.
2. The student's prior academic record must fulfill the admissions requirements of the College of Engineering and Applied Science.

Intercampus transfers of students from one campus of the University to another will be considered on an individual basis if the following conditions are fulfilled:

1. Enrollment limitations permit.
2. The student must have a minimum of 30 hours in an engineering curriculum at that campus, not counting transfer hours.
3. If an engineering student, the student must be in good academic standing with at least a 2.0 cumulative average for all courses attempted and for all courses that count toward graduation requirements. If the student is not an engineering major, his academic record must fulfill the admission requirements of the College of Engineering and Applied Science.

It is strongly recommended that incompatible campus academic sequences such as calculus and, if applicable, E.E. 213/214 be completed before transferring campuses. Students contemplating a transfer should check with their department on such sequences.

Both intrauniversity and intercampus 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 of Colorado, the Office of Admissions and Records issues a Statement of Advanced Standing 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 to the Dean's Office 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 will have a dean's stop placed in their records and 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 17 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 degree 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 meet fully 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 health sciences 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	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.

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.

An engineering student wishing to obtain a combined degree must submit a petition to both the College of Business and the College of Engineering and be approved as a combined degree student. 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 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

¹See appropriate chairman for possible substitution of courses.

should feel free to consult with the deans and/or members of their staffs about their problems. During the freshman year, 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. *Every student should read and follow the assigned curriculum carefully.*

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 admission and matriculation as an engineering degree student of the University of Colorado. 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.

A student is awarded a degree by a vote of the faculty of the College of Engineering and Applied Science after a department of the college determines that all of the requirements for the degree have been met. The diploma specifies whether the student graduated from the University of Colorado at Boulder, at Colorado Springs, or at Denver. The campus named is the one

where the department recommending the student for the degree is located. Consideration will generally be given to designating the campus where the last 30 hours of course work were completed. However, the final decision on the campus designation is made by the awarding faculty.

2. Overall grade-point averages of 2.0 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. (See departmental requirements.)

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).
- d. Up to a maximum of 6 hours of communications skills (e.g., English composition, technical writing, public speaking, elementary foreign language) may be substituted for 6 hours of the social-humanistic requirement. Alternatively, these courses may be counted as technical electives.

Qualified students will be permitted to take appropriate honors courses as substitutes for social-humanistic courses.

Such courses as 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 prospective employers.

10. There are no language requirements for the B.S. degree in engineering, but it is strongly recommended that students 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. 253, 260, 261, preferably in sequence; or Engl. 260, 261, 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, 260, and 261—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. 220-3. Modern Short Story.
- Engl. 221-3. Science Fiction.
- Engl. 222-3. Introduction to Folklore.
- Engl. 260-3, 261-3. Great Books. (Not open to students who have credit in Humanities 101, 102.)
- Engl. 252-3. Masterworks of British Literature.
- Engl. 253-3. Modern and Contemporary Literature.
- Engl. 266-3. Masterworks of American Literature.
- Engl. 267-3. Modern and Contemporary Literature.
- Engl. 290-3. Major Works of Shakespeare.
- Engl. 291-3. Literature and Visual Arts.
- Engl. 315-3. Report Writing (For engineering students, the course may be considered a technical elective).
- Engl. 322-3. Folklore.
- Engl. 365-3, 366-3. Survey of American Literature.
- Engl. 368-3. Twentieth-Century American Literature.
- Engl. 397-3, 398-3. Shakespeare.
- Engl. 465-3, 466-3. Studies in American Literature.

ENGLISH AS A FOREIGN LANGUAGE

No social-humanistic credit will be given for courses dealing with English as a foreign language. However, a committee of engineering faculty members has been charged with finding ways to make sure that students whose native language is not English acquire fully adequate communication capabilities in oral and written English. Students who may have problems with the English language should be sure to complete appropriate course work.

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 fall schedule pick-up the beginning of the last year, 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.

Students planning to graduate in December or May should complete an application form prior to the third week of the fall semester. Forms are available at schedule pick-up or in the dean's office EC AD 1-1.

Incompletes and Correspondence Courses. All *incompletes* must be completed and all correspondence course grades must be officially received no later than three 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 December, May and August.

Campus Designation on Diploma. See undergraduate degree requirements, paragraph 1.

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 equivalent to required courses should consult with the appropriate department regarding possible credit or waiver.

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 and the Dean's Office. 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.

INCOMPLETES

The grade of *I/W* (incomplete, withdrawn) is not given in the college. The grade of *I/F* (incomplete, failing) will be given only for circumstances clearly beyond the student's control, such as a documented medical or personal emergency. The *I/F* reverts to an *F*

if it is not removed in one year by completing the course requirements (not by retaking the course).

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. Suspended students *are not* permitted to enroll for Boulder evening or mini-college courses 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 offices of the University of Colorado at Denver are 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

The Audiovisual College Education (ACE) Program televises courses at the Boulder, Colorado Springs, and

Denver campuses and the Health Sciences Center for use by business, industry, and government at remote locations off the campuses. The Intercampus Instruction Program televises courses on all four campuses for mutual exchange to avoid duplication and to supplement the ACE courses. In-state and out-of-state tuition charges for televised courses are comparable to charges for regular instruction.

For information about live or videotaped televised courses, contact the Office of University-Industry Relations, Campus Box 433, Boulder, Colorado 80309, or call 303/492-8211. For a special catalog of ACE courses and for information on the scheduling of courses, write or call the chairman of the department concerned or the Office of University-Industry Relations.

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
Chemical Engineering	Engineering Design and Economic Evaluation
Civil, Environmental, and Architectural Engineering	Mechanical Engineering Mechanics

The Master of Science in applied mathematics is presented by the College of Engineering with the cooperation of the Department of Mathematics.

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 construction, illumination, energy conservation, structures, water resources, water quality, and geotechnical 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 George R. Inger, 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 students until the first semester of their 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 except for the additional requirement of C.S. 310. 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 electives	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 Science of Flight	2
A.Math. 135. Calculus for Engineers I	4
Ch.E. 210. Physical and Chemical Properties of Matter (Note 2)	4
Engl. 260. 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. Engineering Drawing	2
Engl. 261. 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
Aero. 203. 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
Aero. 204. 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. Materials Science	3
Aero. 341. 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. 342. Systems Analysis II (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 5)	13
Social-humanistic elective (Note 3)	3
	18

Curriculum Notes

1. For other options in English, see the English language listings under degree requirements.
2. 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.
3. Technical electives, social-humanistic electives, and English may be taken *pass/fail*, subject to the regulations of the College of Engineering and Applied Science.
4. E.E. 413, Control Systems Analysis, may be substituted.
5. 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, kinetic theory, magnetohydrodynamics, material sciences and solid state physics, physics of fluids, 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 are 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 Master of Engineering and 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, Campus Box 429, Boulder, Colorado 80309.

APPLIED MATHEMATICS

Office in Engineering Center OT 2-38
Professor Daniel W. Stroock, 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 five departments of the College of Engineering and Applied Science (aerospace engineering, chemical engineering, civil and environmental engineering, electrical engineering, 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 6 hours of language courses below the 300 level or 6 hours of English composition 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 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. and Ph.D. degrees in applied mathematics. For graduate course listings, see 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. 260. Great Books (Note 1)	3
E.E. 210. Fundamentals of Computing I	3
	15

Spring Semester

Math. 230. Analytic Geometry and Calculus II	5
Engr. 101. Engineering Drawing I	2
Engl. 261. Great Books (Note 1)	3
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
	15

SOPHOMORE YEAR

Fall Semester

Math. 240. Analytical Geometry and Calculus III	4
Engl. 253. Modern and Contemporary Literature (Note 1)	3
E.Phys. 213. General Physics	3
E.Phys. 215. Experimental Physics	1
Electives (Note 2)	6
	17

Spring Semester

Chem. 103. General Chemistry	5
Electives (Note 2)	12
	17

JUNIOR YEAR

Fall Semester

Math. 313. Introduction to Linear Algebra	3
Electives (Note 2)	15
	18

Spring Semester

Engr. 301. Thermodynamics	3
Electives (Note 2)	15
	18

SENIOR YEAR

Fall Semester

Electives (Note 2)	18
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Spring Semester

Electives (Note 2)	18
Minimum total hours for degree	136

Requirements under each option are as follows:

OPTION I—ENGINEERING MINOR	<i>Semester Hours</i>
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
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Noncomputer-oriented engineering courses	9
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).

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 4-34
Professor Ronald N. Helms, Division Head

BACHELOR'S DEGREE REQUIREMENTS

The architectural engineering curriculum is supervised and administered by the Department of Civil, Environmental, and Architectural Engineering of the College of Engineering and Applied Science. Students in this program are required to take some courses in the College of Environmental Design.

Options in Architectural Engineering. Architectural 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: construction engineering, environmental engineering, or structural engineering.

Construction Engineering. Specialization in construction leads to contracting and building construction. 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 interested in environmental engineering may concentrate their efforts in the fields of illumination and building electrical systems design; heating-ventilating-air conditioning systems design; sanitation 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 major 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 fundamental 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.

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. Engineering Drawing I	2
E.Phys. 111. General Physics	4
Social-humanistic elective	3
	15
<i>Spring Semester</i>	
A.Math. 136. Calculus for Engineers II	4
Arch.E. 102. Descriptive Geometry	2
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
C.S. 110. Elementary Programming for Scientists and Engineers	3
Social-humanistic 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. 311. Analytical Mechanics II	3
C.E. 312. Mechanics of Materials	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
C.E. 314. Engineering Materials Laboratory (construction and structures only)	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	3
	17-19

<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); (environmental — M.E. 362, technical elective)	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—Ch.E. 351, engineering science elective)	6
	18

<i>Spring Semester</i>	
Arch.E. 470. Applied Structural Design (construction majors substitute Arch.E. 446)	3
Arch. 471. History/Philosophy	3
Technical elective	5-6
Social-humanistic elective (construction majors required to take Econ. 202)	3
Specialty requirement (structures—C.E. 458; environmental—technical elective; construction—C.E. 497)	3
	17-18
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. 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. 403-2. Elements of Electronics
- E.E. 443-1. Elements of Electronics Laboratory
- E.E. 495-3. Energy
- E.E. 576-3. Power Distribution Systems
- 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 Lee Brown, 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, plastics, 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. Chemical engineers are currently redesigning chemical processes to conserve energy and are working on alternative sources of energy such as coal gasification, solar energy, and geothermal 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 several real-time process computers and an analog computer. 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)	5
C.S. 210. Fundamentals of Computing I	3
Engl. 260. Great Books (Note 2)	3
Ch.E. 130. Introduction to Chemical Engineering	2
	17

Spring Semester

A.Math. 136. Calculus for Engineers II	4
Engr. 101. Engineering Drawing I	2
Chem. 106. General Chemistry (Note 1)	5
Ch.E. 201. Introduction to Chemical Engineering Calculations	3
Engl. 261. Great Books (Note 2)	3
	17

SOPHOMORE YEAR

Fall Semester

A.Math. 235. Calculus for Engineers III	4
Chem. 331. Organic Chemistry	4
Ch.E. 241. Chemical Engineering Materials and Industrial Chemicals	2
E.Phys. 111. General Physics	4
Social-humanistic elective (Note 3)	3
	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
	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 Engineering	2
A.Math. 135. Calculus for Engineers I	4
E.Phys. 111. General Physics	4

C.S. 110. Elementary Programming for Scientists and Engineers	3
Social-humanistic elective (Note 1)	3
	16

Spring Semester

C.E. 221. Plane Surveying	3
A.Math. 136. Calculus for Engineers II	4
Engr. 101. Engineering Drawing I	2
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
Social-humanistic elective (Note 1)	3
	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	3
	17-18

Spring Semester

C.E. 312. Mechanics of Materials	3
Geol. 397. Geology for Engineers	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	3
	18-19

JUNIOR YEAR

Fall Semester

C.E. 311. Analytical Mechanics II	3
C.E. 331. Theoretical Fluid Mechanics	3
C.E. 380. Soils and Foundation Engineering	3
C.E. 314 or C.E. 315. Engineering Materials Laboratory	2
Engineering science elective	3
Social-humanistic elective	3
	17

Spring Semester

C.E. 332. Applied Fluid Mechanics	3
C.E. 350. Structural Analysis	3
E.E. 303. Electric Circuits I	3
Engr. 301. Thermodynamics	3
Technical electives	2
Social-humanistic elective	3
	17

SENIOR YEAR

Fall Semester

C.E. 457. Design of Steel Structures	3
Technical electives	7
Engineering science elective	3
Social-humanistic elective	3
	16

Spring Semester

C.E. 458. Reinforced Concrete Design	3
C.E. 499. Senior Seminar	1
Technical electives	7
Engineering science elective	3
Social-humanistic elective (Note 1)	3
	17
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.

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. Undergraduate 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. Computer science courses which are application oriented will be taught as service courses to students of computer science and other fields.

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

GRADUATE DEGREE PROGRAMS

General Admission Requirements

The Computer Science Department offers the following areas of study: automata theory, programming languages, operating systems, business systems, and numerical analysis. A graduate student should consider a major in computer science if he is primarily interested in the general aspects of computational processes, both theoretical and practical, e.g., theory of algorithms, methods by which algorithms are implemented on a computer, and information structures. A student who is primarily interested in the results of a computer process and its relation to a particular area of application should major in another field and consider a minor in computer science.

An applicant will be favorably considered for graduate study in computer science if he holds at least a bachelor's degree or its equivalent from an institution comparable to the University of Colorado. He should have considerable programming experience and sufficient mathematical maturity to understand pure mathematics courses.

The applicant should satisfy the following requirements for mathematics courses: at least one year of university-level calculus and at least two one-semester courses of a mathematical nature beyond calculus, for example, advanced calculus, differential equations, linear algebra, probability, statistics, combinatorial analysis, etc. These courses need not be in a mathematics department; however, they should require mathematical maturity expected of an upper level mathematics undergraduate.

In computer science, the applicant should offer the equivalent of the following University of Colorado courses (the contents of which are outlined later in this document): C.S. 210-310, 401, 445, 453, and 465.

Applicants should have a grade-point average of at least 3.0 (on a scale of 4.0). Applicants having the listed qualifications will, if accepted, be classified as regular degree students. Applicants with an average below 3.0 and above 2.75 and/or lacking certain of the prerequisites, as indicated, will be considered on an individual basis. Students accepted in this category will be classified as provisional degree students.

All applicants who wish to be considered for financial aid should have their applications in by February 15 preceding the academic year in which they plan to enroll. Financial aid opportunities exist through research assistant and teaching assistant positions and through work at selected area industries in a one-year internship program.

All Ph.D. applicants and any applicants who wish to apply for financial aid must submit scores from the Verbal, Quantitative, and Advanced sections of the Graduate Record Examination. Applicants with a grade-point average near or below 3.0 should also submit G.R.E. scores, as they weigh heavily in deciding borderline cases.

The Ph.D. applicant must satisfy the same entrance requirements as those noted above for the M.S. degree. In addition, strong academic and problem-solving abilities should have been demonstrated.

Ph.D. applications should be submitted by January 15 preceding the academic year in which the applicant wishes to enroll. M.S. applications should be submitted by April 1 preceding the fall semester and by October 1 preceding the spring semester in which the applicant wishes to enroll.

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 orally 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.

Doctor's Degree

Admission requirements for this program are given above under general admission requirements. 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. After the thesis has been completed, an oral final examination on the thesis and related topics will be conducted. The examination will be conducted by a committee of at least five graduate faculty members.

Further details on either the M.S. or Ph.D. degree programs are available in the departmental office.

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 rotating machines and vehicles to lasers
Power equipment and systems, solid-state devices, solid-state materials, integrated circuit fabrication techniques
Modeling of systems related to electrical engineering
Selected undergraduate students may participate in bioelectronics research

Within these areas of specialization the fields are so numerous it is impossible for the four years of training to cover them in detail. Students may acquire specialization in a research field through graduate work beyond the bachelor's degree either at the University or through courses available through special continuing education programs. 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 students learn more fundamentals in electronic circuits, electromagnetic and transmission theory, electrical machines and transformers, heat, and mechanics. Those in the computer science option will learn more fundamentals of programming and computer hardware. 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 usually 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 approved by their adviser 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 they may prefer to use the standard curriculum to strengthen their knowledge 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./C.S. 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 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. They should check with the electrical engineering department office during the latter part of the junior year.

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. Engineering Drawing I. (Note 8)	2
E.E. 130. Problems and Methods of Modern Electrical Engineering (Note 1)	2
Social-humanistic elective (Note 2)	3
	15

Spring Semester

A.Math. 136. Calculus for Engineers II	4
E.Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
E.E./C.S. 210. Introduction to Computing (Note 3)	3
Social-humanistic elective (Note 2)	6
	18

SOPHOMORE YEAR

Fall Semester

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

Spring Semester

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	3
E.E. 254. Circuits Laboratory II	1
E.E. 257. Logic Circuits	3
Social-humanistic elective (Note 2)	3
	17

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)	10
Social-humanistic elective (Note 2)	3
	19

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. Engineering Drawing 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	3
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)	3
	17

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
	<hr/>
	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
	<hr/>
	17

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
	<hr/>
	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)	10
	<hr/>
	18

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 from group b as shown in undergraduate degree requirements. The electrical engineering department does not require a sequence of two courses in one area. Upper division students are expected to take upper division social-humanistic electives.
3. E.E./C.S. 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.

8. This requirement may be waived upon completion of one year of mechanical drawing in high school.

The student who has good grades and is interested in graduate work should certainly take additional mathematics. Some preliminary counseling with a department graduate adviser is desirable.

Some students, after satisfying their minimum electrical engineering requirements, may wish to use part of their remaining elective hours in areas other than electrical engineering, mathematics, or physics. With prior 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, Campus Box 425, 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 bulletin.

Each semester several courses are taught under the Special Topics Classification. Typical courses taught during the last several years include:

Signal Processing for Remote Probing	Conduction in Metals at Low Temperatures
Computer Memory and Storage	Pulse Response of Transmission Lines
Nonlinear Optics	Error Correcting Codes
Crystal Physics	Problems in Pattern Recognition
Foundations of Plasma Physics	Decision Theory
Interaction of Light and Sound	Semiconductor Diode Lasers
Lightning Transients	Computerized Design of Networks

ENGINEERING DESIGN AND ECONOMIC EVALUATION

Office in Engineering Center OT 4-7,
Mechanical Engineering Department

Starting in the fall of 1978, no new students were enrolled in the engineering design and economic evaluation (EDEE) program. However, required EDEE courses will continue to be offered in order to allow those students who were enrolled prior to the fall of 1978 to receive the EDEE degree. A number of the required upper division and elective courses in the EDEE program will continue to be available in the mechanical engineering department.

New students wishing to pursue a curriculum emphasizing this facet of engineering should enroll in mechanical engineering and select the majority of their elective courses in this area. Undergraduate counselors within the mechanical engineering department are available to assist 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.

Graduate Study in Engineering Design and Economic Evaluation¹

The engineering design and economic evaluation graduate program leading to the M.S. degree is

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. In addition to the course work and the thesis, an oral examination on the thesis is required.

Curriculum for B.S. (EDEE)

SENIOR YEAR

Fall Semester

M.E. 414. Mechanical Engineering Design I (Note 4)	3
EDEE 442. Operations Research II	3
EDEE 451. Engineering Management	3
EDEE 461. Senior Project	2
Social-humanistic elective (Notes 1 and 3)	3
Technical elective (Note 5)	3
	17

Spring Semester

M.E. 416. Mechanical Engineering Design II	3
EDEE 462. Senior Project	2
Social-humanistic elective (Notes 1 and 3)	3
Technical electives (Note 2)	9 or 10
	17 or 18

Minimum hours for degree (Note 5) 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 5.)
2. Technical electives must include a minimum of three EDEE elective courses.
3. EDEE-business students should include Econ. 201 and 202 among their social-humanistic courses. (See also note 2.)
4. The sequence of courses leading to EDEE 332 prepares students for M.E. 414.
5. A minimum of 136 hours is required for the degree. Up to 6 hours of ROTC credit may be acceptable.

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

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.

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, 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 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. Engineering Drawing I	2

Social-humanistic electives (Note 2)	6
E.Phys. 111. General Physics	<u>4</u>
	16

Spring Semester

A.Math. 136. Calculus for Engineers II	4
Social-humanistic electives (Note 2)	6
E. Phys. 112. General Physics	4
E.Phys. 114. Experimental Physics	1
C.S. 210. Fundamentals of Computing I (or C.S. 110-3)	<u>3</u>
	18

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)	<u>6</u>
	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)	<u>5</u>
	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)	<u>3</u>
	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)	<u>2</u>
	16

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)	6
Social-humanistic elective (Note 2)	<u>3</u>
	17

Spring Semester

E.Phys. 492. Atomic and Nuclear Physics	3
E.Phys. 496. Senior Laboratory (Note 6)	2
Electives (Note 3)	<u>12</u>
	17

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

<i>Spring Semester</i>	<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
Electives (Note 7)	7
	16

SENIOR YEAR

<i>Fall Semester</i>	
E.E. 403. Elements of Electronics	2
E.E. 443. Elements of Electronics Laboratory	1
Electives (Note 7)	13
	16

<i>Spring Semester</i>	
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. However, up to 6 hours of English composition, technical writing, public speaking, and/or elementary foreign language may be included in these 12 hours.
3. Required and elective engineering courses (excluding mathematics and physics) must total 22 semester hours.
4. Or a two-semester general chemistry course.
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, 446, 451, 455, 461, 462, 491, 492, 495, 496, 500, 501, 503, 504, and 585; (2) applied natural science electives (24 semester hours, minimum)—these two groups 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 Robert A. Christopher, Associate 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 undergraduate adviser. Under Plan B, the specific requirements of the program are determined after a detailed conference with the 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
Industrial engineering	

Curriculum for B.S. (M.E.)

FRESHMAN YEAR

<i>Fall Semester</i>	<i>Semester Hours</i>
Engl. 260. 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
Chem. 103. General Chemistry	5
	17

Spring Semester

Engl. 261. Great Books (Note 1)	3
E.Phys. 111. General Physics	4
A.Math. 136. Calculus for Engineers II	4
Engr. 101. Engineering Drawing I	2
M.E. 131. Manufacturing Processes (or other approved elective)	2
Social-humanistic elective	3
	18

SOPHOMORE YEAR

Fall Semester

M.E. 281. Mechanics I	3
M.E. 203. Introduction to Computer-Aided Design	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
	18

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
Social-humanistic elective	3
	<u>17</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
Social-humanistic elective	3
	<u>17</u>

SENIOR YEAR

Fall Semester

M.E. 412. Mechanical Engineering Laboratory	3
M.E. 401. Introduction to Materials Science II	3
Technical electives	9
M.E. 414. Mechanical Engineering Design I	3
	<u>18</u>

Spring Semester

Technical electives	12
Social-humanistic elective	3
	<u>15</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 solid

mechanics, fluid mechanics, heat transfer, thermodynamics, mechanical and thermal design, and engineering economy and management. These areas of study provide the technical background necessary to deal with a wide variety of contemporary mechanical engineering problems. Typical examples include combustion-generated pollution; fire safety; effective use of alternative energy sources such as solar and geothermal heat; efficient energy management of thermal systems; dynamic behavior of high-strength composites; earthquake engineering; brittle fracture of coal and oil shale; and bioengineering topics such as heart valve research, design of prosthetic devices, and modeling of the human spine.

At the M.S. degree level students following Plan I (with thesis) are required to take 9 hours of core courses which include engineering analysis and a selection from thermodynamics, mechanics, design, and mechanisms. Students following Plan II (all formal course work) are required to take 15 hours of core courses in thermodynamics, continuum mechanics, dynamics, and engineering mathematics. The remainder of the program is developed by the student in consultation with the adviser.

For admission to Ph.D. candidacy the student must pass a comprehensive examination to demonstrate a general competence in mechanical engineering at an advanced level. In addition, second-year college-level reading proficiency must be demonstrated in scientific French, German, Russian, or other foreign language approved by the department upon petition by the student.

Graduate Study in Mechanics

Graduate programs leading to the M.S. and Ph.D. degrees in mechanics which emphasize the mechanical sciences of solids and fluids and thermal science, 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.

Requirements for the M.S. and Ph.D. degrees in mechanics are similar to those in mechanical engineering, with the additional requirement that students following Plan II (all formal course work) at the M.S. level must take 6 hours in advanced calculus, ordinary and differential equations, complex variables, boundary value problems, or their equivalent.

College of Environmental Design

Dwayne C. Nuzum, Dean

Spenser W. Havlick, Assistant Dean

INFORMATION ABOUT THE COLLEGE

Scope and Purpose

The environmental design professions have long been recognized as major contributors to the improvement of the built environment. 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 with 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 the physical, ecological, 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, changing resource

availability and human values, rapid technological change—all require of the environmental designer a broad educational base 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.

Combined Programs and Double Majors

Official combined programs are available only in conjunction with the College of Business. 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.

Organization

The College of Environmental Design is presently organized into six 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, urban and regional planning, and interior design. The environmental design undergraduate degree program is only offered on the Boulder Campus, and the graduate degree programs are offered at 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.

A media center, workshop, darkroom, and drawing studios supplement design studios, 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.

The Boulder Community Design Center, a nonprofit organization, provides technical assistance in architectural and graphic design, planning and community development to other community groups, individuals, and organizations.

In response to a growing number of community needs, design services for a variety of projects including child and health care facilities, community centers, housing, and parks have been generated through the Community Design Center.

Students, clients, and professional volunteers are offered a creative learning experience through active group and citizen participation. All learn to identify and assess their particular needs throughout the design process, and through this approach, neighborhood and individual goals are translated into effective design programs.

The Community Design Center stimulates broad involvement within the community, and interested members are offered an opportunity to volunteer. While professionals gain a better understanding of community problems, design students receive training and practical experience in defining, managing, and resolving community problems.

Equipment such as special drawing instruments, the heliodon for use in studying the continuing effect of sun rays on a building, a computer terminal with added computer graphic capabilities and photocopying equipment are available to the student.

House of Essentials (the HOE project) is an urban laboratory and applications studio. Students apply skills to create appropriate technology for existing and experimental dwellings in Boulder. Special applications include passive solar energy and other forms of appropriate technology.

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 given to outstanding students and faculty.

Scholarships, Loans, Awards, and Prizes

SCHOLARSHIPS

Several scholarships are available to 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 the College of Environmental Design also have available two special loan funds: the Carolyn Miller Scott Memorial Loan Fund, established in 1962, 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 goals:

1. Effective understanding of forces that shape the environment and the expression of human thought, feeling, and emotion through alteration of the natural and built 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 and social 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 2.75 cumulative grade-point average in all previous college work. All course work except the last term, if in progress, must be completed and on the official transcript sent for admissions consideration. Transfer students should make application to the Office of Admissions. 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.

Prerequisite courses for application include mathematics through analytical geometry or algebra and trigonometry, a general college physics course with laboratory (units), and graphics or freehand drawing. Students who select architecture must complete college calculus, and for students whose emphasis is planning or other design-related areas, statistics is required prior to graduation.

Normally students should effect the transfer prior to the third year of college-level work; all transfer students will be required to take the six semesters of required environmental design studio and the three semesters of required social and natural science and media courses offered in the college.

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 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. Environmental Design Studio (6 semesters in sequence) ..	36
First year — Env.D. 100-6 (fall); Env.D. 101-6; Env.D. 100-6; Env.D. 101-6; Env.D. 200-6; Env.D. 300-6 and two 400-level Env.D. Studio Courses.	
b. Environmental Design content courses:	
Three semesters each	27
Env.D. Language/Media, 120/121/220-3	
Env.D. Natural Science/Technology, 130/131/230-3	
Env.D. Societal Science, 110/111/210-3	

Elective or General Study Courses 65

The following courses are necessary for graduation (and for admission for transfer students) even though they are not totally representative of the environmental design professions: either statistics or college calculus, college physics, and expository writing.

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, either statistics or calculus must be completed in addition to expository writing and college physics. 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. Students intending to pursue graduate studies in architecture should plan to take the following courses:

- Env.D. 420/421-3. Architectural Graphics I and II
- Env.D. 450/451-3. Environmental Systems I and II
- Env.D. 452/453-2. Architectural Structures I and II
- Env.D. 401/402-6. Architecture Studio I and II
- Arch. 470/471-3. History of Architecture

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's office.

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 (2.0) 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. 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. The College of Environmental Design does not give incomplete grades (*IW* or *IF*) for incomplete work. Only extreme emergency situations warrant an extension of time for the appropriate letter grade to be awarded for a course.

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.

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.

STUDIO COURSE QUALITY REQUIREMENT

In studio courses, a grade of C or better is prerequisite before the next course in the sequence is taken.

GRADUATE PROGRAMS

The College of Environmental Design at the Denver Campus (UCD) offers five graduate programs: the Master of Architecture, Master of Architecture in Urban Design, Master of Interior Design-Interior Architecture and Space Planning, Master of Landscape Architecture, and Master of Urban and Regional Planning-Community Development. The graduate programs allow for advanced experience in the areas for better environment.

Graduate students in all of the graduate programs will be accepted at the Denver Campus of the University of Colorado. Facilities are in the Bromley Building and include classrooms, library, administrative offices, faculty offices, a darkroom, model shop, and drawing and design spaces for students.

Financial Aid

Graduate scholarships and fellowships are available to continuing students only, with the exception of Colorado Grants. A limited number of Colorado Grants are available to new students who are residents of the State of Colorado and who fulfill the University's criteria for financial need. Forms to apply for State of Colorado Graduate Grants, Federal Work-Study assistance, and Federal National Direct Student Loans (NDSL), are available through the College of Environmental Design, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202.

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 Office. Only 6 hours of course work may be pass/fail in any given semester.

GRADE-POINT AVERAGE REQUIREMENTS AND SCHOLASTIC SUSPENSION

Graduate 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.

STUDIO COURSE QUALITY REQUIREMENTS

In studio courses a grade of *C* or better is prerequisite before the next course in the sequence is taken.

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 College of Environmental Design 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, Denver Campus

The Division of Architecture offers three degree programs, all of which lead to the Master of Architecture. The three programs are named by typical time-in-residence: three-year, two-year, and one-year programs. The three- and two-year programs lead to the first professional degree for architectural practice; the one-year program leads to a second professional degree.

The one-year program is open only to applicants already holding the first professional degree in architecture (generally the bachelor's, occasionally the master's). Individually organized studies are focused on the student's interests in architecture or in architecture with an urban design specialization.

The two-year program is open to holders of the Bachelor of Environmental Design or Architectural Studies degree and is arranged to receive graduates of

the Division of Environmental Design at Boulder or similar undergraduate studies at other schools.

The three-year program is open to holders of the bachelor's degree in all other fields.

CURRICULUM

The Division of Architecture is a professional school; its role and purpose is the education of men and women who wish to design buildings. The division provides studies in architectural design, graphic communications, history and theory, technology, and professional practice for this purpose.

Architectural design is the central activity of the several programs and the design studio serves to integrate architectural learning from all course work in the supportive arts and sciences. Most studies are conducted on the case study method; skill in the definition and the solution of design problems is acquired through the analysis and the working of exercises which simulate actual building problems. Advanced studio options are available with projects in the Community Center for Development and Design. The design thesis is the culmination of architectural studies.

Communications courses provide the graphic skills necessary to present design ideas. History and theory courses anchor the student's work in social responsibility, and in an understanding of the forces that give shape to buildings and cities. Technology courses give basics in structures, and in the environmental concerns of utilities, heating, lighting, and acoustics. Professional courses provide exposure to the workings of contemporary practice, and an internship in a practicing professional's office is a course option in the final year.

The goal of all of these studies is competency for the graduates of the division as intelligent, knowledgeable, and creative designers, each at the threshold of entry to architectural careers in private practice, government, or industry.

ADMISSION REQUIREMENTS

Application

The complete set of materials for application for the Master of Architecture programs includes the application form, college transcripts, three recommendations, statement of purpose, and a portfolio of academic and professional work. To be considered for admission, the complete set of application materials must be received by March 15 preceding the fall semester of entry. The portfolio must be no larger than 14 inches by 17 inches. The application form and additional information may be obtained by writing to the Director of Architecture, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202.

A four-year degree in architecture or environmental design from an accredited college or university is required for acceptance into the two-year program. A Bachelor or Master 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 University of Colorado architectural engineering program may enter the first year of the three-year program with qualification based upon the course work taken previously and upon academic performance. However, a student in this program must still apply and be accepted into the Master of Architecture program and must have completed all requirements for the Bachelor of Science degree in architectural engineering before entry into the second year of the program.

Admission

An Admissions Committee will review the application materials and select students to be admitted to programs. Applicants will be notified that they have been accepted, are on a waiting list, or have not been accepted, prior to May 1.

The recommended minimum grade-point average is 2.75 on a 4-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.

ONE-YEAR PROGRAM

The one-year program is available only to students already holding the first professional degree, the Bachelor or Master of Architecture. The Master of Architecture or Master of Architecture in Urban Design is awarded upon satisfactory completion of 32 semester hours of courses and special projects arranged 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.

One-Year Program Order Of Studies

Fall Semester

Arch. 710. Research design thesis	7
Elective course work program	9
Total	16

Spring Semester

Arch. 711. Research design thesis	7
Elective course work program	9
Total	16
Total semester hours required	32

The research/design project for thesis must be approved by the Thesis Committee before the student enters the program. The student is asked to submit a statement describing the proposed project with the application. The project may be individual or collaborative, theoretical or real.

TWO-YEAR PROGRAM

The two-year program is open to the student with a four-year Bachelor of Environmental Design or Architectural Studies degree who seeks the first professional degree in architecture. The program is a two-year, 64-semester-hour series of studies leading to the Master of Architecture degree.

Students in the third or fourth year of the University of Colorado Environmental Design degree program who intend to pursue the Master of Architecture should take Structures (Arch. 452 and 453), Environmental Systems (Arch. 450), Materials and Methods of Construction (Arch. 451), Architectural History (Arch. 470 and 471), and Architectural Graphics (Arch. 410 and 411), and a minimum of six semesters of Design (including Arch. 400 and 401). Students who have not completed these courses previous to entry will be asked to complete them while in the program. Students from other four-year design 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 prior studies 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.

Two-Year Program Course Requirements

	<i>Semester Hours</i>
Architectural design	24
Technologies	15
Theory	3
Professional practice and construction documents	4
Landscape Architecture	3
Planning	3
Electives ¹	12
Total	64

Two-Year Program Recommended Order of Studies

Fall Semester, First Year

	<i>Semester Hours</i>
Arch. 600. Design	5
L.A. 630. Survey of Landscape Architecture	3
Arch. 650. Heating and Plumbing	3
U.P.C.D. 500. Fundamentals of Planning	3
Arch. 660. Structures III	3
Total	17

Spring Semester, First Year

Arch. 610. Design	5
Arch. 651. Illumination and Acoustics	3
Arch. 654. Concrete Structures	2
Arch. 660. Professional Practice and Construction Documents	4
Elective ¹	2
Total	16

Fall Semester, Second Year

Arch. 700. Design	5
Arch. 712. Thesis Preparation	2

¹Elective courses may be taken from additional architecture or college course offerings, or from other divisions at the University of Colorado. A minimum of three semester hours must be acquired each from the Landscape Architecture and the Urban and Regional Planning curriculums.

Arch. 760. Internship (optional)	3
Electives ¹	6
Total	16

Spring Semester, Second Year

Arch. 701. Design Thesis	7
Arch. 761. Internship (optional)	3
Arch. 750. Systems Synthesis	3
Elective ¹	2
Total	15

Total semester hours required 64

THREE-YEAR PROGRAM

The three-year program is open to students with a Bachelor of Arts or Bachelor of Science degree, with a particular program prerequisite of one year of high school or college physics, one semester of college algebra and trigonometry, and one semester of calculus. The mathematics and physics requirement must be completed before entering the program. The Master of Architecture is awarded upon satisfactory completion of 96 semester hours and all required courses.

Three-Year Course Requirements

	<i>Semester Hours</i>
Architectural design	34
Technologies	27
History/philosophy	6
Graphic communications	6
Theory and practice	3
Professional practice and construction documents	4
Planning and Landscape Architecture electives	6
Electives	10
Total	96

Three-Year Program Recommended Order Of Studies

<i>Fall Semester, First Year</i>	<i>Semester Hours</i>
Arch. 500. Design	5
L.A. 510. Graphics I	3
Arch. 551. Materials and construction	3
Arch. 552. Structures I	3
U.P.C.D. 570. Development of Environmental Form	3
Total	17

Spring Semester, First Year

Arch. 501. Design	5
L.A. 511. Graphics II	3
Arch. 550. Environmental systems	3
Arch. 553. Structures II	3
Arch. 571. History/philosophy II	3
Total	17

Fall Semester, Second Year

Arch. 600. Design	5
L.A. 630. Survey of Landscape Architecture	3
Arch. 650. Heating and Plumbing	3
U.P.C.D. 500. Fundamentals of Planning	3
Arch. 660. Structures III	3
Total	17

Spring Semester, Second Year

Arch. 601. Design	5
Arch. 651. Lighting and Acoustics	3
Arch. 654. Structures IV	3

Arch. 660. Professional practice and construction documents ..	4
Arch. 680. Theory and Practice <i>or</i>	
Arch. 670. Designer Philosophies <i>or</i>	
U.D. 682. Architecture and Urban Design Theory	3
Total	18

Fall Semester, Third Year

Arch. 700. Design	5
Arch. 712. Thesis preparation	2
Arch. 750. Systems Synthesis	3
Arch. 760. Internship (Optional)	3
Elective ¹	3
Total	16

Spring Semester, Third Year

Arch. 701. Design Thesis	7
Arch. 761. Internship (optional)	3
Arch. 712. Thesis Preparation	2
Arch. 750. Systems Synthesis	3
Elective ¹	3
Total	18

Total semester hours required 96

Independent Study Courses

Arch. 960 includes 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 with an instructor who will sponsor the project. A student may take not more than 6 hours of independent study courses per semester. Students in the two-year program may take 9 hours of independent study; those in the three-year program may take 12 hours.

Master of Landscape Architecture, Denver Campus

The academic program leading to a Master of Landscape Architecture degree at the University of Colorado at Denver responds to a perceived need to offer professional training preparing students to meet the complex and demanding challenges of designing and shaping the environment.

Our rapidly growing western regions, both urban and rural, require comprehensive problem-solving skills which address regional climate, geology, soils, hydrology, and vegetation. These related processes provide a regional basis for planning and designing land areas for public/private use, enjoyment, and preservation.

PROGRAMS

UCD offers both two- and three-year graduate-level professional programs leading to the degree Master of Landscape Architecture. The two-year second professional degree program, comprised of a minimum of 64 semester hours, is structured to provide advanced training and exposure in the theoretical, technical, and practical aspects of design for those M.L.A. candidates possessing a Bachelor of Landscape Architecture degree. The three-year first professional degree

¹Elective courses may be taken from additional architecture or college course offerings, or from other divisions at the University of Colorado. A minimum of three semester hours must be acquired each from the Landscape Architecture and the Urban and Regional Planning curriculums.

program, comprised of a minimum of 96 semester hours, is offered to students with undergraduate degrees not specifically related to landscape architecture.

These programs permit the M.L.A. candidate to pursue a wide range of career goals responding to the profession's concerns and expertise in physical planning and design. A major goal of the program is to develop the candidates' knowledge and practical skills of landscape architecture to assume effective roles in professional practice. Emphasis is placed upon emerging problems and frontier areas of the Rocky Mountain Region, and on applying problem-solving tools, theories, and methodologies to environmental concerns covering a broad range of scales and project types.

CURRICULUM

The curriculum includes those subjects considered as essential to core professional training in the field of landscape architecture, including design, technology, history, and professional practice. Both programs and courses have a design focus upon real problem-solving situations with emphasis on design process.

Opportunities exist to develop complementary knowledge and skills related to interdisciplinary projects involving the graduate programs of architecture, urban design, urban and regional planning, and public administration, within the College of Environmental Design. Additionally, through the Center for Community Development and Design, the M.L.A. candidate is afforded opportunity for actual project experience and participation for a variety of projects within the Denver metropolitan area and the state of Colorado.

The hierarchy of courses from term to term includes sequences of design, technical, and history core courses required of all entering candidates. The final spring term is reserved for a design thesis project contributing to the program and the profession of landscape architecture. The thesis project is performed under the guidance of a Comprehensive Thesis Committee comprised of faculty, practicing professionals, and technical specialists in the thesis topic. Additionally, the M.L.A. candidate is required to complete a minimum 12-week internship with a professional landscape architecture office or under the work supervision of a professionally registered landscape architect.

ADMISSION REQUIREMENTS

Applicants to the three-year program or those who do not have a first professional degree, Bachelor of Landscape Architecture, should have proficiency in college mathematics, physical science, English, environmental science, and a basic course in art or drawing.

Applicants to the two-year program, having undergraduate degrees in urban and regional planning, architecture, environmental design, or other physical design degrees are considered for admission upon individual evaluation of their undergraduate curriculum, scholastic performance, and professional experience. To be considered for admission into the graduate programs in landscape architecture, applicants must submit application forms, college transcripts, three

recommendations, statement of purpose, and a portfolio of academic and professional work by March 15 preceding the fall semester they wish to enter the program. The portfolio format is to be 14 inches by 17 inches or smaller.

Application forms and further information may be obtained by writing to the Director of Landscape Architecture, College of Environmental Design, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202.

Order of Studies (Two- and Three-Year Programs)

<i>FIRST YEAR</i>	<i>Semester Hours</i>
<i>Fall Semester</i>	
L.A. 500. Landscape Architecture Design I	5
L.A. 510. Graphic Communication I	3
L.A. 550. L.A. Engineering I — Environmental Systems	3
L.A. 561. Syntheology Field Research — (Retreat I)	1
L.A. 580. Rocky Mountain Plant Materials	3
	15
<i>Spring Semester</i>	
L.A. 501. Landscape Architecture Design II	5
L.A. 511. Graphic Communication II	3
L.A. 560. L.A. Construction I — Elements of Structures	3
U.P.C.D. 570. Development of Environmental Form	3
L.A. 581. Rocky Mountain Plant Design	3
	17
<i>SECOND YEAR</i>	
<i>Fall Semester</i>	
L.A. 600. Landscape Architecture Design III	5
L.A. 650. Landscape Architecture Engineering II	3
L.A. 670. Landscape Architecture History/Theory Seminar	3
Biol. Ecology Elective	3
INTD. 530. Theories and Methods of Programming	3
L.A. 661. Syntheology Field Research — (Retreat II)	1
	18
<i>Spring Semester</i>	
L.A. 601. Landscape Architecture Design IV	5
L.A. 651. Landscape Architecture Engineering III	3
L.A. 681. Rocky Mountain Plant Technology	3
U.D. 684. U.D. Development Systems and Management	3
Elective ¹	3
	17
<i>THIRD YEAR</i>	
<i>Fall Semester</i>	
L.A. 700. Landscape Architecture Design V	5
L.A. 760. Landscape Architecture Construction II	3
B.Ad. Business Administration Elective	3
L.A. 761. Syntheology Field Research — (Retreat III)	1
L.A. 790. Independent Design Practicum	
Research and Research Methods	2
L.A. 792. Landscape Architecture Issues Seminar	1
	15
<i>Spring Semester</i>	
L.A. 701. Independent Design Practicum — Design VI	5
L.A. 721. Professional Practice Seminar	3
L.A. 791. Natural Resource Issues Seminar	3
Elective ¹	3
	14
Total hours required for M.L.A. degree	96

¹Elective courses may be taken from additional architecture or college course offerings or from other divisions at the University of Colorado. A minimum of 3 semester hours each must be acquired from the Landscape Architecture and the Urban and Regional Planning curriculums.

Master of Architecture in Urban Design, Denver Campus

Urban design is another of the graduate environmental design programs taught at facilities which are located within two urban renewal projects in the core of the metropolitan area. The curriculum focuses upon the complex problems that are generated by change and growth in a vigorous urban and regional laboratory. Emphasis is given to participatory community and publicly funded design, research, and technology. Special efforts are made to utilize the vast resources of information 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 inputs into the design processes.

Direct daily contact with students and instructors in the planning, landscape, architecture, and interior 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 primary consideration in meeting the internship requirements.

The master's year is a synthesis of the special civic-scale factors influencing urban design in one of four options: recreational facilities, community development, rehabilitation or renewal, transportation and health care. In this phase, students are carefully advised throughout the period of their independent research and design studies. Opportunities to do state and city outreach work in association with the Center for Community Development and Design (the College's design aid field program for ethnic and economic minorities) are available. Many other real problems and/or case studies from the community which require anticipatory and feasibility design and development also are considered. Whenever possible, individual and/or team projects in cooperation with allied disciplines and institutions are encouraged.

ADMISSION REQUIREMENTS

In order for students to be considered for admission into the graduate program, they must submit application forms, college transcripts, three letters of recommendation, statement of purpose, and a portfolio of academic and professional work by April 15 preceding the fall semester they wish to enter. All portfolio material submitted with the application must be in 8½" by 14" format or smaller. If slides are included, they must be in a looseleaf slide holder. It is recommended that students indicate the type and length of all work experience they have had since receiving a degree. Application forms and information may be obtained by writing to the director of Master of Architecture in Urban Design, College of Environmental Design, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202

ONE-YEAR PROGRAM (MASTER OF ARCHITECTURE IN URBAN DESIGN)

A one-year program leading to the Master of Architecture in Urban Design degree is available to students holding a first professional degree in architecture, landscape architecture, or urban planning. The degree is awarded upon satisfactory completion of 32 semester credit hours. The program is for students who wish to pursue advanced studies in compound, complex community design problems.

Course Requirements	Semester Hours
Urban Design Studio	12
Urban Design Seminar	3-6
Planning	6
Electives (professional)	6-9
Independent study	3
	32

The design studio is the focal point for the specialization selected by the student. The project chosen is developed on an independent study basis with meetings, seminars, and evaluations scheduled between the student and the faculty advisers. Cognate courses are selected with the guidance of the faculty advisers from related subjects offered by the College or other units of the University.

Master of Interior Design—Interior Architecture and Space Planning, Denver Campus

The Master of Interior Design program is structured to educate designers who will be qualified to assume responsible leadership roles in the continuing growth of the profession and in the improvement of the quality of man's near environment by constructively relating the design process to man's life process.

There are two programs leading to the Master of Interior Design degree. The two-year program is open to applicants holding Bachelor of Interior Design, Bachelor of Environmental Design, or Bachelor of Architecture degrees. The three-year program is designed for applicants holding bachelor's degrees in other fields from accredited four-year colleges or universities.

The program is characteristically different from more traditional programs in the following ways:

Multidisciplinary Approach. Individualized instruction and guidance are provided in skills and knowledge that are integrated from related disciplines. Accordingly, the student develops personal models and methodologies within a multidisciplinary conceptual framework for the analysis, design, and evaluation of appropriate interior environments.

Interior Architecture and Space Planning Orientation. The program relies heavily upon the conviction that the design of an interior space and the building form containing it are inextricably related. The former inwardly responding to the human environment, the latter outwardly responding to the natural environment; both design activities requiring high degrees of interdependent specializations in generating an adequate integrative environmental form.

Social and Behavioral Base. Understanding the social, behavioral, and biological implications of man-environment interactions is emphasized as an integral part of design research/problem-solving methods in all design studio work.

Coordinated University-Professional Community Learning Experiences. The program is a direct response to the Rocky Mountain region's general recognition of a need for designers whose professional community serves as an auxiliary source of educational enrichment by providing students with opportunities to combine theoretical and applied learning.

ADMISSION REQUIREMENTS

Application

In order for students to be considered for admission into the graduate program, they must submit application forms, two original transcripts, three recommendations, statement of purpose, and a portfolio of academic and professional work by March 15 preceding the fall semester that they wish 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 the Director of Interior Design, College of Environmental Design, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202

Admission

A Faculty Admissions Committee will review the application materials and select the students to be admitted to the program. Applicants will be notified that they have been accepted, are on a waiting list, or have not been accepted, prior to May 1.

The recommended minimum grade-point average is 2.75 on a 4-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.

Sequence of Studies, Two and Three-Year Programs

<i>Fall Semester, First Year</i>	<i>Semester Hours</i>
I.D. 500. Design Research/Problem-Solving Methods	5
Arch. 510. Graphic Communications I	3
Arch. 570. History/Philosophy I	3
Arch. 551. Materials and Methods of Construction	3
Elective course	3
	17

Spring Semester, First Year

I.D. 501. Residential Design	5
Arch. 511. Graphic Communications II	3
Arch. 557. Elements of Structure	3
Arch 571. History/Philosophy II	3
Psych. 320. Human Behavior and Maturation Through the Life Span	3
or	
Psych. 225. Biological Behavior	3
	17

Fall Semester, Second Year

I.D. 600. Transportation Design	5
Arch. 650. Environmental Control Systems I	3
B.Ad. 504. Fundamentals of Management and Organization	3
I.D. 680. Physical Environmental Factors	3
I.D. 660. Furniture Design	3
	17

Spring Semester, Second Year

I.D. 601. Commercial Design	5
Arch. 651. Environmental Control Systems II	3
I.D. 681. Human Environmental Factors	3
I.D. 662. Professional Practice	3
B.Ad. 506. Legal Environment of Business	3
	17

Fall Semester, Third Year

I.D. 700. Institutional Design	7
I.D. 624. Environmental Signage and Graphic Design	3
I.D. 663. Internship I	3
L.A. 630. Landscape Architecture	3
	16

Spring Semester, Third Year

I.D. 701. Thesis	7
I.D. 664. Internship II	3
B.Law 412. Business Law	3
B.Ad. 411. Business and Society	3
or	
B.Ad. 503. Fundamentals of Marketing (Fall or Spring Semester)	3
	16

Master of Urban and Regional Planning and Community Development, Denver Campus

The MURP-MPCD 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, UCD 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 60 semester hours as a minimum for graduation. Forty-five 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 required credits, 4 are spent in experimental 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 MPCD'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, in the student's last semester, is the satisfactory completion 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. This is the major thrust of the core requirement entitled Planning Studio 3.

ADMISSION REQUIREMENTS

In order for a student to be considered for admission into the graduate 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 include academic performance, experience, interest, and motivation for study.

Candidates for admission should note that a 1-semester-hour course in statistics is part of the 60-hour core curriculum. Students who have taken an acceptable course in statistics may have this requirement waived.

Application forms and information may be obtained by writing to Director of Urban and Regional Planning and Community Development Program, University of Colorado at Denver, 1100 14th Street, Denver, Colorado 80202.

CENTER FOR COMMUNITY DEVELOPMENT AND DESIGN

The Center for Community Development and Design provides educational and technical assistance to solve design, planning, and community development problems upon request to groups, organizations, neighborhoods, communities, and small towns that cannot afford or do not have access to these services. The center provides these services to aid in the development of the community and to encourage local self-reliance. These services are provided by mobilizing the necessary and available resources of the College of Environmental Design and the community and by utilizing the appropriate community development process and participatory techniques.

A central goal of the center is to combine academic and practical experience of students working with community members on problem solving through supervised projects in the field. The faculty and staff of the center coordinate community projects for which students register through classes in the various academic curricula. Students who register for these projects assume an added responsibility of satisfying client needs that goes beyond academic credit.

Students are expected to do two things: utilize and develop professional expertise which not only enhances their own education but also better prepares them to assist in the community problem-solving process, and to develop an understanding for community participatory processes and be able to integrate these into the technical aspects of their community project.

The types of projects students may select to work on include developing a physical design program for a child care center in an inter-city neighborhood; assisting a neighborhood to organize, design, and implement a self-help housing program in a small mountain town; and developing a comprehensive plan in cooperation with a planning commission in a Colorado high plains town.

Graduate School

Stanley J. Cristol, Acting Dean

INFORMATION ABOUT THE SCHOOL

*M. Laurance Morse, Associate Dean
(Medical Center)*

Robert N. Rogers, Associate Dean (Denver)

Ernest Patterson, Assistant Dean

Thomas J. Napierkowski, 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 and governed by the rules of the Graduate School.

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	Astro-Geophysics
Anatomy ¹	Astrophysics
Anthropology	Biochemistry ¹
Applied mathematics	Biology
Applied physics	Biometrics ¹
	Biophysics and genetics ¹

Chemical engineering	Mathematical physics
Chemical physics	Mathematics
Chemistry	Mechanical engineering
Civil engineering	Mechanics
Classics	Microbiology ¹
Communication	Music education
Communication disorders and speech science	Musiology
Comparative literature	Nursing
Computer science	Pathology ¹
Economics	Pharmacology ¹
Education	Pharmacy
Electrical engineering	Philosophy
English	Physics
French	Physiology ¹
Geography	Political science
Geology	Psychology
Geophysics	Slavic languages and literatures
German	Sociology
History	Spanish
Linguistics	Theatre

The M.A. can be earned in the following fields:

Anthropology	General psychology ³
Art education	Geography
Art history	German
Biology	History
Classics	Italian
Communication	Journalism
Communication disorders and speech science	Linguistics
Comparative literature	Mathematics
Dance	Philosophy
Economics	Political science
Education	Psychology
English language	Russian
English literature	Sociology
French	Spanish
	Theatre

The M.S. can be earned in the following fields:

Aerospace engineering sciences	Business: management and organization
Anatomy ¹	Business: management science
Anesthesiology ¹	Business marketing
Applied mathematics	Chemical engineering
Applied physics	Chemistry
Astro-Geophysics	Child health associate ¹
Biochemistry ¹	Civil engineering
Biometrics ¹	Computer science
Biophysics and genetics ¹	Electrical engineering
Business: accounting	
Business: finance	

¹Departments offering degrees in these fields are located on the campus of the Health Sciences Center in Denver.

²Offered only on the Denver Campus.

³Offered only on Colorado Springs Campus.

Engineering design and economic evaluation	Pathology ¹
Environmental Sciences	Pediatrics ¹
Geology	Pharmacology ¹
Health administration	Physical education
Mechanical engineering	Physical medicine ²
Mechanics	Physical therapy ¹
Medicine ¹	Physics
Microbiology ¹	Physiology ¹
Nursing ¹	Preventive medicine ²
Obstetrics and gynecology ¹	Psychiatry ¹
	Radiology ¹
	Telecommunications

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 \$60 million. Of this total, the expenditures on the Boulder, Denver, and Colorado Springs campuses are now approximately \$30 million per year. The sponsored research, clinical and instructional program of the Health Sciences Center in Denver totals more than \$34 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 an interdisciplinary research institute of the Graduate School of the University of Colorado which emphasizes the environmental sciences (biology, geography, and geology), especially as they pertain to high latitudes and high altitudes and to cold environments in the past. INSTAAR faculty are appointed jointly in the institute and in the relevant academic department, usually in the College of Arts and Sciences. Courses taught include Arctic and Alpine Environments, Physical Geography of Arctic Regions, Data Processing in the Earth Sciences, Advanced Geomorphology, History of Biological Communities, Advanced Palynology, Mountain Geomorphology, Techniques in Geocology, Mountain Climatology, Physical Climatology, Synoptic and Dynamic Climatology, Seminar in Climatic Change, and Independent Study. Not all courses are offered every year.

INSTAAR'S main headquarters are on the East Campus of the University. The facility includes lecture room; reading room; well-equipped geomorphology, sedimentology, palynology, plant and animal ecology, and amino-acid dating laboratories; staff, faculty, and graduate student offices; and the editorial office of *Arctic and Alpine Research*, a quarterly journal published by the Institute.

INSTAAR also operates World Data Center-A for Glaciology (Snow and Ice) under contract to NOAA-Environmental Data and Information Service.

The Mountain Research Station, operated by INSTAAR is located at 2,925 m (9,600 ft) in the Front Range of the Colorado Rocky Mountains, 40 km (25 miles) west of Boulder. The Mountain Research Station is a complex of buildings including summer and winterized living quarters, washhouse, dining room, meeting room, Alpine Laboratory with offices, laboratories and library, and a warehouse. Weather observing stations have been operated since 1952 at four elevations between 2,200 m and 2,750 m. Solar radiation and near-surface ground-temperature measurements, together with the standard climatic parameters, form a data bank vital to many branches of field research. During the summer, based at the Mountain Research Station, INSTAAR operates research participation projects supported by the National Science Foundation. Under this scheme high school students may spend ten weeks working in association with faculty and graduate students on various phases of the research program in the Colorado Mountains.

Under a new agreement with United Nations University, the University of Colorado will become an Associate Institution of UNU. Involvement will include guidance of applied mountain research in the Himalayas, northern Thailand, and Papua New Guinea, and a UN agency-sponsored scholarship program for the training of scholars from these areas through INSTAAR facilities in Boulder and at the Mountain Research Station.

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 Research on Judgment and Policy, Program of Research on General Social and Economic Dynamics, Program of Research on Problem Behavior, Research

¹Departments offering degrees in these fields are located on the campus of the Health Sciences Center in Denver.

Program on Technology, Environment and Man, and Program of Research on Population Processes.

The University Computing Center provides computing services in support of the instructional and research activities of the University. The center is located on the Boulder East Campus, but serves students and faculty on all four University campuses through remote job entry stations and time-sharing terminals. The center has two Control Data Corporation 6400 computers and related communication and input/output equipment. The computing software available includes programming languages such as FORTRAN, PASCAL, COBOL, and BASIC, as well as a library of statistical and mathematical packages and other applications programs. The center offers non-credit courses in programming and the use of center facilities each semester. Programming advisers are available to answer user questions.

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), climate dynamics, 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 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 and the fabrication of large-scale integrated circuits; laser research; 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 in the National Center for Atmospheric Research (NCAR) building in south Boulder.

HAO is a part of NCAR, 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.

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 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 laser 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 individual differences in learning, psycholinguistics, text processing, perceptual and motor processes, problem solving, concept formation and developmental and educational psychology. The central offices are located in Muenzinger Psychology Building.

The Laboratory for Atmospheric and Space Physics (LASP) is an established center for research in terrestrial and planetary atmospheres, solar physics, and space astronomy. A forerunner in ultraviolet spectroscopy, LASP is located on the Boulder campus and involves students and faculty from the Departments of

Astro-Geophysics and Physics in many experimental and theoretical research programs. LASP has experiments on two current NASA spacecraft: on the Voyager mission a photopolarimeter is studying the atmospheres of Jupiter, Saturn and Uranus; and the Pioneer Venus mission carries a programmable ultraviolet spectrometer which is examining the Venusian atmosphere and the planet's cloud tops. In addition, LASP is developing the complete instrument package for the Solar Mesosphere Explorer satellite, scheduled for launch in 1981 to study the effects of active minor species on the Earth's ozone layer. LASP personnel will conduct all mission operations for the SME as well as interpret the scientific data. An ultraviolet spectrometer experiment is currently being developed at LASP for the Galileo mission to Jupiter in 1984. LASP has developed a unique data handling system for use with these space experiments as well as with earlier experiments such as the Mariner 9 Mars orbiter and the Orbiting Solar Observatory-8. Laboratory experiments, such as a major program to develop sensitive, new photoelectric array detectors for ground-based and space astronomical observations, are also pursued on a continuing basis. LASP astrophysicists are involved in analyzing and interpreting data from other scientific satellites such as the High Energy Astrophysical Observatory, the International Ultraviolet Explorer, and Copernicus. They are also involved in developing state-of-the-art ultraviolet and x-ray instruments. Active sounding rocket programs complement the research in planetary atmospheres, solar astrophysics, and astronomy.

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, new geophysical measurement techniques, 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 operating under the direction of the Department of Physics, conducts experimental and theoretical research in nuclear physics with a staff of faculty members and research associates. The investigations center on problems of nuclear structure and nuclear reaction mechanisms, as well as applications of nuclear science to a number of other fields. In particular, problems from the area of environmental and medical science are 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 are available. A magnetic spectrometer system permits very high resolution analysis of

charged particle reaction products, and a time-of-flight system for precision neutron studies are two somewhat unique features of the laboratory equipment. Staff members and faculty of the laboratory participate also in experiments carried out at the Los Alamos Meson Physics Facility and at the Indiana University Cyclotron Facility. Research assistantships are available to support graduate students for research in nuclear physics and in the field of modern accelerator design.

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. Noncredit 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, and CLEAR staff members teach credit courses in other schools and colleges as related to those fields.

The Bureau of Governmental Research and Service prepares studies and publishes reports and monographs on public policy issues. It also occasionally sponsors conferences for public officials and for people concerned with governmental problems. A main focus of interest is on Colorado and the Rocky Mountain region, but ongoing research also deals with national and international 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.

The Economics Institute offers intensive transitional training and orientation to foreign students entering graduate programs in economics, agricultural economics, and business-related fields 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 science, agricultural systems, economic development, business organization and management, 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, and its courses are open to local students by special arrangement. The institute is sponsored by the American Economic Association, in cooperation with the American Agricultural Economic Association, the Institute of International Education, and the University of Colorado.

The Center for Educational Leadership Services in the School of Education provides assistance to the schools and educational agencies of Colorado and facilitation of faculty research work. Evaluation services, school surveys, assistance in curriculum revision, inservice education programs, educational planning, and a variety of consultant services are available through the center, which focuses the resources of the University on educational problems in the state.

The Laboratory of Educational Research in the School of Education has two interrelated and complementary functions: service and training. It serves faculty, graduate students, and school districts in matters of research, design, statistics, measurement, and computer utilization; and it provides for a training ground and medium for practical experience in a wide variety of research projects for doctoral candidates pursuing a research specialization.

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: three low-turbulence wind tunnels and several hotwire 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 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 astrophysical and geophysical sciences. Special emphases are placed on studies of the sun, atmospheres of the earth, and other planets, theoretical and observational astrophysics, astronomy, geophysical and astrophysical fluid dynamics, aeronomy, space physics, hydrodynamics, plasma physics (including controlled thermonuclear fusion), radiative transfer, atmospheric circulations, and the earth's magnetic field.

The department operates the Sommers-Bausch Observatory, a radio observatory west of Boulder, laboratories in experimental fluid dynamics and plasma physics, 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, Institute for Telecommunication Sciences, and other Boulder institutions.

Chemical engineering research facilities are varied. For studies in kinetics and catalysis there are two quadrupole mass spectrometers, a magnetic sector mass spectrometer, and a time of flight mass spectrometer. Studies to characterize surface properties make use of the Auger electron spectrometer. Laboratories for flow characterization in porous media use two Aminco Mercury porosimeters, a Lippens-de Boer gas adsorption apparatus and a Wicke-Kallenbach gaseous counter diffusion apparatus.

There is a complete core flooding laboratory for work in enhanced oil recovery, leaching of oil shales, and modified in-situ oil shale studies. Spinning drop tensiometers, a Langmuir trough, and a Wilhemy plate apparatus are used for surface phenomena studies involving surfactant flooding.

Cryostats and gas chromatographs are used for low temperature thermal conductivity and phase equilibria studies, and there 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.

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.

Most of the research laboratories are being interfaced to the departmental Minicomputer/Microprocessor network. This distributed laboratory computer system consists of a central NOVA S/130 minicomputer with remote Micro/NOVA laboratory terminals. The system has complete multi-programming, multi-tasking capabilities, and all real-time programming is done in a high level scientific language such as FORTRAN.

Civil, environmental, and architectural engineering laboratories facilitate research in structures, vibrations, materials testing (including metals, timber, concrete, masonry, soils, rock, and highway materials), hydraulics, sanitary engineering and water quality, surveying and photogrammetry, and illumination. There is a 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.

Electrical engineering department special equipment and facilities include an anechoic chamber for studying propagation effects at microwave frequencies; high-voltage laboratory for impulse tests to 1,000,000 volts; a class 10,000 clean room facility for epitaxial growth and fabrication of microwave and optical devices; high-vacuum and vacuum deposition equipment for thin-films research; an integrated circuits laboratory; ion implantation equipment; crystal-growing facilities; a class 10,000 clean room facility; a modern systems laboratory; undergraduate laboratories in circuits, electronics, and energy conversion; a holography laboratory; numerous special purpose computers; mini- and microprocessors and a computer laboratory; 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 convective heat transfer, mechanical behavior of materials, combustion, prosthetic device performance, 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 oscillators and high-precision counter-timers 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 Campus shares facilities at the Auraria complex.

The Speech and Hearing Clinic has a two-fold purpose. It provides facilities for the training of undergraduate and graduate students, and it provides speech and hearing evaluation and remediation services for the Boulder community. Any student of the University or any 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 evaluations, lipreading instruction, hearing aid evaluations, and auditory training for the hearing-impaired.

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 Digital Equipment VAX 11/780 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.

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 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 150,000 volumes with a subscription list of over 1,000 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:

History (M.A.)	Psychology (M.A.)
Special education (M.A.)	Electrical engineering (M.S.)
Basic science (M.B.S.)	Applied mathematics (M.S.)
Education (M.A.)	Sociology (M.A.)
Political science (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 Urban and Public Policy Research, 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 and speech science	Psychology
Economics	Political science
English	Sociology (urban)

The Master of Arts in Education (M.A.) in:

Counseling and guidance	Early childhood education
Counseling and guidance in the agency setting	Educational psychology
	Elementary education

Library media
Reading
Secondary education

Foundations of education

Specialist in Education (Ed.S.)

The Master of Science (M.S.) in:

Accounting	Finance
Applied mathematics	Management and organization
Chemistry	Management science
Civil engineering	Marketing
Electrical engineering	Mechanical engineering
Environmental science	

The Master of Basic Science (M.B.S.)

The Master of Humanities (M.H.)

The Master of Social Science

Significant course work may be taken in the following programs at the graduate level:

Computer science	Music
Fine arts	Philosophy
Geology	Physical education
	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 Health Sciences Center in Denver

The University's Health Sciences 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 Health Sciences 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 Health Sciences 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, the Eleanor Roosevelt Institute for Cancer Research, the Barbara Davis Children's, Diabetes Center, and affiliated at Denver General Hospital is the Davis Institute for the Care and Study of the Aging.

The Denison Memorial Library has a collection of over 156,000 bound volumes and a subscription list of 1,900 medical and scientific journals, American and foreign. There are photo reproduction facilities and 120 private study carrels.

The Health Sciences 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 immuno-chemical 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 following graduate programs are available for completion through the Graduate School on the Health Sciences Center campus.

The Master of Science (M.S.) in:

Anesthesiology	Health Administration
Biometrics	Laboratory Medicine
Biophysics and Genetics (Genetic Counseling)	Nursing, School of Physical Therapy
Child Health Associate	Radiology (Medical Physics)

The Doctor of Philosophy (Ph.D.) in:

Anatomy	Molecular and Human Genetics
Biochemistry	Nursing, School of Pathology
Biometrics	Pharmacology
Biophysics and Genetics	Physiology
Microbiology and Immunology	
Molecular and Cellular Biology	

International Education

The staff of the Office of International Education expedites the exchange of students and faculty, provides information and guidance to foreign students, schedules and 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, Environmental Design Building.

Division of Continuing Education

For courses offered and other information, write to the Center for Lifelong Learning, University of Colorado, 970 Aurora, Boulder 80302 or call (303) 492-5141.

Opportunities for professional level management and engineering seminars and conferences are available year-round through the Center for Conferences and Management/Technical Programs, 970 Aurora, Boulder 80302. Call (303) 492-5141. 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. The GSAC works with and makes recommendations to various University administrators, the dean of the Graduate School, the Executive Committee of the Graduate School, the Western Interstate Commission for Higher Education, and the graduate faculty. 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 183E, 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 1981-82 school year have not yet been set. The tuition rates per campus for the 1980-81 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	\$ 25	\$ 81
2	50	162
3	75	243
4	100	324
5	125	405
6	150	486
7	175	1,215
8	200	1,215
9	225	1,215
10	250	1,215
11-18	276	1,215
Over 18	\$19 per hour additional	\$81 per hour additional

¹The Board of Regents reserves the right to change tuition and fees at any time.

Denver Campus Tuition, Per Semester¹

See the *University of Colorado at Denver Bulletin* for current schedule of fees and academic calendar.

Credit Hours of Enrollment	Undergraduate Students		Graduate Students	
	Resident	Non-resident	Resident	Non-resident
0-1	\$ 23	\$ 77	\$ 24	\$ 80
2	46	154	48	160
3	69	231	72	240
4	92	308	96	320
5	115	385	120	400
6	138	462	144	480
7	161	1,146	168	1,198
8	184	1,146	192	1,198
9	207	1,146	216	1,198
10-18	261	1,146	274	1,198
Each credit hour over 18	18	77	19	80
Charge for Candidate for Degree			72	72
Charge for students enrolled for doctoral thesis			109	109

Health Sciences Center Campus Tuition

See the *University of Colorado Health Sciences Center Course Book* for the academic calendar.

Graduate Programs in the School of Nursing, Health Administration and Radiology, Per Semester¹

Credit Hours of Enrollment	Resident	Nonresident
0.1 — 3.0	\$186	\$ 756
3.1 — 4.0	248	2,772
4.1 — 5.0	310	2,772
5.1 — 6.0	371	2,772
6.1 — 7.0	433	2,772
7.1 — 8.0	495	2,772
8.1 — 9.0	557	2,772
9.1 — 10.0	619	2,772
10.1 — 18.0	681	2,772
18.1 — 19.0	726	2,957
19.1 — 20.0	772	3,142
20.1 — 21.0	817	3,326
21.1 — 22.0	863	3,511
22.1 — 23.0	908	3,696
23.1 — 24.0	953	3,881

Graduate Programs in All Other Clinical and Basic Science Areas, Per Quarter¹

Credit Hours of Enrollment	Resident	Nonresident
0.1 — 3.0	\$ 124	\$ 504
3.1 — 4.0	165	1,848
4.1 — 5.0	206	1,848
5.1 — 6.0	248	1,848
6.1 — 7.0	289	1,848
7.1 — 8.0	330	1,848
8.1 — 9.0	371	1,848
9.1 — 10.0	413	1,848
10.1 — 18.0	454	1,848
18.1 — 19.0	484	1,971
19.1 — 20.0	515	2,094
20.1 — 21.0	545	2,218
21.1 — 22.0	575	2,341
22.1 — 23.0	605	2,464
23.1 — 24.0	636	2,587

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, 1981-82*.

Graduate School Fellowships

A limited number of fellowships is available for Ph.D. students in the basic science departments at the Health Sciences Center.

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

¹The Board of Regents reserves the right to change tuition and fees at any time.

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

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.

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. Students may be admitted to the Graduate School in either of the two categories described below.

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 the 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 dean of the Graduate School 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.

Graduate Record Examinations

The Graduate Record examinations are requested of applicants for fellowships and scholarships and applicants for admission as provisional degree students. 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. For the Health Sciences Center see individual departments. Satisfactory scores on the Graduate Record Examinations are required on the Health Sciences Center Campus for graduate students in the basic sciences.

Students who are applying for the fall of 1981 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, Campus Box 103, University of Colorado, Boulder 80309; or from the Educational Testing Service, Box 955, Princeton, New Jersey 08540.

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 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.

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. Further information may be obtained from the Office of the Associate Dean, Graduate School; University of Colorado, Denver, 1100 14th Street, Denver, Colorado 80203, (303) 629-2773.

Graduate School at the Health Sciences Center

The Graduate School at the Health Sciences Center campus of the University of Colorado is located in Denver and is under the jurisdiction of the associate dean of the Graduate School.

Requests and inquiries regarding admission to all graduate programs at the Health Sciences Center should be addressed to the graduate program in which the applicant wishes to study, University of Colorado Health Sciences Center, 4200 East 9th Ave., Denver, Colorado 80262.

Aside from the general admission requirements for the Graduate School, the minimal departmental admission requirements for most doctoral degree programs are as follows:

Basic Sciences: One year each of biology, general physics, differential and integral calculus, and one semester of physical chemistry.

Nursing: a master's degree in nursing or its equivalent with a cumulative grade-point average of 3.5; a recommended score of 1150 on the aptitude portion of the GRE, prior clinical nursing experience and

evidence of research interests, and an interview for those applicants meeting the above criteria.

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.

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. 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 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 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 enrollment limits are reached or the deadline passed. The 1980 confirmation amounts were \$300 for a nonresident student and \$100 for a resident of Colorado. If the con-

firmation is accepted, the student will be sent information regarding registration. Should the enrollment limits be reached, 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 after processing of the approved application has been completed.

Late Registration

Late registration will be held only if enrollment limits have not been reached. 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 may 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 or be subject to the late registration fee if a late registration is held.

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 noncredit 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.

A student is required to maintain at least a *B* average in *all* work attempted in Graduate School.

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 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 Ph.D.

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 who receives a grade of *C*, *D*, or *F* in a course may repeat that course once, 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 fields 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 work must be at the 500 level or above. Courses below the 500 level may be used only if they are in departments other than the student's major department.

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

A graduate student who writes a thesis under Plan I must register for 4, 5, or 6 semester thesis hours (700). The student may register for 6 hours during one semester or spread the total out over a number of semesters. The student may not register for zero thesis hours. After the student has registered for the total number of thesis hours, he or she should, if registration is required for a final examination, register as Candidate for Degree (999).

The final grade will be withheld until the thesis is completed; if the thesis is not finished at the end of the term in which the student is registered, an *in progress* (IP) will be reported.

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 many 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 term for which the student 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, 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 at least 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. Students who are noticeably deficient in their general training or in the specific preparation required by the department 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 requirement 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.

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 at least 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.

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 one week prior to 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 more 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-level or above 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.

CHANGE IN REQUIREMENTS FOR DOCTORAL DEGREE

For students entering after July 1, 1980, a minimum of 75 semester hours of course work and thesis credit combined will be required for all doctoral degrees within the Graduate School. Of that minimum, students must complete at least 30 hours of course work at or above the 500 level and 30 hours of thesis credit. Students presently enrolled will be required to complete a

minimum of 30 hours of course work at the 500 level and above and 30 hours of thesis credit, except that students graduating prior to the summer of 1981 will be required to complete a minimum of 30 hours of course work at the 500 level or above and 24 hours of thesis credit.

Course work and work on dissertation may proceed concurrently in any combination throughout the doctoral program. However, at no time shall a doctoral student register for more than 15 hours of 500 level and above courses.

Following successful completion of comprehensive exams and "admission to candidacy" students must register continuously. Students admitted to "candidacy for degree" will register for and be charged for 10 hours of credit for each full-time term of doctoral work. For each term of part-time enrollment, students will be charged for 7 hours of credit, except that students not making use of campus facilities may petition the Graduate School for 3-credit-hour status. It is expected that the student and adviser will consult each semester as to the number of hours for which the student will register, consistent with the classifications identified above.

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 faculty 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 toward the doctorate until 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

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.

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.

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.

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 defending the dissertation 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 fewer than eight months of further work.

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.

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 320. Unless equivalent subject matter has already been taken, first-year graduate students will be required to enroll in Psych. 410 (Beh. Gen.) or EPOB 420. 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, EPOB 422/522, or EPOB 527).

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 or EPOB 421), and Research in Behavioral Genetics (Psych. 601).

Note: Changes in the above requirements are now under consideration. Interested students should consult with their departments and the institute.

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, kinetics, and chemistry and physics of the surface and condensed state.

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, 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. 553. Statistical Mechanics	3
Chem. 556. Physical Chemistry of Macromolecules	3
Chem. 558. Quantum Chemistry	3
Chem. 559. Advanced Molecular Spectroscopy	3
Chem. 652. Advanced Topics in Physical Chemistry	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.

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, astrogeophysics, 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 M.B.S. 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, Campus Box 329, 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. For the nonthesis option, 30 semester hours of basic science courses numbered 300 and above, taught by members of the graduate faculty, and selected from two or more departments. For the thesis option, 24 hours of basic science courses numbered 300 and above, taught by members of the graduate faculty, and selected from two or more departments. Of the required hours for either option, 12 hours or more must be from courses numbered 500 and above. Thesis credit does not count toward these 12 hours. Courses fulfilling program 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. For the nonthesis option, completion of a paper describing a research project or other specialized study on a topic approved by the Executive Committee. For the thesis option, completion of a thesis which must meet the general requirements of the Graduate School for M.A. or M.S. theses and must be approved by the Executive Committee. Approval of the topic, for either option, 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.

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. Students are required to take 3 semester hours in small business management and are permitted to take an additional 3 semester hours in the College of Business and Administration. 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

Within the science option there are two choices: the nonthesis option or the thesis option.

1. In either option the student must take 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. For the nonthesis option, upper division electives in science, mathematics, or computer science to complete an approved 30-semester-hour degree plan. For the thesis option, upper division electives in science, mathematics, or computer science to complete an approved 24-semester-hour degree plan. Of the required hours for either option, 12 hours or more must be from courses numbered 500 and above, not to include thesis credit. The required hours may also include 3 semester hours of upper division courses or seminars in secondary school teaching, history of science, or philosophy of science.

3. Thesis Option. The student who plans to present a thesis for the M.B.S. degree must report this to the Executive Committee of the M.B.S. program not later than the second semester. The student's choice of a thesis adviser must be approved by Executive Committee at this time.

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 Continuing 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

In recent years the increasingly mathematical character of many branches of physics has opened up numerous opportunities for fruitful interplay of the ideas of mathematics with those of physics. At the same time increasing specialization in both fields has, if anything, reduced the possibility of communication between the two disciplines, so that students of mathematics have less time to study physics and vice versa. This contrasts strongly with the period up to the first quarter of this century, when there was close contact between the two fields, many great mathematicians were deeply involved in physics problems, and a number of important mathematical ideas had their origin in the study of nature itself.

It is against this background that the Departments of Mathematics and Physics offer an interdisciplinary doctoral program in mathematical physics, with the following general objectives:

1. To attract students to and prepare them for research in modern mathematical physics and the relevant mathematics.
2. To promote collaboration and cooperation between the Departments of Mathematics and of Physics.
3. To institute courses pertinent to mathematical physics not already offered in either department.
4. To develop a strong center of mathematical physics at this university.

Initially the number of students involved in the program will be small, and it should be possible for the Steering Committee to follow their progress individually and closely. It therefore seems unnecessary and undesirable to spell out in complete detail a rigid set of requirements and regulations. The design of the program is outlined below.

1. Administration of the Program. The mathematical physics program is guided by a Steering Committee composed of members from the Departments of Mathematics and Physics. This Steering Committee administers the program within the rules of the Graduate School.

2. Admission Requirements. The requirements for entrance into the program are acceptance as a degree student either in the Department of Mathematics or in the Department of Physics and a good undergraduate background in both physics and mathematics, obtained by either a double major in undergraduate study or a major in one of the fields combined with suitable subsequent study of undergraduate courses in the other. Acceptance into the program is decided by the Steering Committee on the basis of the foregoing requirements and the student's general promise. Satisfaction of the second requirement is evaluated in each case individually, partly on the basis of the student's transcript and partly on the basis of a written examination on undergraduate work in the second field. For a student enrolled in the Department of Mathematics, that examination is the Physics Department's Preliminary Examination given to entering physics graduate students at the beginning of each fall term. For a student enrolled in the Physics Department, it is a similar examination on undergraduate

mathematics administered by the Steering Committee or by a faculty member designated by the committee. The examination is partly diagnostic; as result of it, the Steering Committee or the student's adviser may recommend further study of certain subjects.

3. *Advisory Committee.* Each student in the program, as soon as his field of specialization has been chosen, requests the staff member with whom he wishes to work to act as chairman of his advisory committee. The chairman, with the advice and approval of the Steering Committee, selects one member of the graduate faculty from the Department of Mathematics and one from the Department of Physics to serve on the student's advisory committee. A purpose of the advisory committee (beyond guiding the student throughout his graduate study) is to insure against too narrow a specialization.

4. *Course Requirements.* To prepare for the Ph.D. in mathematical physics, each student must take appropriate course work in the Department of Mathematics and the Department of Physics. His program of study must be approved by his advisory committee and should be designed in part to prepare him for the second-year examination (see 5 below) in the department in which he is matriculated. In addition, the candidate is expected to pass at least two distinct graduate-level core courses in the second field (see table below) and at least two semesters of the advanced mathematical physics courses (Math. 653, 654, 655, 656 = Phys. 603, 604, 605, 606).

Core Courses in the Second Field

Mathematics Courses for 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 Courses for Mathematics Students

Phys. 621. Mechanics
 Phys. 625, 626, 627, 628. Quantum Mechanics
 Phys. 631, 632. Electromagnetism
 Phys. 644, 645. Statistical Mechanics
 Phys. 685. Theory of Relativity

These are in addition to subjects like ordinary and partial differential equations, linear algebra, and complex variables required of all physics students and covered, for example, in mathematical physics.

5. *Examination Requirements.* Each student in the mathematical physics program must pass the second-year examination in the department in which the student is matriculated (i.e., the physics comprehensive or the mathematics preliminary examination) according to the rules of that department. The second-year examination constitutes the *Comprehensive Examination* required by the Graduate School.

6. *Transferring into and out of the Program.* Transfer into the program is possible at any time, subject to the entrance requirements mentioned above, and also transfer out of it, because a student in the program retains status as a regular degree student in

the department of his or her primary field. Formal acceptance into the program is usually deferred until the student has passed the second-year examination but any student who is interested in the program and has an appropriate background is urged to apply for the program as soon as possible.

7. *Master's Degree.* Master's degrees in mathematical physics are not given. If for any reason a student becomes a master's degree candidate, he will be transferred out of the mathematical physics program into a regular department major.

8. *Research Requirements.* Each successful participant in the program is required to submit and to defend a thesis describing original research performed by himself. He may carry out his research under the direction of any Graduate Faculty member in the Department of Mathematics or the Department of Physics.

9. *Language Requirement.* Each student in the program must fulfill the language requirement of the department in which he has matriculated.

TELECOMMUNICATIONS

The telecommunications program is interdisciplinary, involving the Departments of Communication, Electrical Engineering, Finance, Political Science, Computer Science, and Sociology, and the College of Business, leading to a Master of Science degree in telecommunications. The object of this 12- to 18-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 basically 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
EDEE 595. Selected Topics/Engineering Management	3
E.E. 594. Telephone Systems	3
B.Ad. 200. Business Information and Computer ¹	3
Comm. 606. Management of Communication Systems	3
P.Sc. 580. The Political System and Telecommunications	3
E.E. 597. Speakers Seminar	1
<i>Spring Semester</i>	
E.E. 537. Telecommunications Laboratory ¹	2

¹May not be necessary for recent engineering graduates or others with the relevant experience.

E.E. 532. Telecommunications System Theory or	
E.E. 567. Reliability and Queuing Theory	3
E.E. 591. Electromagnetic Wave Transmission for Telecommunications	3
Comm. 560. Radio-TV Station Organization and Operation ...	3
EDEE 950. Independent Study/Engineering Economy	3
Fin. 580. Structure and Financing of the Telecommunication Industry	3
P.Sc. 581. Legal Structure and Regulation	3
E.E. 597. Speakers Seminar	1
<i>Summer Session</i>	
E.E. 591. Cable TV	2
E.E. 592. Contemporary Issues in Telecommunication Policy	3
Telecommunications Project or Thesis	6

A minimum of 32 hours is needed to graduate, but students are encouraged to take at least 40 hours where possible.

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 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, B.Ad. 200, is available for students without any computer background.

E.E. 537 (Telecommunications Laboratory) is designed for students lacking a prior experience with electrical equipment. E.E. 534 is normally a prerequisite. Students at the entry to the program are expected to be competent at least at the high school level in mathematics and elementary physics, and are advised to review such material if necessary prior to commencing course work.

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 1 hour of credit and exposes the student to a range of topics from speakers representing many different sides of the telecommunication industry.

The student will register for a total of 6 hours of credit for a project or thesis. The courses registered for will be decided upon by each individual with the help of the student's adviser.

Graduate School at the Health Sciences Center

ANATOMY

Students wishing to pursue graduate work in anatomy leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees, and Graduate School at the Health Sciences 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.

Anat. 501A-11. Human Anatomy. *Winter.* Designed to help the student achieve a reasonable, competent knowledge and understanding of the structure and function of the human body through lectures, discussions, cadaver dissection, and investigation of clinical correlates. Willson, Smith.

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. Temple, 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, Selitrennikoff.

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. 632-3. Human Embryology. *Spring.* Principles of development are presented through examination of embryogenesis of mammals, especially humans. The first half of the course deals with topics such as fertilization, embryo transport, implantation, formation of extra-embryonic membranes, and early organogenesis. The remaining part of the course covers selected aspects of organogenesis with a strong emphasis upon the relationship between developmental processes and the establishment of adult gross and microscopic anatomy. Congenital malformations and their causes will also be emphasized. Lectures will be supplemented with demonstrations and audiovisual material. Cunha.

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-credit to be arranged. Master's Thesis. *All quarters.*

Anat. 800-credit to be arranged. 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 in special aspects such as pediatric, cardiac, obstetric, or transplant anesthesia or in pain management. 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. 650. Research in Anesthesiology. *All quarters.* Individual clinical or laboratory research or participation in appropriate ongoing projects in the department. Special permission and individual arrangements necessary. Swanson.

Anes. 700-credit to be arranged. Master's Thesis. *All quarters.* Special permission and individual arrangements necessary. Swanson.

BIOCHEMISTRY, BIOPHYSICS, AND GENETICS

The graduate program gives advanced training to candidates for the Ph.D. degree in general biochemistry, biophysics, and genetics; theoretical biophysics; cell biology; 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.

Students considering graduate studies in the department should read carefully the sections of this catalog concerning Requirements for Advanced Degrees and Graduate School Admission Requirements.

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

The department welcomes applications from students who have a strong background at the college level in biology and chemistry, preferably students who have majored in both or who have honors degrees in one or the other of these fields. Requests for admission should be sent to:

Committee on Admissions
Department of Biochemistry, Biophysics, and
Genetics
University of Colorado Health Sciences Center
4200 E. 9th Avenue, B-126
Denver, Colorado 80262

Students should make certain that the Committee on Admissions is provided with transcripts relating to their college degrees, with letters of recommendation from their colleges and with the results of the Graduate Record Examination (GRE).

In general, preference will be given to students who meet the following standards:

1. A combined score in excess of 1900 in the Verbal, Quantitative, and Analytical sections of the GRE. Students are encouraged to take the Advanced section of this examination, although this is not a requirement.
2. Completion in college of two semesters, or equivalent, in organic chemistry; one semester, or equivalent, of organic chemistry laboratory; one year of biology; and one year of general physics.
3. Completion in college of a course in physical chemistry that deals in some detail with thermodynamics and the properties of solutions.
4. Completion of college-level mathematics through the calculus.
5. Completion in college of four semesters, or equivalent, in a foreign language.

Students who do not fully meet the requirements in 3 and 5 may be admitted on a probationary basis, but will be required to make up these deficiencies.

For descriptions of research programs in the department, students should request from the department a descriptive brochure covering these programs.

Biochem. 500-6. Principles of Biochemistry. *Fall.* Primarily for medical 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. Hirs and staff.

Biochem. 600-5. General Biochemistry for Graduate Students. *Fall, Winter, Spring.* A three-quarter course, 5 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, particularly biophysics and genetics. The major areas of biochemistry and molecular biology will be 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. Hirs.

Biochem. 604-2. Protein Biosynthesis. *Winter.* 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 Erikson.

Biochem. 606-4. Structure and Function of Proteins. *Fall.* An interdepartmental course. Comprehensive treatment of protein structure and enzyme action. Given first in sequence with PHCL 606, Proteins: Regulation of Metabolism and Cell Function. Prer., Biochem. 600 and consent of instructor. Bublitz.

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. 613-1. Nucleic Acids. (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.

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. Hirs and staff.

Biochem. 660-1. Seminar in Biochemistry, Biophysics, and Genetics. *Fall, Winter, Spring.* Analysis and discussion of recent research. Required of all graduate students in biochemistry, biophysics, and genetics. Hirs and staff.

Biochem. 700-credit to be arranged. Master's Thesis. *All quarters.*

Biochem. 800-credit to be arranged. Doctor's Thesis. *All quarters.*

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 and Rock.

Biophys-Gen. 601-3. Topics in Medical Genetics. *Fall, Winter, Spring.* This is a three-quarter course, with 3 hours of credit each quarter. *Fall:* Survey of principles of genetics and introduction to counseling skills. *Winter:* Biomedical foundation for understanding genetic disorders. *Spring:* Clinical and laboratory methods in diagnosis and treatment of genetic disorders. Nora.

Biophys-Gen. 602-2. Human Genetics: Core Curriculum. *Winter, Spring.* A didactic review of the basic content of genetics suitable for candidates preparing for certification in clinical genetics, genetic counseling, and clinical laboratory genetics. The presentations will be shared by those with special competence in the various areas. Nora.

Biophys-Gen. 603-1. Interviewing and Counseling in Clinical Genetics: Theory and Applications. *Fall, Winter, Spring.* Techniques of interviewing and dynamics of counseling will be presented in didactic sessions and practical clinical settings. The impact of genetic disease on the family and the role of the genetic counselor in identifying and responding knowledgeably and compassionately to the needs of the family will be stressed. Nora.

Biophys-Gen. 606-3. Applied Medical Genetics. *Fall, Winter, Spring.* Study of and participation in the school operation of a genetic counseling clinic, with exposure to records, patient interviews, pedigree construction and analysis, literature searches, and problem solving. Laboratory experience in biochemical genetics, population genetics and cytogenetics. Prer., Biophys-Gen. 502 or a one-semester genetics course. Sujansky, Morse, and Nora.

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. 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. Evolution of Regulatory Mechanisms. *Winter.* Metabolic controls in prokaryotes and, at the cellular level, in eukaryotes. The relevance of cellular mechanisms of regulation to eukaryotic development. Prer., one-year course in biochemistry or equivalent. Rickenberg.

Biophys-Gen. 612-3. Eukaryotic Genetics. *Spring.* Is intended to provide a general survey of important developments in genetic analysis of eukaryotic systems. Topics include genetic analysis in somatic cells, structure and function of eukaryotic genes and chromosomes, genetic regulation and differentiation, biochemical genetics in eukaryotes. Other important genetic studies in eukaryotes of current interest will also be selected for discussion. Prer., biochemistry. Kao and staff.

Biophys-Gen. 614-2. Physicochemistry of Macromolecules in Solution. *Winter.* 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 and Campbell.

Biophys-Gen. 618-2. Molecular Biology of the Eukaryotic Cell. *Spring.* A literature review of techniques, current knowledge and theory of chromosome structure, gene expression and cellular regulation in both developmental and model cellular systems. Prer., Bioc. 613. Staff.

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. 621-1. Genetic Epidemiology. *Spring.* This discipline underlines a major area of studies of disease causation as investigated in families and populations. The seminar will look at several problems including common birth defects, cancer, IQ, teratology, and coronary disease in a lecture/discussion format. Prer., course in genetics, epidemiology, or biometrics. Nora.

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. Staff.

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. Staff.

Biophys-Gen. 628-1. Environmental Mutagens and Carcinogens and their Detection. *Spring.* Discussion of the history of mutagens and carcinogens in relation to man; industrialization and deterioration of the environment; regulation by legal bodies; genetic effects; methods of screening; mutagenesis, carcinogenesis, and teratogenesis and their possible relationship. Prer., consent of instructor. Webber and Morse.

Biophys-Gen. 630-3. Laboratory Techniques of Mammalian Cells in Vitro. *Fall.* 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. 660-1. Seminar in Biochemistry, Biophysics, and Genetics. *Fall, Winter, Spring.* Analysis and discussion of recent research. Required of all graduate students in biochemistry, biophysics, and genetics. Hirs and staff.

Biophys-Gen. 700-credit to be arranged. Master's Thesis. *All quarters.*

Biophys-Gen. 800-credit to be arranged. Doctor's Thesis. *All quarters.*

BIOMETRICS

The Department of Biometrics offers training leading to either an M.S. or Ph.D. degree. Applicants are expected to have a bachelor's degree in a scientific field with mathematics through intermediate (second year) calculus and two years of course work in the physical and/or biological sciences. No beginning students will be accepted who do not have at least a 3.0 grade-point average as undergraduates. Applicants 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.

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.

Admission to the Ph.D. program requires a master's degree in statistics or its equivalent. 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. Biostatistical Methods. *Fall.* This is the first of a two-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. Biostatistical 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. 610-3. 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. 613-3. Epidemiology. *Fall.* Offers an introduction to the approaches and methods used in describing the natural history of disease in the community, for locating clues to the causes of disease and of ways to develop and evaluate preventive strategies and other medical services. Lecture-discussions are supplemented with problem-solving exercises.

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. 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. *Winter.* 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. Nonparametric 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. 629-3. Epidemiologic Methods. A participating seminar review of research problems in methodology most used in epidemiological studies of chronic diseases.

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.* 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. 660C-3. Longitudinal Data Analysis. Continuation of Biomet. 660B. Students will conduct supervised individual investigations of large data collections which are the center of current research at the Health Sciences Center. They will encounter and solve many of the problems typical of multivariate computer analysis of massive collections of real data while applying the techniques discussed in Biomet. 660A and 660B.

Biomet. 700-credit to be arranged. Master's Thesis. *All quarters.*

Biomet. 800-credit to be arranged. 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. Satisfactory completion of the first four quarters of the Child Health Associate Program.

CHB Biol. 514-1. 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.

CHB 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., CHB 337 and consent of instructor. Weston.

CHB 519-2. Pediatric Pharmacology I. *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 antipyretics, antitussives, antihistamines, antibiotics, vaccines, bronchodilators, minor and major analgesics, anticonvulsants, and emergency drugs. Pannbacker.

CHB 524-1. 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.

CHB 529-2. Pediatric Pharmacology II. *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. Pannbacker.

CHB 531-2. Problem Solving in Medical-Surgical Pediatrics I. *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. Common pediatric entities will be emphasized. Areas covered include: hematology, oncology, neurology, allergy, infectious disease, and laboratory medicine. Berman.

CHB 532-4. Problem Solving in Medical-Surgical Pediatrics II. *Winter.* 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. Common pediatric entities will be emphasized. Areas covered include renal disease, neonatology, genetics, pulmonary disease, dentistry, endocrinology, and ophthalmology. Berman.

CHB 533-4. Problem Solving in Medical-Surgical Pediatrics III. *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. Common pediatric entities will be emphasized. Areas covered include pediatric surgery, gynecology, cardiology, orthopedics, and gastroenterology. Berman.

CHB 534-1. Emergency Medicine in Practice. *Winter.* Provides students with the knowledge and skills to handle various types of emergent 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.

CHB 537-2. Pediatric Clinical Preceptorship I. *Fall.* Involves approximately 9 hrs. per wk. of time 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. Prer., CHB 337 and consent of instructor. Moore.

CHB 538-3. Pediatric Clinical Preceptorship II. *Winter.* See CHB 537 for description.

CHB 539-3. Pediatric Clinical Preceptorship III. *Spring.* See CHB 537 for description.

CHBT 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. Walker.

CHP 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., CHB 337 and consent of instructor.

CHP 517-1. Graduate Seminar I. *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.

CHP 518-2. Psychosocial Aspects of Pediatrics I. *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. Schmitt.

CHP 527-1. Graduate Seminar II. *Winter.* See CHP 517 for course description.

CHP 528-2. Psychosocial Aspects of Pediatrics II. *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 may be done in this course. Prer., consent of instructor. Schmitt.

CHP 532-1. 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.

CHP 537-1. Graduate Seminar III. *Spring.* See CHP 517 for course description.

CHP 538-2. Psychosocial Aspects of Pediatrics III. *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. Schmitt.

CHA 620. Master's Project — Proposal. *All quarters.* This first segment of the clinical research project involves formulating a worthy problem for investigation including an in-depth review of the literature, overview of the methodology, analysis of data, and timetable of the study. An expert in the field and a program faculty sponsor should be solicited as advisers. Credit to be arranged. Moore.

CHA 621. Master's Project — Final Report. *All quarters.* This second segment of the project includes carrying out all field work and data collection of the approved proposal, analysis of data, and preparation of the final complete report. Advisers/consultants should be utilized to monitor each step as it proceeds. Credit to be arranged. Moore.

CHA 622. Master's Project — Oral Presentation. The third segment of the graduate project demands an oral presentation of the completed project to CHAP faculty, students, instructors, project sponsors, and other interested parties. Preparation of effective audiovisual aids and fielding questions after the presentation are integral parts of this presentation. The study should also be prepared for publication in the appropriate journal if feasible. Credit to be arranged. Moore.

CHA 623-5. Internship Summary Report. *All quarters.* These credit hours entail completion of a summarizing report of the internship clinical experiences and accomplishments quantitating numbers and

types of patients seen; comparing health care services and provision formats in the varied clinical sites; delineating patient, preceptor, other health care personnel acceptance; noting variations in self-utilization at different sites; discussion of other factors impinging on them as nontraditional health care providers; discerning factors both positive and negative as relates to the internship goals; describing personal and professional accomplishments during the year. Moore.

CHA 950. Independent Study-credit to be arranged. *All quarters.* Students, after consultation regarding their special interests and needs, may select a topic for in-depth independent study with credit hours commensurate with time given to study. This effort must be documented by written or verbal presentations and demonstrated functional knowledge on the topic studied. Moore.

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 Graduate School Admission Requirements.

The following courses are offered at the Health Sciences 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. Students should 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.* 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. Luke.

H.A. 602-3. Health Economics. *Spring.* 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. Luke.

H.A. 603-2. Regulation I: Cost Containment and Reimbursement. *Fall.* Provides students with a working knowledge of major third-party reimbursement procedures and policies, with particular emphasis on the Medicare and Medicaid programs. In addition, it examines cost containment efforts in the health care sector at the federal and state levels, including analysis of recent Congressional proposals. Schlenker.

H.A. 604-2. Regulation II: Quality Assurance. *Spring.* An in-depth examination of organizational 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. Luke.

H.A. 605-2. Medical Sociology. *Fall, Spring.* A basic introduction to sociological concepts and their application to an understanding of health behavior and attitudes. Illness behavior is viewed from the perspective of the patient, health practitioner, social science, and social influences. Staff.

H.A. 606-2, 607-2. Policy Analysis I, II. *Fall, Spring.* A sequence of electives dealing with the formulation and analysis of health policy at the federal, regional, and local levels. Students develop a conceptual and analytic framework for policy analysis based on the theoretical constructs of political science, sociology, and economics. Staff.

H.A. 610-2, 611-3. Quantitative Methods I, II. *Fall, Spring.* A sequence of required courses designed to provide students with scientific problem-solving/decision-making techniques. The courses cover

statistical inference, quantitative and nonquantitative approaches to problem solving and include, but are not limited to, topics in computer processing, forecasting, queuing, operations research, and regression analysis. The courses are designed to provide students with the ability to use quantitative methods in their own work, to communicate with others working in the field, and to read and comprehend written material containing a variety of quantitative methods. Shaughnessy.

H.A. 614-2, 615-2. Topics in Quantitative Methods I, II. *Fall, Spring.* An elective sequence for students choosing this area of emphasis. Consists of project-directed work. Staff.

H.A. 619-2. Seminar in Research Methods. *Fall.* 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. Orleans.

H.A. 620-2. Health Sciences. *Fall.* 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. Slater.

H.A. 621-3. General Systems Theory. *Fall.* 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. Kaiser.

H.A. 622-2. Health Planning I. *Spring.* 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. Slater.

H.A. 623-3. Health Planning II. *Fall.* 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. Staff.

H.A. 624-3. Health Planning III. *Spring.* The primary focus of this course is area-wide health planning on broad scale social planning settings. Students will gain conceptual and practical skills in planning methodologies (including regulation), strategy development and implementation, as well as learning to deal effectively with the political system. Staff.

H.A. 625-2. Health Planning Practicum. *Fall, Spring.* 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. *Fall, Spring.* 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. Orleans.

H.A. 627-3, 628-3. Program Evaluation II, IV. *Fall, Spring.* 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. Shaughnessy.

H.A. 630-2. Principles and Practices of Community Health Education. *Fall, Spring.* 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 con-

sumerism, 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. 641-2. Administrative Communication. *Fall, Spring.* 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. 642-2. Organization and Management I. *Fall.* 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. Staff.

H.A. 643-2. Organization and Management II. *Spring.* 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. Staff.

H.A. 644-2. Legal Problems in Health Care Administration. *Spring.* 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. *Fall.* 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. Staff.

H.A. 650-credit to be arranged. Research. Practicum in health administration. Staff.

H.A. 662-3. Finance I. *Fall.* Focuses on the financial management process in health care organizations. Attention is placed on the management of assets, the budget process, sources of funds for short- and long-term needs and the financial accounting reporting system. A comprehensive case serves as the focal point. Suver.

H.A. 663-3. Finance II. *Spring.* Explores in-depth the accounting systems utilized in hospitals, with emphasis on the decision-making process. Management accounting techniques will be thoroughly covered. Such current topics as break-even analysis, flexible budgeting, and capital budgeting will be explored, along with their impact on the health care environment. Problems will serve as the primary pedagogical tool, with a comprehensive case serving as the integrative device. Suver.

H.A. 664-3. Finance III. *Fall.* 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. Suver.

H.A. 665-3. Finance IV. *Spring.* 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. A hospital simulation game will be utilized to integrate the financial management concepts introduced in the preceding finance courses. Suver.

H.A. 670-3. Institutional Management I. *Fall.* Examination of the structure, organization, and management of health care institutions including ownership, administration, professional and nonprofessional departments, and personnel. Staff.

H.A. 671-3. Institutional Management II. *Spring.* 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. Staff.

H.A. 672-2. Ambulatory Care Administration. *Fall, Spring.* 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. 674-1. Multi-institutional Management. *Fall, Spring.* 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. 676-2. Rural Health Systems I. *Fall.* 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. Warren.

H.A. 677-2. Rural Health Systems II. *Spring.* 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. Warren.

H.A. 678-2. Health Care Marketing. *Fall, Spring.* 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. Guest faculty.

H.A. 700-credit to be arranged. Master's Thesis. *All semesters.* Staff.

INTERDEPARTMENTAL PROGRAMS

Molecular and Cellular Biology

This interdepartmental program leading to the Ph.D. degree provides training in molecular and cellular biology with a strong emphasis on the basic mechanisms of disease. Its faculty is composed of members of the basic science departments of the University of Colorado Health Sciences Center School of Medicine.

All entering students participate in a rigorous one-year core program of formal course work and seminars designed to provide them with the fundamental knowledge necessary for research in molecular and cellular biology. During the first year, each student also rotates through at least three laboratories of the participating faculty. Students then select a faculty sponsor for their advanced research training. The diverse research interests of the participating faculty ensure a broad range of fields from which to choose an area of specialization.

Candidates for admission should have theoretical and laboratory training in general biology, including genetics, inorganic and organic chemistry, physics, physical chemistry, calculus, and statistics. Students must meet all the usual requirements of the University of Colorado, including the foreign language stipulation. Students are required to take the Graduate Record Examination (GRE) and have their scores forwarded prior to admission.

Interdepartmental courses and selected courses from individual departments at the Health Sciences Center are offered for this program.

Molecular and Human Genetics

This interdepartmental program leading to the Ph.D. degree provides training in genetics with specialization extending from basic molecular studies to more clinically oriented research and genetic counseling. The faculty is drawn from the Departments of Biochemistry, Biophysics, and Genetics; Pediatrics; and Obstetrics and Gynecology of the University of Colorado Health Sciences Center School of Medicine.

A wide range of course work and research training is provided in the first year of study. This includes studies in genetics as well as training in allied fields. Students do laboratory rotations in four areas of genetics: (1) molecular and microbial genetics, (2) somatic cell genetics, (3) biochemical genetics, and (4) clinical and cytogenetics. During the second year of the program they select a faculty adviser for advanced research training.

Candidates for admission should have theoretical and laboratory training in general biology, including genetics, inorganic and organic chemistry, physics, physical chemistry, calculus, and statistics. Students must meet all the usual requirements of the University of Colorado, including the foreign language stipulation. Students are required to take the Graduate Record Examination (GRE) and have their scores forwarded prior to admission.

The following interdepartmental courses are taken in the above interdepartmental graduate programs and/or in other Health Sciences Center programs.

IDPT 602-3. Basic Oncology. *Winter.* Designed for both medical and graduate students, part of the content of which is based upon the cell biology and molecular biology of the cancer cell. The focussing of this knowledge to the understanding of the problems and the management of the cancer patient is emphasized. While clinical illustrations are used, this is not a course in the systematic management of the cancer patient. Lehman and Kerr.

IDPT 607-2. Drugs and the Developing Organism. *Fall.* Designed to provide an understanding of basic physiologic mechanisms involved in pediatric pharmacology. It covers liver enzymes, renal function, placenta-barrier, and blood-brain-barrier. Child disorders such as the hyperkinetic syndromes, epilepsies, and newborn addiction are discussed. Presented by the Departments of Pharmacology and Psychiatry. Vernadakis and Manchester.

IDPT 608-credit to be arranged. Clinical Research Techniques and Studies of Human Disease. *Spring.* The course will focus on experimental design, execution, and interpretation of clinical research studies with reference to current techniques and effective use of methods. Discussions of current and future clinical research problems will be presented by members of different divisions and departments in an effort to provide the student with an understanding of recent advances in clinical research in several subspecialties. Students will write a literature report on a clinical research subject of their choice and present it to the class. Gordon.

IDPT 609-3. Membranes and Transport. *Spring.* Membrane structure and function will be considered in a lecture-discussion format. Student presentations and readings from current journals will supplement lectures on such topics as membrane structure and fluidity, electrolyte and nutrient transport across membranes, energy transduction in membranes and membrane potentials. Neville, Harold and Sinensky.

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. Vernadakis.

IDPT 615-1. Physiology of Skeletal Muscle and Bone. *Fall.* Cellular contractile mechanisms, functional and exercise aspects of muscle contraction and relationship of muscle and bone. Jointly by Departments of Physiology, Physical Medicine and Rehabilitation, and Orthopedic Surgery. Lectures and demonstrations. Sexton, Gersten, Miles, Cenkovich, and Solomons.

IDPT 616-1. Neuroscience Seminar. *Fall.* Designed to demonstrate current neuroscientific research and its applications in the study of neurological diseases. The student attends weekly lectures in which faculty members present current neuroscientific investigations in their laboratory. The lectures are reviewed both for methodology and clinical relevance with the course directors in a Friday noon informal brown-bag seminar. Students need not have previous knowledge in the field. Ringel.

IDPT 620-no credit. Current Topics in Immunology. *All quarters.* Overview of current, clinically relevant topics in immunology. Clinical topics in immunology from January to May; Denver Immunology Research Seminars from June to December. Kohler.

IDPT 621-2. Functional Basis of Cardiovascular Disease. *Fall.* Covers the pathophysiology of several common clinical cardiovascular disorders. *Prer., Physiol.* 501. Tucker and Reeves.

IDPT 622-2. Geriatric Pharmacology. *Spring.* The course will consist of lectures by Dr. Antonia Vernadakis and invited guests from the University of Colorado, Colorado State University at Fort Collins, and others, including internationally recognized experts in the field. Topics will include CNS aging (morphological, biochemical, and functional, psychological); neuroendocrine mechanisms and aging; drug metabolism (liver and kidney function); cellular aging. Vernadakis.

IDPT 624-4. Microbial and Molecular Genetics. *Winter.* A lecture course with emphasis on modern microbial genetics, primarily of *Escherichia coli* and its phages. Sadler and Taylor.

IDPT 627-3. Developmental Neurobiology. *Spring.* Lectures and student presentations covering advanced topics in neuroembryology, growth and maturation neurons, synaptogenesis (microscopic physiological and biochemical), and higher brain integration systems. Vernadakis.

IDPT 629-2. Human Inborn Errors of Metabolism. *Spring.* Examines human diseases which result from mutations of catalytic, transport, and structural proteins. Emphasis on the mechanisms through which the abnormal phenotype is produced as well as on recent advances in the prevention and treatment of these conditions. Patients will be presented when possible. Goodman.

IDPT 630-4. Basic Mechanisms in Virology. *Spring.* Molecular aspects of the structure and replication of viruses will be presented. Bacteriophages will be considered, but primary emphasis will be placed on animal viruses and significant part of the course will deal with tumor viruses. Among topics to be considered are transformation by RNA and DNA tumor viruses, genetics of animal viruses, biosynthesis of viral nucleic acids and proteins, virus assembly, latency, and expression of endogenous viral genes. When appropriate material is available, laboratory demonstrations will be presented. Erikson.

IDPT 640-1.5. Mammary Gland Biology, Lactation and Breast Feeding. *Spring.* An interdisciplinary approach to the function of the human mammary gland as it relates to infant nutrition. The course will comprise eleven 75-minute presentations on such topics as breast feeding through the ages, the mechanism and control of milk secretion and letdown, practical techniques in breast feeding, the mammary gland and human reproduction, antibodies in milk, mastitis, drugs in milk, the biology of the mammary cell. There will be a final examination over lecture content and assigned reading. The course is open to all students in the HSC but will be directed toward medical, graduate and graduate nursing students. Neville.

IDPT 642-1. Topics in Lactation Research. *Spring.* A companion course to IDPT 640 for students interested in a more in-depth study of the original literature dealing with mammary gland biology, human lactation, and the practice of breast feeding. Original papers will be assigned for discussion by faculty and students. Neville.

IDPT 662-3. Mathematical Modeling in Medicine. *Spring.* 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. Swanson.

MEDICINE

Students wishing to pursue graduate work in Medicine leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and Graduate School admission requirements.

Med. 646. Special Problems in Analytical Clinical Chemistry. *Fall, Winter, Spring.* A problem will be selected jointly by the instructor and student. The purpose of the course is to give experience in formulating and solving current problems of importance and interest in clinical chemistry. Special emphasis will be placed on the use of advanced analytical instrumentation. Pearson.

Med. 650. Research in Medicine. *All quarters.* The course will focus on learning biochemical research techniques with emphasis toward their utilization in clinical research. S. Gordon.

Med. 700-credit to be arranged. Master's Thesis. *All quarters.* S. Gordon.

MICROBIOLOGY AND IMMUNOLOGY

Candidates for admission to graduate work in microbiology and immunology 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 Graduate School Admission Requirements.

The Department of Microbiology and Immunology 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. 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. Roberts and staff.

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. Borek and staff.

Microbiol. 629-2.5. Immunology. *Fall.* This course is the same as Microbiol. 524, the medical core course, but is adapted for graduate students. Such students will not be required to attend clinical correlation sessions, but will attend a weekly in-depth discussion of the material presented in lectures at a time to be chosen. J. Cohen.

Microbiol. 630-2. Advanced Immunology. *Spring.* Given even-numbered years. An advanced course in immunology focusing on immunochemistry and advanced topics of cellular immunology. Students must have a considerable background in immunology. Claman and staff.

Microbiol. 631-2. Immunobiology. *Winter.* Lectures on the biology of immunologic responses, allergic reactions, pathogenesis of disease, acquired immunity, and immune control mechanisms. Crowle.

Microbiol. 650-credit to be arranged. Research in Microbiology and Immunology. All quarters. Independent research in Microbiology and/or Immunology open to all graduate students with approval of their individual departments or advisors. Arrangements will be made with the Microbiology and Immunology faculty member under which research is done. Pre-requisites: training in microbiology/immunology and biochemistry. Pizer and staff.

Microbiol. 700-credit to be arranged. Master's Thesis. All quarters. Pizer.

Microbiol. 800-credit to be arranged. Doctor's Thesis. All quarters. Pizer.

GRADUATE NURSING PROGRAM

Master of Science Degree

The Master of Science program focuses on specialization in nursing and prepares graduates who can assume leadership roles in clinical, administrative, and educational settings. Within the master's program there are five specialty areas of nursing:

Community Health Nursing
Medical-Surgical Nursing
Nursing Administration
Parent-Child Nursing
Psychiatric-Mental Health Nursing

A Family Nurse Clinician subspecialty, drawing from the programs in Parent-Child, Community and Medical-Surgical Nursing is available. In addition, students may elect to develop a functional area in teaching. 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.
7. Acquire and extend competencies in leadership.

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 Affairs, University of Colorado Health Sciences Center, C-288, 4200 East Ninth Avenue, Denver, Colorado 80262.

A *School of Nursing Bulletin* is available by sending \$1 to the above address.

ADMISSION REQUIREMENTS

Requirements for admission to the Master of Science program in nursing are as follows:

1. Professional registered nurse licensure (state of Colorado) and a baccalaureate degree in nursing from a school of nursing accredited by the National League for Nursing. If the baccalaureate program was not accredited by the N.L.N. at the time of graduation, each nursing course and the program as a whole will need to be evaluated for equivalency to the University's baccalaureate course offerings. Therefore, the following credentials will be required to support the application:
 - a. Outlines of nursing courses, including descriptions of clinical experiences.
 - b. A letter from the dean stating progress being made toward accreditation.

2. A minimum grade-point average of 2.75 on the baccalaureate level. This is essential for advanced study.

3. Evidence of successful completion of a course in elementary statistics.

4. Acceptable performance on the Graduate Record Examination, aptitude portion only.

5. A personal interview may be required.

Doctor of Philosophy Program in Nursing

The Doctor of Philosophy program in nursing offers the professional nurse with a master's degree an opportunity to pursue doctoral study. The purpose of the program is to prepare nurse investigators who are able to advance the knowledge of nursing.

Graduate studies and research opportunities are available in three areas:

1. *Psychosocial Nursing* is the study of health, stress, and illness behaviors of individuals and groups. A major focus is the promotion of wellness through psychosocial nursing interventions. Available within psychosocial nursing is the mental health program, which prepares nurses to improve practice and advance nursing knowledge in the promotion of mental health and the prevention of mental illness. A concentration on aging is also available within psychosocial nursing.

2. *Psychobiological Nursing* is the study of the interrelationship of psychological and biological processes in determining human behavior in health and illness. The development of biological and behavioral intervention strategies to improve the psychobiological function of the individual is the primary research goal. Concentrations on aging and developmental psychobiology are available within psychobiological nursing.

3. *Nursing Care Delivery Systems* is the study of developing, managing, and evaluating systems through which nursing is provided. It encompasses environments and systems in which nursing is practiced and external systems which impinge on the practice of nursing or the delivery of care.

ADMISSION REQUIREMENTS

All applicants must meet the general admission requirements for doctoral applicants of the Graduate School of the University of Colorado, as outlined in the Graduate School section of the catalog. The following are additional requirements of the Department of Nursing:

1. Completion of a master's degree in nursing or its equivalent.

2. A cumulative master's grade-point average of 3.5.

3. A combined score of 1150 on verbal and quantitative aptitude portions of the Graduate Record Examination.

An interview is required for applicants meeting these admission requirements. Other factors to be considered are kind and amount of prior clinical nursing experience; evidence of research interest; and the cultural, geographical, and educational mix of students.

Applicants should request the Educational Testing Service to send their scores on the Aptitude Test (ver-

bal and quantitative) of the Graduate Record Examination (GRE) to the School of Nursing, Doctoral Program. An analytic score will be included for applicants taking the examination after 1977.

Applicants are not cleared for admission if GRE scores are lacking or if the faculty finds the scores unsatisfactory. The GRE is administered at many centers throughout the world. Information about the GRE will be sent with application materials or may be obtained from the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540, or from the graduate office of a university in the applicant's area.

DEGREE REQUIREMENTS

Awarding of the Ph.D. degree will be based on completion of a minimum of 72 semester hours of acceptable postbaccalaureate graduate work, including 16 semester hours awarded for the dissertation. If the master's degree has been completed, the requirements for the Ph.D. can be expected to take approximately three years of full-time study and research. Approval of up to 10 hours of transfer credit will be based on the relevancy and recency of the applicant's prior work.

Each student will be expected to demonstrate competence in certain basic areas of theory and research and each specialty area will identify required seminars. In addition, each student will select courses supportive to that specialty area. Some courses may be selected from those available within the School of Nursing, but students will be encouraged to elect supportive courses from other academic departments in the University.

Students will take written preliminary examinations within the first year of their program as well as comprehensive examinations to advance to Ph.D. candidacy. The dissertation is to be an original piece of work based on investigation of a problem in nursing practice or nursing care delivery.

COURSE REQUIREMENTS

All doctoral students are required to enroll initially in a two-semester sequence on theory construction and analysis.

Most students also will be in their programs of study with a survey course on research designs used in applied sciences as well as in biological and behavioral sciences. Each student will be required to take course work necessary to develop a level of competence in research methods and statistics. As a minimum, students will be required to take two research design courses beyond the survey course and two advanced statistics courses and to develop facility in the use of computers.

Depending on the specialty area elected, students may begin required specialty courses in the first year of study or may need to take other courses prerequisite for enrollment in the required seminars. In addition to the required seminars in specialty areas, students will elect course work most supportive of the specialty area in view of the student's career goals. Students are required to enroll in a seminar on issues of concern to researchers and research administrators. Depending on their interests, students will supplement any of the

above-described courses with additional courses or through independent study in other departments or in the School of Nursing.

PRELIMINARY EXAMINATION

Each student will take a written preliminary examination within one year of admission to regular degree status. The purposes of this examination are to try to determine which students are capable of successful completion of the program and to use the results in subsequent academic advising. The examination will test knowledge in three areas: theory construction and analysis, research design and statistics, and the general field of nursing. A student who does poorly in the written examination may be permitted to repeat it the next time it is offered. A student who fails the examination two times will not be continued in the program.

COMPREHENSIVE EXAMINATION

The student is advanced to Ph.D. candidacy upon successful completion of written examinations in each of the following: theory construction and analysis, research design and statistics, and the specialty area. These examinations ordinarily will be offered twice a year, in November and April. Written examinations may be supplemented by oral examinations at the option of the examining committee.

DISSERTATION

The dissertation is to be an original piece of work based on investigation of a problem in nursing practice and related to the candidate's field of specialization. Supervision of the candidate is the responsibility of the dissertation committee which will include nursing faculty directly involved in the field of the student's specialty as well as faculty members involved in supportive and related areas.

Additional information and application materials may be obtained by writing to Associate Dean, School of Nursing, University of Colorado Health Sciences Center, 4200 East Ninth Avenue, C-288, Denver, Colorado 80262.

FINANCIAL ASSISTANCE

A doctoral student may wish to apply for financial aid in the form of a traineeship, fellowship, assistantship, loan, or scholarship. Some sources of financial assistance available are:

Mental Health Traineeships. Students in the mental health sequence are eligible for a traineeship including payment of tuition, fees, and a monthly stipend of \$325.

Professional Nurse Traineeships. Students who have not already received three one-year appointments in the Federal Professional Nurse Traineeship Program may be appointed for time unused. This program provides tuition, fees, and a variable small monthly stipend.

National Research Service Awards for Individual Predoctoral and Postdoctoral Nurse Fellowships. The National Research Service Award Act authorizes the

Division of Nursing to provide National Research Service Awards (NRSA) to nurses for predoctoral and postdoctoral training in specified areas of nursing and in biomedical and behavioral fields important to nursing. Application is made after admission to the program.

Graduate Nursing Student Loan and Scholarship Program. Some funds have been allocated by the federal government for graduate nursing student loans and scholarships. Further information and applications may be obtained from the Office of Student Financial Aid, University of Colorado Health Sciences Center, 4200 E. 9th Avenue, Denver, Colorado 80262.

Additional sources of support are available for students not otherwise supported.

Nurs. 503-2. Women's Role and the Health Care System. *Fall.* A graduate-level seminar for nursing students and other eligible Health Sciences 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. 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.

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.

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.

Nurs. 601-2. Seminar in Nursing Research. *Spring.* Elective seminar explores and critically evaluates 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. Quayhagen.

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.¹ *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.

¹Not offered on a regular basis.

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. Metzger.

Nurs. 618-3. Clinical Nurse Specialist Seminar. 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. Berlinger.

Nurs. 620-3. Pathophysiology I. *Fall.* Abnormal function of neural and endocrine structures: etiology, pathologic alteration, and management. Brockway.

Nurs. 621-3. Pathophysiology II. *Spring.* Abnormal function of cardiovascular, renal, and respiratory structures: etiology, pathologic alteration, and management. *Prer., Nurs. 620-3.* Brockway.

Nurs. 623-4. Adult Primary Care I. *Fall.* This 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 disorders, major and minor health problems, with management; health care outcomes; and nurse practitioner role adaptation. *Prer., or coreq., Nurs. 620.* Stephens.

Nurs. 624-4. Adult Primary Care II. *Spring.* This semester of the two-semester adult nurse practitioner track consists of two major components: primary health-care management of common adult chronic disorders; and adult life-cycle and life-style concepts, including psychosocial assessment and management. *Prer., Nurs. 623. Prer. or coreq., Nurs. 621.*

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 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., Nurs. 602 and 620.* Kaufmann.

Nurs. 626-2. The Adult—Illness Management and Health Maintenance II. *Spring.* Continuation of Nurs. 625. Kaufmann.

Nurs. 627-3 or 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 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. *Prer., Nurs. 475 or equivalent; prer. or coreq., Nurs. 602.* 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 research specific to family life. 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. Parent-child nursing faculty.

Nurs. 631-3. Advanced Parent-Child Nursing II. *Spring.* Continuation of Nurs. 630. Emphasis is on application of theory and intervention strategies. *Prer., Nurs. 630.* Parent-child nursing faculty.

Nurs. 632-2 to 6. Health Assessment and Maintenance in Maternity and Perinatal Nursing. *Fall, Spring.* This series, comprised of 2 credit modules, has been developed to enable 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.* This series, comprised of 2 credit 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. 634-2 to 6. Health Assessment and Maintenance in Pediatric Nursing. *Fall, Spring.* This course, comprised of 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 nursing faculty.

Nurs. 635-2 to 6. Health Assessment and Restoration in Pediatric Nursing. *Fall, Spring.* This series, comprised of 2 credit modules, concentrates on the assessment and intervention in various stages and states of pediatric nursing. Parent-child nursing faculty.

Nurs. 636-2 to 6. Current Issues in Parent-Child Nursing. *Fall, Spring.* This series, comprised of 2 credit modules, provides the student opportunities to gain greater depth of inquiry in areas directly related 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 theories from psychiatric, behavioral, and social sciences and psychiatric nursing as applied to clinical practice. Individually supervised, selected clinical experiences in individual patient work. *Prer., Nurs. 644; 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. Organization of content characteristic of associate degree programs in nursing.

Nurs. 652-3. Teaching in Continuing Education. A seminar course 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 the student for beginning a teaching career in schools of nursing. *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. Marriner.

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.* Marriner.

¹Not offered on a regular basis.

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. 659. Krueger.

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. Krueger.

Nurs. 662-3. Quality Assurance in Health Care. *Spring.* The history of the development of quality assurance in health care; governmental, professional, and legal considerations; current theoretical and research issues; quality assurance mechanisms in inpatient and community settings; and cost to benefit ratios. Krueger.

Nurs. 663-3. Concepts for Practice. *Fall.* Concepts of clinical nursing practice applicable for various patient populations in diverse settings. Bloch.

Nurs. 665-4. 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. This includes analysis of practice in community settings. Community health nursing faculty.

Nurs. 666-2 to 6. Community Health Nursing II. *Spring.* Focuses on community health needs, 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. Community health nursing faculty.

Nurs. 668-3. Epidemiology. *Spring.* Epidemiological concepts and methods with emphasis on critical thinking in matters of health and disease.

Nurs. 675-4. Primary Care of the Family I. *Fall.* First semester of a three-course sequence designed to provide knowledge and skills to determine the health status of families as well as individual members and to offer appropriate therapeutic interventions. Provides clinical practicum. Carter.

Nurs. 676-4. Primary Care of the Family II. *Spring.* Second semester of a three-course sequence designed to provide knowledge and skills to determine the health status of families as well as individual members, and to offer appropriate therapeutic interventions. Includes clinical practicum. Prer., Nurs. 675. Carter.

Nurs. 677-4. Primary Care of the Family Practicum. *Summer.* An 8-week summer course which is the third course in a sequence designed to provide the student with extensive practice in determining health status of families as well as individual members and to offer appropriate therapeutic interventions. Prer., Nurs. 676. Carter.

Nurs. 680-1 to 2. Independent Study. *Fall, Spring, Summer.*

Nurs. 681-2. 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. Spring.

Nurs. 682-2. 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. Gregg.

Nurs. 683-4. 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. Spring.

Nurs. 684-4. Community Psychiatric Nursing II. *Spring.* Continuation of Nurs. 683 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. 683. Gregg.

Nurs. 685-2. Elective Clinical Psychiatric Nursing I. *Fall.* Individually tailored clinical experience developed around a specific

clinical interest of the student and guided by a faculty member. Prer., Nurs. 645. Psychiatric nursing faculty.

Nurs. 686-2. Elective Clinical Psychiatric Nursing II. *Spring.* Individually tailored clinical experience related to a student's particular interest and need. The clinical project may be a continuation of the study started in Nurs. 685 or a separate project. Prer., Nurs. 683. Psychiatric nursing faculty.

Nurs. 690-1 to 4. Selected Topic in Graduate Study.

Nurs. 691-1 to 3. Guided Research in Nursing. *Fall, Spring.* Independent research in an area of interest to graduate nursing students. Approval must be obtained from the student's adviser and the faculty member involved. Prer., satisfactory completion of graduate-level courses in one nursing specialty and Nurs. 600 or its equivalent. Doctoral teaching faculty.

Nurs. 692-3. Survey of Research Design in Nursing. *Fall.* This seminar focuses on a broad range of research designs used in biological and behavioral studies. Nature of scientific inquiry and issues in design are addressed. Selection of designs is based on methods required to develop and test theory in psychosocial, psychobiological, and nursing care delivery areas. Prer., admission to Ph.D. program or consent of instructor.

Nurs. 700-4 to 6. Master's Thesis and Related Seminar. *Summer, Fall, Spring.* Identification of a problem, design and conduct of the investigation of the problem, and a written report. Opportunity to discuss and test thesis plans with a group of colleagues.

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 Graduate School 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. 650-credit to be arranged. Research in Obstetrics and Gynecology. *All quarters.*

Ob.Gyn. 700-credit to be arranged. 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 Graduate School 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 45 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.

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. Areas of research interest include virology, cell biology, membrane structure and biochemistry, tumor biology, and experimental pathology.

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.

Path. 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. Lehman and staff.

Path. 613-1. Research Seminars and Journal Club. *Fall, Winter, Spring, Rendi.*

Path. 627-4. Basic Mechanisms in Virology. *Spring.* Molecular aspects of the structure and replication of viruses will be presented. Bacteriophages will be considered, but primary emphasis will be placed on animal viruses and a significant part of the course will deal with tumor viruses. Among topics to be considered are: transformation by RNA and DNA tumor viruses, genetics of animal viruses, biosynthesis of viral nucleic acids and proteins, virus assembly, latency, and expression of endogenous viral genes. When appropriate material is available, laboratory demonstrations will be presented. Erikson.

Path. 650. Research in Pathology. *All quarters.* Credit to be arranged.

Path. 700-credit to be arranged. Master's Thesis. *All quarters.*

Path. 800-credit to be arranged. 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 Graduate School 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 510-3.5. Pharmacology. *Fall.* Intensive study of the drugs used in medical practice. This quarter includes general principles, endocrine therapy, antimicrobial and cancer chemotherapy, toxicology and drug metabolism. Lectures and clinical correlations. Prer., physiology and biochemistry. 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. Weiner and staff.

PHCL 514-5. Pharmacology. *Winter.* Intensive study of the drugs used in medical practice. This quarter includes autonomic pharmacology, cardiovascular pharmacology, central nervous system pharmacology, developmental pharmacology and evaluation of drugs in clinical practice. Lectures, clinical correlations, tutorials and students presentations. Prer., Pharmacology 510 or equivalent. Weiner and staff.

PHCL 600-3. Introduction to Pharmacology. *Fall.* Principles of pharmacology, including pharmacokinetics, receptor-ligand interactions, dose-response and structure-activity relationships, and drug metabolism are presented.

PHCL 601-3. Spectroscopic Methods. *Spring.* Problem-solving course using infra-red, ultra-violet, nuclear magnetic resonance, liquid scintillation, and mass spectroscopic techniques to determine structures of organic molecules of biochemical interest. The use of the techniques in present biomedical research is also stressed. Prer., organic chemistry and Biochem. 600. 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 Metabolism and Cell Function. *Winter.* Detailed discussion of the mechanisms by which cells regulate metabolic processes and macromolecular synthesis. Emphasis will be placed on mechanisms of hormonal regulation, on the regulation of enzyme levels by alteration of the rate of protein synthesis, and on the structure and regulation of active eukaryotic chromatin. The regulation of enzyme activity by allosteric mechanisms will be considered. Prer., BIOC 600 or equivalent, or consent of instructor. Langan and Maller.

PHCL 608-3. Drug Evaluation and Regulation. *Spring.* This course is intended to acquaint students with the problems associated with preclinical and clinical evaluation of chemicals for possible therapeutic use. The procedure for evaluation of drugs will be detailed and the role of the federal government regulatory agencies in this process will be considered. Concepts of benefit vs. risk, guidelines for drug evaluation, the adequacy and appropriateness of federal regulations, and the ethics of human experimentation to evaluate drugs in children and adults will be discussed. Prer., PHCL 510. Weiner.

PHCL 609-3. Biochemistry of Neurotransmission. *Even-numbered years.* Lecture topics will include (1) the synthesis, metabolism, storage and release of norepinephrine, acetylcholine, and other putative transmitters in the peripheral and central nervous systems; (2) the identification and assay and properties of receptors; (3) CNS neuropharmacology including the biochemical mechanisms of actions of CNS active drugs and current knowledge of the biochemical basis for neurologic and psychiatric disease. Molinoff, Hoffer, and Weiner.

PHCL 610-3. Membrane Pharmacology. *Fall.* A lecture course on aspects of membrane structure and function relevant to drug action at the cell and molecular levels. Prerequisites: physical chemistry and cell biology (at the undergraduate levels). Staff.

PHCL 612-3. Drug Metabolism and Drug Interactions. *Spring.* Mechanisms by which drugs are chemically altered in the body will be discussed. Emphasis will be given to drug interactions. Prer., biochemistry. Deitrich and Murphy.

PHCL 617-2. 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. Weiner and staff.

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. Hoffer.

PHCL 650. Introduction to Research in Pharmacology. *All quarters.* Directed laboratory research in selected area by the faculty. Credit to be arranged. Weiner.

PHCL 700-credit to be arranged. Master's Thesis. *All quarters.* Weiner.

PHCL 800-credit to be arranged. Doctor's Thesis. *All quarters.* Weiner.

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 Graduate School 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, internes, and allied health personnel.

Phys.Med. 850. Research in Physical Medicine and Rehabilitation. *Fall, Winter.* Credit to be arranged.

Phys.Med. 700-credit to be arranged. Master's Thesis. *All quarters.*

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 introduc-

tory 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. Barnett.

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. Barnett.

P.T. 650-6. Research in Physical Therapy. *Spring, Summer.* Independent research under guidance of a staff member. Gersten.

P.T. 700-credit to be arranged. Master's Thesis. *All quarters.* Faculty.

PHYSIOLOGY

Students wishing to pursue graduate work in physiology leading to candidacy for advanced degrees should read carefully Requirements for Advanced Degrees and Graduate School 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. Martin and staff.

Physiol. 603-credit to be arranged. Physiology Seminar. *Fall, Winter, Spring.* Prer., Physiol. 601. Martin and staff.

Physiol. 604-3. Cellular and Molecular Endocrinology. *Winter.* Physiological and biochemical aspects of hormone synthesis, storage, secretion and action. Discussion sections and student presentations from assigned journal articles. Prer., consent of instructor. Eipper and Mains.

Physiol. 609-2. Physiology of the Eye. Informal lectures and discussion of ocular structures and their physiology. Prer., consent of instructor. Paterson.

Physiol. 613-3. Cellular Neurobiology. *Winter.* Lectures and student presentations covering basic mechanisms involved in the action potential, synaptic transmission, neural integration, and other selected topics. Betz, Caldwell, Levinson, Martin, Roper and Wickelgren.

Physiol. 614-2. Cardiorespiratory Physiology. *Winter.* Selected topics in mammalian cardiovascular and/or respiratory physiology with special emphasis on fundamental principles. Lectures and demonstrations. Prer., *Physiol.* 501 or equivalent. Banchemo.

Physiol. 615-2. Development, Maintenance, and Plasticity of Neuronal Connections. *Spring.* Focuses on cellular mechanisms that underlie long-term changes in the organization of the nervous system. Betz, Caldwell, Roper, and Wickelgren.

Physiol. 650-credit to be arranged. Research in Physiology. Laboratory and library problems. Primarily for graduate students. Martin and staff.

Physiol. 700-credit to be arranged. Master's Thesis. *All quarters.* Study for the master's degree is not encouraged except in special situations. Martin.

Physiol. 800-credit to be arranged. Doctor's Thesis. *All quarters.*

PREVENTIVE MEDICINE AND COMPREHENSIVE HEALTH CARE

This department offers courses leading to a master's degree in preventive medicine and comprehensive health care. The program is designed for physicians and graduate-level nurses desiring education in population medicine and with community health, rather than hospital medical care, orientation. Skills for research are emphasized, with independent projects carried out in areas such as environmental and occupational health, material and child health, and technology assessment. This department's Division of Health Administration also offers a degree program in health care management.

Prev.Med. 608-1.3. Ethical Decision Making in Health Professions. *Fall, Spring.* Interdisciplinary faculty-student seminars to explore various ethical and legal problems which arise in the delivery of health care. Assigned and elective readings and presentations in the areas of overlap between the health professions, ethics and law will be discussed and applied to real life decision making in the health professions. Cobb and staff.

Prev.Med. 612-1.3. Concepts of Health. *Spring.* This interdisciplinary seminar, primarily for medical students and other health professionals, will discuss readings and examine the implications of various concepts of health to the responsibilities of health professionals and to the future of medical practice. Cobb.

Prev.Med. 613-1.5. Methods of Inquiry in Medicine. *Fall, Spring.* This is a two-semester course, with 1.5 hours of credit each semester. The course will familiarize medical and nursing students with scientific research methods and applications, in order to encourage objectivity in medical evaluation and practice. Course activity will revolve around a scientifically designed research project, with application of techniques learned during core teaching hours. Faculty will provide guidance throughout the course.

Prev.Med. 614-3. Introduction to Occupational and Environmental Health. *Fall.* The purpose of this course is to increase the awareness of future primary care practitioners of environmental and occupational health issues, so they can make full use of the potential of the primary care area in the prevention and management of these health problems. Martini.

Prev.Med. 617-2. Technology Assessment and Medical Care. *Spring.* Consider some of the current approaches to the assessment of medical technology. The differing methodological requirements of current modes of assessment will be reviewed, including consensus conferences, evaluation research, the review of literature as to the nature of evidence, and the movement toward controlled trials. Prer., *Epidemiology or Research Methods.* Orleans.

Prev. Med. 619-3. Perspectives in International Health. *Fall.* Previously listed as Prev. Med. 615. Course will engender for students an awareness of the determinants of health and health care services in cultural settings other than their own. Core faculty and both local and international guests will help students better understand how environmental, socioeconomic, and biologic differences contribute to health status and the delivery of services in a large group of nations (including the U.S.). Practical use of population data and indices will

provide students the ability to compare and study different health and medical care patterns that may be encountered in the course of their professions. Martini.

Prev. Med. 650-credit to be arranged. Research in Preventive Medicine. *All quarters.* Staff.

Prev. Med. 668-3. Epidemiology. *Spring.* Epidemiological concepts and methods with emphasis on critical thinking in matters of health and disease. Martini.

Prev. Med. 670-2. Environmental Health Seminars. *Spring.* Weekly meetings for students and faculty to take turns presenting to the group a variety of aspects of environmental health problems, cases, studies, and programs for discussion. Prer. PRMD 614. Cobb.

Prev. Med. 700-credit to be arranged. Master's Thesis. *All semesters.* Cobb.

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-credit to be arranged. Research in Psychiatry. *All quarters.* Students, after consultation regarding their special interests or needs, are assigned to investigators in the Department of Psychiatry, with ongoing research relevant to the student's desires and/or experience. Staff.

Psy. 700-credit to be arranged. Master's Thesis. *All quarters.* Staff.

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, and Graduate School Admission Requirements.

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. 600-2. Clinical Experience. *All semesters.* Practical experience available in all areas of radiology. Students will spend six to eight weeks in the major clinical divisions, approximately 20 hours per week. An additional three to four weeks will be spent in each of several other activities. Students spend their time primarily with the physicists in the various divisions, but also will be expected to interact with clinicians and technologists during a variety of clinical procedures. Carson and staff.

Radiol. 610-1. Clinical Radiology. *Fall, Spring.* Consists of lectures by clinicians covering practical clinical aspects of radiology. Diagnostic radiology: roentgenography, fluoroscopy, angiography, neuroradiology, orthopedic and pediatric radiology, analog and computed tomography. Nuclear medicine: isotopes and pharmaceuticals, static and dynamic studies, image processing, quantitative imaging. Ultrasound: image production and display, imaging modes, image processing, application to abdominal imaging, obstetrics, cardiology, hemodynamics. Radiation therapy: oncology, benign and malignant tumors, choices of treatment, treatment planning, fractionation, patient followup, tumor registries. Paquette, Taubman, Johnson, Klingensmith, and Fritzbeg.

Radiol. 613-2. Basic Radiological Physics. *Fall, Spring.* Structure of matter, radioactive decay, decay schemes, transient and secular equilibrium; production of radioactive nuclides; interaction of particulate radiation; production of x-rays, x-ray tubes and circuits; radiation-generating equipment; interaction of electromagnetic radiation; attenuation of x and gamma rays; radiation intensity, exposure, and dose; ionization measurements; in-air and in-phantom calibration of x-ray, gamma-ray, and electron beams; radiation quality; measurement of low-nonionizing radiation; introduction to radiation protection. One lecture per week for graduate students and residents, with an additional lecture each week for graduate students only. Includes experiments at the TRIGA reactor and at the cyclotron. Hendee and staff.

Radiol. 614-2. Radiation Biology. *Spring.* Emphasizes the effects of irradiation on human tissues, effects of radiation on cellular, molecular organs and whole organism levels, and late effects of ionizing radiation including mutation and carcinogenesis.

Radiol. 615-2. Physics of Radiation Therapy. *Fall.* Interactions of X and gamma rays in tissue, backscatter, depth dose, tissue-air ratios, design and operation of medical linear accelerators, Bragg-Gray theory, calibration of high-energy photon and electron beams, treatment planning, isodose distributions, corrections for surface obliquities and heterogeneities, wedge and tissue compensating filters, field separation, integral dose, interstitial and intracavitary implants. Hendee, Cacak, Dubuque, and Shabason.

Radiol. 616-2. Physics of Medical Imaging. *Fall.* Conceptual and approach to medical imaging, illustrating principles such as unsharpness, contrast, distortion and noise, with applications to roentgenography and nuclear medicine. One lecture per week includes resident physicians, and a second hour each week is devoted to physics students during which the characteristics of imaging systems and quantifiable aspects of the image forming process are explored in depth. Hendee, Cacak, Carson, Spitzer, and Rossi.

Radiol. 617-2. Physics of Medical Imaging. *Spring.* Conceptual approach to medical imaging, illustrating principles such as unsharpness, contrast, distortion and noise, with applications to ultrasound and computed tomography. One lecture per week includes resident physicians, and a second hour each week is devoted to physics students during which the characteristics of imaging systems and quantifiable aspects of the image forming process are explored in depth. Hendee, Carson, Spitzer, and Rossi.

Radiol. 623-2. Radiopharmacy. *Summer.* Radionuclide selection and production, radiochemistry, chemistry and biological properties of routine and new radiopharmaceuticals, selection of appropriate agents, pharmaceutical preparation considerations, quality assurance, *in vitro* studies, competitive protein binding assays. Will include observation and participation in nuclear medicine hot lab and laboratory preparations from chemicals to biological assay. Fritzbeg.

Radiol. 625-2. Health Physics. *Spring.* Radiation units, radiation protection, standards and their development, radiation dose from external sources in various configurations, shielding calculations and room design, internal radiation dosimetry, physiologic models for dose estimates, tracer kinetics and their application to dose estimates, maximum permissible exposures, health physics instrumentation, radiation safety operations, decontamination procedures. Hendee, Dubuque, Shabason, Spitzer, and Rossi.

Radiol. 631-1. Special Topics in Radiology I. *Fall.* Current research topics in radiology; experimental design; recent advances in imaging methodology and therapeutic equipment; new techniques in dosimetry, quality assurance, and treatment planning; federal, state, and local regulations and guidelines; professional ethics; business practices in medical physics. Hendee.

Radiol. 632-1. Special Topics in Radiology II. *Spring.* Continuation of Radiol. 631. Hendee.

Radiol. 650-credit to be arranged. Research in Radiology. *All semesters.* Available as an elective to a limited number of students. Students must have an acceptable protocol or qualifications appropriate for participation in ongoing departmental project. Hendee, Cacak, and Rossi.

Radiol. 700-credit to be arranged. Master's Thesis. *All semesters.* Prer., completion of master's course work. Hendee, Carson, Cacak, and Rossi.

The following course on the *quarter* system is being offered to nonmedical physics majors.

Radiol. 612-4. Radioisotopes in Biological Research. *Spring.* Radioisotope safety; dose units; dose rates from radioactive sources; working levels; regulatory and advisory agencies; federal, state, and institutional regulations, licensing procedures; properties of the atom and nucleus, radioactive decay; secular and transient equilibrium; production of radioactive nuclides, synthesis of radioactive compounds; analysis, purity; stability and availability of radioactive compounds; counting statistics and error analysis; experimental design; quantitative counting; interactions of radiation; radiation detectors; counting systems; gamma spectroscopy; sample preparation for external counting; sample preparation for liquid scintillation; liquid scintillation counting; tracer kinetics; biological distribution of radionuclides; internal absorbed dose; health physics. Hendee.

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 or mass communication. The school offers its majors superior professional instruction with a broad education in the liberal arts. It provides service to the mass media, other state educational institutions, including high schools, and the public at large. The School of Journalism makes courses available to nonjournalism majors within the limits of space and equipment upon which journalism majors properly have first claim.

Career Opportunities

The school offers news-editorial, advertising, and radio-television sequences and public relations with private enterprise, government, and all the mass media. Graduates find careers in newspapers, magazines, radio, television, advertising and public relations firms, science, industry and government, and in secondary and higher education. The School of Journalism assists students in career planning and 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 three-fourths of their college work in the arts and sciences and approximately one-fourth in 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 laboratories for reporting, editing, advertising, radio-television, and photo-journalism. They have opportunities for using the Associated Press wire service, videotape cameras and recorders, and video display terminals.

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. In addition to working for the school's newspaper, the *Campus Press*, students intern with weekly and daily newspapers, advertising and public relations agencies, social service agencies, and radio and television stations.

Honors

Journalism students may graduate with General Honors and/or School of Journalism Honors. Students interested in General Honors must consult the Honors Program office. The School of Journalism may award the bachelor's degree with honor to students who have a 3.25 cumulative grade-point average and a 3.5 grade-point average in journalism courses, complete an independent study in journalism involving scholarly research effort, and 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.

Dominic F. Manzanares Memorial Scholarship, (\$100) to a minority and/or Colorado resident journalism major.

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.

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; American Advertising Federation; and Kappa Tau Alpha, honorary scholastic society in journalism.

Study Abroad 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 including study abroad semesters. Information and application forms are available at the Boulder Campus Office of International Education, in the basement of the College of Environmental Design, Campus Box 123.

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.

University of Colorado 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:

Humanities	two 2-semester courses
Natural science	two 2-semester courses
Social sciences	two 2-semester courses

These courses may or may not be sequential, according to the college list.

3. Complete both Jour. 100 and Jour. 250.

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, however, 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 also take English composition.

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. 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.

DOUBLE-DEGREE AND COMBINED-DEGREE PROGRAMS

Some students complete requirements in two fields and in some cases receive two degrees from the University. Such a combined program is available combining journalism and business. The student must make application for the combined program in both the School of Journalism and the College of Business and Administration. Any other such combined programs must be arranged by consulting *both* schools or colleges involved.

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, 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. 346. Advertising Media	3
Jour. 440. Advertising Media and Campaigns	3
Jour. 443. Retail Advertising or	
Jour. 497. Advertising Practicum	3
Journalism electives	1-7

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 SEQUENCE

Students may choose either of two options within the radio-television sequence. The news option is designed to prepare students as news directors, reporters, editors, and writers for radio or television stations. The general broadcasting option is designed to prepare students for other careers in radio-television, including positions in programming, advertising, promotions, and management.

Radio-TV News Option

<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
Journalism electives	3-9

Recommended Courses

Jour. 364. Principles of Broadcast Production	4
Jour. 463. Broadcast News Projects	3

General Broadcasting Option

<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. 360. Radio and TV News	3
Jour. 364. Principles of Broadcast Production	4
Jour. 464. Radio, TV Station Organization, Operation	3
Jour. 367. TV Production II or	
Jour. 461. Advanced Radio Production	3
Journalism electives	3-9

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 three 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 director, School of Journalism, Campus Box 287, 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.

School of Journalism majors may not take any journalism course pass/fail, but nonjournalism courses required for the major may be taken pass/fail.

Students may be administratively dropped from courses for failure to attend, especially during the first two weeks of each semester.

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

Thomas G. Brown, Dean

INFORMATION ABOUT THE LAW SCHOOL

History and Purpose

The School of Law was organized in 1892. It is a charter member of the Association of American Law Schools, organized 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, a required three-year program of full-time resident study, a well-qualified faculty, good library facilities, and high admission standards. A relatively small student body and a favorable faculty-student ratio produce classes of a size that encourages discussion. Faculty are readily available for informal consultations with individuals.

The law school is fully accredited by all agencies, and graduates will be academically qualified to take the bar examination in all 50 states provided they, in choosing their curricula, comply with the individual requirements of each state in which they intend to practice.

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. See Admission Procedures. 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 Dean's Office, School of Law, University of Colorado, Boulder, Colorado 80309 (telephone) 303/492-8047, 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. Teaching facilities include an excellent library, classrooms, seminar rooms, a complete trial and appellate courtroom, and video tape equipment.

The building also contains suites for the Legal Aid and Defender Program, the Environmental Law Clinic, offices for various student organizations, faculty and administrative offices, and a student lounge. With the completion of several new additions in 1974, the building has ample space to accommodate the student body of 450 now enrolled.

The law library contains one of the best legal reference collections in the western United States. Completion of the Rothgerber Memorial Library in 1974 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 collection of books in German, Japanese, and French legal materials 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

Law school classes contain a maximum of 75 students and are conducted primarily as discussions rather than by lecture. Judicial opinions and statutes are critically analyzed and the principles extracted are used in arguments about hypothetical situations. Other methods of instruction include research and writing, seminars, and practical experience both in clinical programs and by simulation.

Although students learn a great amount of law, transmission of such knowledge is only a part of the school's purpose. The faculty seeks to train students to use the law, to research and analyze the relevant materials, to make effective arguments as advocates both in speech and in writing, and to evaluate arguments as counsels. Moreover, significant changes in the law occur frequently. While knowledge of the law quickly becomes obsolete, the skills to analyze, argue, and evaluate endure.

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.

The graduating class for the academic year 1978-1979 included 133 graduates. Of the 105 who reported their employment status, 95 percent were employed and, of these, 94 percent were working in law-related areas. The largest group (47 percent) is in private practice, 16 percent are clerking for judges, 14 percent are employed by government on local and federal levels, and 12 percent are in legal services. The remaining 11 percent are working in business, the military services, and academic areas. A beginning average salary of \$17,615 was reported from the 43 law-employed graduates who submitted salary figures. Graduates of this class have located in Arizona, California, Colorado, the District of Columbia, Hawaii, Idaho, Indiana, Iowa, Minnesota, New York, Oklahoma, and Wisconsin.

The graduating class for the academic year 1977-78 included 141 graduates. Of the 107 who reported their employment status, 93 percent were employed and, of these, 97 percent were working in law-related areas. The largest group, (56 percent) is in private practice, 17 percent are clerking for judges, 7 percent are in legal services, and 10 percent are employed by government on local and federal levels. The remaining 10 percent are working in business, the military services, legal foundations, and nonprofit associations. A beginning average salary of \$15,354 was determined from the reports of the 36 law-employed graduates who submitted salary figures. Graduates of this class have located in Alaska, California, Colorado, Idaho, Indiana, Minnesota, Missouri, New Mexico, Pennsylvania, and South Dakota.

Prelegal Preparation

The School of Law of the University of Colorado does not prescribe a rigid prelaw curriculum. Students should pursue 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, including especially writing. Obviously, these skills can be acquired in a number of different areas, and successful law students and lawyers have college majors in almost every field. For instance, the prelaw student should take courses such as mathematics, natural science, philosophy, or economics which emphasize careful analytical thinking. Courses with papers and essay examinations are normally preferable to those with true-false, multiple choice, or fill-in-the-blank examinations. A course or two in each of the following areas would be highly recommended: economics psychology and sociology (legal problems are in large part personal problems, as would be expected in criminal law or domestic relations but also in areas such as taxation); political science (lawyers require an understanding of the governmental system in which they function); natural science (many problems in commer-

cial settings or personal injuries involve scientific questions, as do many problems of evidence); and the humanities. Generally speaking, a law student will benefit from a solid, broad-based liberal education.

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 interested in pursuing natural resource law should take science courses, (geology, etc.). Those 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. Students are strongly advised against outside employment during the first year; however law-related employment for a limited number of hours may actually enhance the educational experience of second- and third-year students. Students should avoid committing themselves to employment of more than 15 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 and Stefan Riesenfeld, professors of law, 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 Walter V. Schaefer, retired Supreme Court Justice, Illinois Supreme Court; 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; Rex E. Lee, dean, Brigham Young University School of Law, and former U.S. Assistant Attorney General; James B. White, professor of law, University of Chicago Law School; and Irving Younger, professor of law, Cornell University.

In addition to the Coen lecturer, a number of speakers are presented annually.

Special Programs

The Legal Aid and Defender Program allows students supervised by full-time clinical faculty who are experienced trial attorneys to represent low income clients in actual civil and criminal cases in Colorado courts. These attorneys also supervise students working with nearby legal services and public defender programs. A clinical program on legal problems of senior citizens may be established. The National Wildlife Federation's Natural Resource Clinic involves students in administrative and judicial proceedings concerning environmental problems.

Activities

The School of Law offers many activities in addition to those available for students in the University as a whole. The Rothgerber Moot Court Competition offers students an opportunity to refine their research skills, as well as develop skills in appellate brief writing and oral argument. Students argue before panels of distinguished judges and lawyers. The *University of Colorado Law Review*, a professional journal edited entirely by students, publishes scholarly articles and comments on matters of concern to the legal profession at both the national and state levels. The Student Bar Association represents the interest of law students generally. Other student organizations include the American Bar Association Law Student Division, the Nicholas R. Doman Society of International Law, American Indian Law Students Association, Black Law Students Association, Chicano Law Students Association, National Lawyers Guild, Environmental Law Institute, and the Women's Law Caucus. Student organizations regularly sponsor programs of interest to the bar and community, such as Women in the Law Day, a symposium on Energy Mineral Development in the Rocky Mountains, and production of Gilbert and Sullivan's *Trial by Jury*.

Expenses and Financial Aid

Colorado residents paid \$926 in tuition and fees for the 1979-80 academic year; nonresidents, \$3,388. The law school admissions office will tentatively classify applicants as residents or nonresidents, but the final decision will be made by the Tuition Classification Officer, Office of Admissions, Regent Administrative Center 125. Living expenses, books, and incidental costs in the

amount of \$3,000 to \$4,500 per year should be added to tuition figures in estimating yearly expenditures.

Grants-in-aid are available on a limited basis to eligible resident students and are awarded on the basis of need and academic merit. Nonresident students may not be awarded grants from state funds under present state policy but may be considered for loans and work-study. Students applying for financial aid, including grants, National Direct Student Loans, and work-study must file the ACT-FFS (American College Testing Service-Family Financial Statement). This application is available on most college campuses or write ACT Operations Division, P.O. Box 809, Iowa City, Iowa 52240. Deadline for receipt of forms by ACT is March 1. Applications for federally insured student loans may be obtained at the University's Office of Financial Aid or at participating banks.

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, (303) 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, but other factors are also important, both because they may indicate ability and motivation, and because the faculty believes that diversity in the student body contributes to the educational process. These other factors include variation in economic, social, or cultural background; geographic diversity, variation in undergraduate or graduate program or institution; unusual employment or other experience; demonstrated and unusual quality of leadership; special achievement in overcoming personal handicaps or disadvantages; and the ability to contribute the perspectives of racial or ethnic minority or other distinctive communities. In its efforts to offer equal opportunity for obtaining a legal education, the

law school will take race affirmatively into account as an important factor in the competitive weighing of individual applications. Colorado residency is also given special consideration, since the University is a state-supported school.

Personal interviews are neither required nor encouraged. Every applicant is invited to submit a personal statement and to ask people familiar with his or her ability to write letters of recommendation in support of the application.

For the fall 1979 entering class, the average grade-point was 3.38 on a 4.0 scale and the average Law School Admission Test score was 649. The qualifications for any entering class will depend 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.

The school maintains an introductory summer program for those persons admitted whose qualifications suggest that prior assistance may be particularly helpful for successful law study. In addition, tutorial assistance will be available for first-year students who desire it and whose qualifications suggest that this type of support might be beneficial.

Usually 10-15 second- and third-year transfer students are accepted each year. Decisions are based heavily on law school performance, in addition to the factors noted for beginning students.

Because of the large number of applications which must be processed, the deadlines set must be strictly observed.

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. Students must return a completed Application for Admission, an LSAT/LSDAS Law School Application Matching Form, and a nonrefundable \$20 application fee by January 15. In addition, the following credentials must be completed and received by February 15 (with each item mailed directly from its source to the School of Law). Because of the large number of applications which must be processed, the deadlines must be met. Late applications will be accepted, but they will be considered only after all of the timely applications, and only the strongest late applicants have any substantial chance of admission.

- a. All applicants 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 Law School Admissions Services, Box 2000, Newton, Pennsylvania, 18940. 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 Law School Admissions Services, Box 2000, Newton, Pennsylvania, 18940. It is given four times each year at a number of places. 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 of an initial decision (admit, hold, or deny) should be received by April 1. Many of the applicants

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.

in the hold category will be placed on the wait-list, and many of the applicants on the wait-list will be admitted. 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 a number of courses offered in the summer. The maximum number of credit to be earned during the summer session will be determined by the Dean's Office.

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 requirements for graduation 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. 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 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.
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.

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.

The School of Law does not offer work leading to advanced degrees in law.

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 are recorded by the University of Colorado as *A, B, C, D, F*.

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). Nonfinal grades are given under circumstances described in the Rules of the Law School.

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.

Normal Course Load; Dropping Courses

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. 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 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 /ny 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.

The first-year curriculum of contracts, torts, civil procedure, criminal law, property, legal writing, and appellate advocacy is required of all students. The second and third years are largely elective; the only required courses are constitutional law, professional responsibility, a seminar, and either practice court or trial advocacy or two semesters in the legal aid and defender program.

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 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.

Program for the Academic Year

FIRST-YEAR STUDENTS

Law 510-3. Contracts I¹
Law 511-3. Contracts II¹
Law 520-1. Legal Writing¹
Law 521-1. Appellate Court Advocacy¹
Law 530-3. Civil Procedure I¹
Law 531-3. Civil Procedure II¹
Law 540-3. Torts I¹
Law 541-3. Torts II¹
Law 550-4. Criminal Law¹
Law 561-4. Property¹

SECOND AND THIRD-YEAR STUDENTS

Law 605-2. Future Interests
Law 606-3. Real Property Conveyancing and Security
Law 610-3. Agency-Partnership
Law 618-4. Commercial Transactions
Law 625-4. Corporations
Law 631-3. Water Resources
Law 633-3. Mining Law
Law 635-3. Evidence
Law 640-3. International Law
Law 645-3. Comparative Law
Law 650-3. Labor Law
Law 651-3. Criminal Procedure
Law 652-3. Unfair Competition and Intellectual Property
Law 653-3. Criminal Procedure: The Adjudicative Process
Law 655-3. Legal Accounting
Law 660-4. Income Tax
Law 661-4. Constitutional Law¹
Law 662-3. Legal Process
Law 665-1. Professional Responsibility¹
Law 669-3. Advanced Tax
Law 672-1. Legal Aid
Law 673-2. Legal Aid—Civil Practice
Law 674-2. Legal Aid—Criminal Practice
Law 683-2. Legal Aid—Evidence Presentation
Law 684-2. Legal Aid—Legal Services Project
Law 699-2. Wills and Trusts
Law 700-3. Administrative Law
Law 705-3. Conflict of Laws
Law 710-3. Domestic Relations
Law 712-3. Public Lands
Law 715-3. Federal Estate and Gift Tax
Law 718-3. Advanced Estate Planning
Law 722-3. History of Jurisprudence
Law 724-3. Corporate Finance
Law 730-3. Due Process and Equal Protection

¹These courses are required; other courses are elective.

Law 733-2. Oil and Gas
Law 734-2. Employment Discrimination
Law 735-3. Real Estate Planning
Law 737-3. American Indian Law
Law 740-1. Interviewing
Law 745-3. Securities Regulation
Law 747-3. Environmental Law
Law 748-2. Negotiation
Law 750-3. Antitrust
Law 755-3. Creditors' Remedies and Debtors' Protection
Law 756-2. Bankruptcy
Law 757-3. International Business Transactions
Law 758-3. Remedies
Law 760-3. Local Government
Law 762-2. Trial Advocacy
Law 764-3. State and Local Tax
Law 766-3. Business Planning
Law 771-1-2. Independent Legal Research
Law 787-3. Federal Courts
Law 788-2. Natural Resources/Litigation Clinic
Law 790-1. Practice Court¹

SEMINARS

Law 703-2. Natural Resources and the Environment:
Law, Policy and Economics
Law 704-2. Economic Analysis of Law

Law 707-2. Federal Courts in the American Political System
Law 719-2. Products Liability
Law 720-2. Problems in Comparative Law
Law 721-2. Legal History
Law 726-2. Federal Common Law of Corporations
Law 727-2. Constitutional Litigation
Law 731-2. First Amendment Law
Law 732-2. Land Use Planning
Law 738-2. Advanced Problems in Water Law
Law 739-2. Exclusionary Practices in Land Use Regulation
Law 746-2. Selected Issues in Jurisprudence
Law 751-2. Law of Corrections
Law 753-2. Social Science Research and the Law
Law 763-2. Federal Tax Policy
Law 765-2. Antitrust Procedure
Law 775-2. Law and Medicine
Law 776-2. Law and Mental Health
Law 777-2. Collective Bargaining in the Public Sector
Law 779-2. Problems in Education Law
Law 781-2. Legal Process
Law 782-2. Labor Arbitration
Law 785-2. Social Legislation
Law 786-2. Natural Resources/Litigation

¹These courses are required; other courses are elective.

College of Music

Robert R. 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 60,000 volumes/scores, 200 current periodicals, and 40,000 recordings. Com-

puterized listening facilities are provided for listening to recordings and studying scores.

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 86 practice rooms; 54 studios and offices, band, choral, opera, and orchestral rehearsal halls; piano and electronic laboratories; and auditoriums with seating capacity of 507 and 250.

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. The year-abroad program in Regensburg, Germany, open to students at the junior level or above, offers applied music study for all instruments and voice as well as music history and music education. 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 with concentrated areas 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, choral, 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, wind/percussion pedagogy, elementary education, and arts management.

Qualified students may receive both the Bachelor of Music and Bachelor of Music Education degrees by taking the required extra work (approximately 30 additional hours). 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.

Additional information concerning undergraduate degrees is presented in the various undergraduate curricula printed elsewhere in this catalog. Questions regarding particular details of the various curricula may be directed to the associate dean for undergraduate studies, College of Music.

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
Edith Edwards Memorial Scholarship
Wallace F. Fiske Memorial Scholarships
Graduate Assistantships
Jessie and Albert Henry Scholarships
Horace Jones Violin Scholarship
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
Howard Waltz Piano 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 19 semester hours. Schedules of fewer than 12 or more than 19 hours must have approval of the associate dean for undergraduate studies 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 associate 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 associate dean for undergraduate studies.

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 1982, fall 1982-83, spring 1982-83 will be held on the following Saturdays: February 6, February 27, and March 13, 1981. 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 associate dean for undergraduate studies (Music C-103) 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 is a professional training course with concentration upon artistic and/or intellectual performance. One of the following concentration areas may be selected: voice, piano, organ or church music, string instruments, wind and percussion instruments, theory/composition, or history and literature. Performance concentration area students 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 concentration areas are available as follows upon recommendation of the adviser and faculty unit chairman concerned.

In piano and string instruments, pedagogy may be recommended as a concentration area. 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 faculty unit concerned.

A concentration area 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 concentration area in performance consists of a four-year program with an emphasis 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 associate dean for undergraduate studies, the adviser, and the chairman of the faculty unit 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 ensemble) is expected of all undergraduates. (Five semester hours of credit in chamber music, as defined by each faculty unit, 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 Concentration Area

Students who wish to have a concentration area in history and literature must have the approval of the chairman of the faculty unit. This area should be declared and approved not later than the junior year, and preferably by the sophomore year.

Students in this area must demonstrate proficiency in at least one facet of performance: voice, keyboard, symphonic, or early instruments. The student 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 associate dean for undergraduate studies.

The courses outlined below are required at the discretion of the adviser. 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	6
Mus. 100, 101. Theory I	6
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 Concentration Area

The following schedule is a basic plan that may be altered to suit individual needs. The organ-performance concentration area 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 concentration areas of church music-organ or 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 (Efinger'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 Organ and Church Music Unit.)

All students will be given a minimum reading study list throughout the course, and students 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	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
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. 226. Service Playing Techniques	2
Mus. 317. Conducting I	2
Mus. 401, 402. Counterpoint	4
Choir	2
Elective in theory	2
Electives in liberal arts and/or music	6

Junior Year

Private organ instruction (and literature class)	8
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 326, 327. Improvisation	4
Mus. 428, 429. Organ Survey	6
Choir	2
Electives in liberal arts and/or music	10

Senior Year

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 Pedagogy Concentration Area

All pedagogy students 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 the performance concentration area in piano.

<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

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.

Senior Year

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 Performance Concentration Area

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. A public recital the senior year is required.

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 keyboard faculty.

<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	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 112. Keyboard Skills	1
Mus. 180, 181. Introduction to Music	6
Band, orchestra, or choir	2
Electives in liberal arts and/or music	9

Sophomore Year

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

Junior Year

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 Performance Concentration Area: Guitar, Harp, String Bass, Viola, Violin, and Violoncello

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 students 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	4
Mus. 100, 101. Theory I	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
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

Theory/Composition Concentration Area

Approval for the concentration area in theory/composition is based on (1) evidence of aptitude in composition or of exceptional aptitude in practical arranging, (2) an acceptable level of keyboard proficiency, and (3) probable success in the teaching of theory.

The thesis for theory/composition students 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 students must register for piano until a requirement of five levels of testing has

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.

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 students. 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.

The student's work is reviewed periodically by the theory/composition faculty unit 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
Mus. 121. Composition Seminar	2
Mus. 153. Composition	2
Mus. 100, 101. Theory I	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
Orchestra, Band or Choir	2
Electives in liberal arts and/or music	5

<i>Sophomore Year</i>	
Private instruction (and literature class)	6
Mus. 221. Composition Seminar	2
Mus. 253. Composition	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
Electives in liberal arts and/or music	12

<i>Junior Year</i>	
Private instruction (and literature class)	6
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 400. Contemporary Theory	2
Mus. 321. Composition Seminar	2
Mus. 353. Composition	4
Orchestra, band, or choir	2
Electives in liberal arts and/or music	10

<i>Senior Year</i>	
Mus. 404. Orchestration	2
Mus. 406, 407. Analysis I, II	4
Mus. 421. Composition Seminar	2
Mus. 453. Composition	4
Mus. 498. Theory Thesis	0
Orchestra, band, or choir	2
Electives in liberal arts	10
Electives in music	6

Voice Performance Concentration Area

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 public 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 learned repertoire including 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	4
Mus. 100, 101. Theory I	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
Mus. 144. Italian Diction and Repertoire	2
Mus. 145. English Diction and Repertoire	2
Choir	2
Electives in liberal arts	8

<i>Sophomore Year</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
Foreign language	10
Elective in theory	2
Elective in liberal arts or music	2
Choir	2

<i>Junior Year</i>	
Private voice instruction (and literature class)	8
Foreign language	10
Mus. 344. German Diction and Repertoire	3
Mus. 345. French Diction and Repertoire	3
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 442. Opera Theatre	2
Choir	1

<i>Senior Year</i>	
Private voice instruction (and literature class)	8
Mus. 217. Choral Literature and Conducting	2
Foreign language	6
Mus. 442. Opera Theatre	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 Concentration Area

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.

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.

<i>Freshman Year</i>	<i>Semester Hours</i>
Private voice instruction (and literature class)	6
Class minor in performance	4
Mus. 100, 101. Theory I	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
Mus. 144. Italian Diction and Repertoire	2
Mus. 145. English Diction and Repertoire	2
Choir	2
Electives in liberal arts (other than theatre and dance)	9

<i>Sophomore Year</i>	
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
Elective in Theory	2
Choir	2
Th.Dn. 250. Introduction to Oral Interpretation	3
Th.Dn. 273. Acting I	3
Electives in music	2
Electives in liberal arts (other than theatre and dance)	8

<i>Junior Year</i>	
Private voice instruction (and literature class)	6
Mus. 380, 381. History of Music (see History Minor)	6
Mus. 442. Opera Theatre	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

<i>Senior Year</i>	
Private voice instruction (and literature class)	6
Mus. 442. Opera Theatre	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 Performance Concentration Area

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 an instrumental faculty unit 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.)

<i>Freshman Year</i>	<i>Semester Hours</i>
Private wind instruction (and literature class)	8
Class minor in performance	4
Mus. 100, 101. Theory I	6
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	6
Band or orchestra	2
Electives in liberal arts and/or music	9

<i>Sophomore Year</i>	
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	2
Elective in theory	2
Electives in liberal arts and/or music	12

<i>Junior Year</i>	
Private wind instruction (and literature class)	8
Mus. 380, 381. History of Music (see History Minor)	6
Band or orchestra	2
Chamber music ¹	2
Electives in liberal arts and/or music	14

<i>Senior Year</i>	
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.

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.

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 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: choral emphasis, general music emphasis, and instrumental emphasis. 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 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 applied areas and are held responsible for checking with their private teachers regarding these meetings.

LIBERAL ARTS REQUIREMENTS

All students entering the music education program, 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	3
Humanities	6
Social sciences	6
Natural sciences	6
Electives	19
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. However, the following courses, which are a part of the required curriculum, may be counted toward meeting the elective requirement as well as fulfilling requirements in music and education.

Semester Hours

Mus. 180, 181. Introduction to Music	4
Mus. 380, 381. History of Music	6

Mus. 311. Introduction to the Arts	3
T.Ed. 441. Reading and Writing in the Content Areas	3
Comm. 230. Principles of Communication I	2

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 to the School of Education through the chairman of the music education faculty for admission to this program no later than the second semester of the junior year. *No student is permitted to take courses in education until he or she is admitted to the Teacher Education Program.*

Requirements for admission to the Teacher Education Program are:

1. A minimum grade-point average of 2.5.
2. Satisfactory completion of the first four semesters of course work as prescribed in a music education curriculum.
3. Satisfactory functional piano ability as demonstrated by passing the proficiency examination or completion of prescribed course work.
4. Satisfactory performance ability as demonstrated by meeting the sophomore proficiency requirements in a private applied area of study.
5. Recommendation by the music education faculty.

An interview with each student is held by the members of the music education faculty 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.

STUDENT TEACHING

Students wishing to receive student teaching assignments must make application to the School of Education through the chairman of the music education faculty early in the semester preceding the student teaching semester.

Prerequisites for student teaching are:

1. Admission to the Teacher Education Program.
2. A minimum grade-point average of 2.5.
3. Completion of the first six semesters of course work prescribed in a music education curriculum.
4. Satisfactory performance ability as demonstrated by meeting the junior proficiency requirements in a private applied area of study.
5. Recommendation by the music education faculty.

Since student teaching is a full-time activity encompassing the normal public school day, as well as time devoted to extracurricular activities, students will not be required to register for other course work during this period.

Student teaching assignments are dependent upon the availability of qualified and approved cooperating teachers, usually in the Denver metropolitan area. Students are expected to provide their own transportation to their assignments and will find that, generally, public transportation is unsatisfactory.

Choral Music Emphasis

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance ¹	2
Performance organization ²	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Liberal arts ³	12

<i>Sophomore Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance ¹	2
Performance organization ²	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music	6
Mus. 210. The Public School Music Curriculum	3
Mus. 311. Introduction to the Arts	3
T.Ed. 410. Foundations of American Education	3
Liberal arts ³	6

<i>Junior Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Mus. 317, 318. Conducting I, II	4
Performance organization ²	2
Teaching Brass Instruments, Teaching Stringed Instruments or Teaching Woodwind Instruments	3
Mus. 312. Teaching Choral Music	3
Mus. 217. Laboratory Choir	1
Mus. 410. Introduction to Student Teaching	1
Instrumental or general music minor	3
T.Ed. 411. Educational Psychology and Adolescent Development	3
T.Ed. 412. Principles and Methods of Secondary Education	3
T.Ed. 441. Reading and Writing in the Content Areas	3
T.Ed. 446. Teaching the Learning Disabled	2
Comm. 230. Principles of Communication I	2

<i>Senior Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	3
Performance organization ²	1
Theory elective	2
Instrumental or general music minor	3
Mus. 411. Student Teaching Seminar	1
T.Ed. 470, 471. Student Teaching	8
Liberal arts ³	4
Free electives	4

General Music Emphasis

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance ¹	2
Performance organization ²	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory	2
Mus. 180, 181. Introduction to Music	4
Liberal arts ³	12

<i>Sophomore Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance ¹	2
Performance organization ²	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music	6
Mus. 210. The Public School Music Curriculum	3
Mus. 311. Introduction to the Arts	3
T.Ed. 410. Foundations of American Education	3
Liberal arts ³	7

Junior Year

Private instruction (and literature class)	6
Mus. 317, 318. Conducting I, II	4
Performance organization ²	2
Teaching Woodwind Instruments, Teaching Brass Instruments or Teaching Stringed Instruments	3
Mus. 310. Teaching General Music	3
Mus. 313. Classroom Instrument Laboratory	2
Mus. 217. Laboratory Choir	1
Mus. 410. Introduction to Student Teaching	1
Mus. 416. Percussion Class and Pedagogy	1
T.Ed. 411. Educational Psychology and Adolescent Development	3
T.Ed. 412. Principles and Methods of Secondary Education	3
T.Ed. 441. Reading and Writing in the Content Areas	3
T.Ed. 446. Teaching the Learning Disabled	2

Senior Year

Private instruction (and literature class)	3
Performance organization ²	1
Theory elective	2
Mus. 411. Student Teaching Seminar	1
T.Ed. 470, 471. Student Teaching	8
Comm. 230. Principles of Communication I	2
Liberal arts ³	1
Free electives	7

Instrumental Music Emphasis

<i>Freshman Year</i>	<i>Semester Hours</i>
Private instruction (and literature class)	6
Class minor in performance ¹	2
Performance organization ²	2
Mus. 100, 101. Theory I	5
Mus. 102, 103. Theory and Ear Training Laboratory I	2
Mus. 180, 181. Introduction to Music	4
Liberal arts ³	13

Sophomore Year

Private instruction (and literature class)	6
Class minor in performance ¹	1
Performance organization ²	2
Mus. 200. Theory II	3
Mus. 202. Theory and Ear Training Laboratory II	1
Mus. 380, 381. History of Music	6
Mus. 210. The Public School Music Curriculum	3
Mus. 311. Introduction to the arts	3
Mus. 321. Teaching Brass Instruments	3
Mus. 416. Percussion Class and Pedagogy	1
T.Ed. 410. Foundations of American Education	3
Liberal arts ³	3

Junior Year

Private instruction (and literature class)	6
Performance organization ²	2
Mus. 316. Teaching Stringed Instruments	3
Mus. 315. Teaching Woodwind Instruments	3
Mus. 317, 318. Conducting I, II	4
Mus. 314. Teaching Instrumental Music	3
Mus. 217. Laboratory Choir	1
Mus. 410. Introduction to Student Teaching	1
T.Ed. 411. Educational Psychology and Adolescent Development	3
T.Ed. 412. Principles and Methods of Secondary Education	3
T.Ed. 441. Reading and Writing in the Content Areas	3
T.Ed. 446. Teaching the Learning Disabled	2

Senior Year

Private instruction (and literature class)	3
Performance organization ²	1
Theory elective	2

¹May be used to meet minor voice requirements and/or piano proficiency.

²A minimum of 4 semester hours must be earned in a choir.

³See the requirements in liberal arts.

Mus. 411. Student Teaching Seminar	1
T.Ed. 470, 471. Student Teaching	8
Comm. 230. Principles of Communication I	2
Liberal arts ²	6
Free electives	4

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 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-elementary education certification, music history, music-journalism, music-theatre, 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	6
Mus. 180, 181. Introduction to Music	6
English language or literature (see 1 below)	6
Foreign language (see 2 below)	8
Electives in liberal arts	2

Sophomore Year

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:

- Two semesters of English (composition or literature).
- 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.
- Nonmusic electives to fulfill the minimum requirement of 70 semester hours of credit.
- 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.)
- 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.

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.
²See the requirements in Liberal Arts.

Th.Dn. 471-3. History of the Theatre I.
Mus. 477-3. History of the Opera.

Music-Business

Business courses are frequently closed to nonbusiness 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.
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-Elementary Education Certification

This concentration of courses allows a student to study music and, at the same time, gain certification for teaching in the elementary classroom. It does not give certification for teaching music. Most courses listed below should be elected in the junior and senior years.

<i>Required Courses</i>	<i>Semester Hours</i>
T.Ed. 309. Foundations of American Education: Elementary . . .	2
T.Ed. 310. Educational Psychology for Elementary School	2
T.Ed. 311. Child Growth and Development	2
T.Ed. 320. Expressive Arts: Art and Physical Education in the Elementary School	2
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	2
T.Ed. 423. Methods in Elementary Science	2
T.Ed. 424. Methods in Elementary Social Studies	2
T.Ed. 446. Teaching the Exceptional Child in the Regular Classroom	2
T.Ed. 456. Children's Literature	3
T.Ed. 470. Student Teaching-Elementary School	8
Mus. 310. Teaching General Music	3
Mus. 110. Piano Class (two semesters)	4

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.³

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.

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.

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.
 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, composition, conducting, or pedagogy; 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 and the major faculty unit chairman 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

8:00 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 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. Examination questions in theory and history will serve as a basis for recommending specific courses and possible further examination in these areas. In addition, the major field written examination for Master of Music degree students in performance will cover musical styles as well as problems of performance and pedagogy. (See the preceding information on Preliminary Examinations.)

Residence. The minimum residence requirement for this degree is two semesters, plus one summer. In some faculty units 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 faculty unit concerned for advice.

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.

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. All parts of the preliminary examination (or appropriate courses) — as required by the major faculty unit — must be passed 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 faculty unit) and a minimum of 10 hours outside of the major field, 6 of which must constitute a minor in the College of Music.

There are four specific areas of study in the master's degree program: music education, music literature, performance, and theory/composition. A student must select a major in one of these four areas and a minor from one of the remaining three. The minor will consist of 6 graduate credit hours.

Major courses for a degree in performance include private instruction, historical research, and recitals. 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 faculty units 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 faculty unit.

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 faculty unit.

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 faculty, 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 faculty.

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; organ performance; performance, literature, and pedagogy of piano, voice, strings, winds, and percussion; performance, literature, and pedagogy of piano: process of group environments.

ENTRANCE REQUIREMENTS

Entrance requirements include a master's degree in music or demonstrated equivalency comparable to that of this University, submission of performance tapes and tapes of compositions, personal interview when possible, tests in music commensurate to the Master of Music, and demonstration of proficiency in the use of the English language. Among the supplementary application materials, a student must submit evidence of written English language proficiency, such as a previously written term paper, a copy of a master's thesis, or a Graduate Record Examination verbal score in the upper 30 percentile.

RESIDENCE REQUIREMENTS

Residence will be three semesters or equivalent in summer sessions beyond the master's degree, of which at least two semesters must be in residence at this University and must be consecutive. Not more than one-half semester residence credit may be earned in a summer session. The student must be properly registered to earn residence credit.

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 at least 5 semester hours in work numbered 500 or above or at least 8 semester hours of other graduate work.

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 or 6 semester hours of other graduate work.

CONTINUOUS REGISTRATION

After the residence requirement for the Doctor of Musical Arts program has been satisfied, a student must enroll and pay tuition for fall and spring semesters of each year until attaining the degree or formally resigning. After a student has enrolled in all required dissertation courses, he or she will enroll in Mus. 801, Precandidate for Doctor of Musical Arts, until having become a candidate for the degree. After becoming a candidate, the student will enroll in Mus. 802, Candidate for Doctor of Musical Arts, until the degree is attained. This continuing registration is independent of whether the student is in residence at this University. (See also section on Residence Requirements.)

CREDIT REQUIRED

While no specific minimum number of credit hours beyond the master's degree will be required, programs vary. Consult specific dissertation requirements.

PRELIMINARY EXAMINATIONS

While not a requirement for admission to the Doctor of Musical Arts program, the preliminary examinations must be taken at the beginning of the first semester or summer of residence, since they serve as important diagnostic tools. Examinations are given in music history, theory, aural perception, and the major field.

QUALITY OF WORK

Students are expected to complete with distinction all work for which they enroll. A grade 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.

PROGRAM COORDINATION

The dean of the College of Music has appointed a member of the faculty of each program in the College of Music to act as Doctor of Musical Arts program coordinator. The coordinator's duties involve specifically (1) advising, on the basis of the preliminary examinations, 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 where required) for presentation to the permanent advisory committee for approval; and (3) generally facilitating and expediting the student's program and activities.

PERMANENT ADVISORY AND EXAMINATION COMMITTEES

In consultation with the 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 the 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 program coordinator and will recommend any adjustments that seem necessary. It will approve 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. The student's degree plan will be considered a contract between him and his permanent advisory committee. The contract will be drawn as soon as possible after the establishment of the permanent advisory committee but not later than the second semester of residence.

The examination committee will consist of the permanent advisory committee and at least two additional members of the graduate faculty. This committee will be appointed before the completion of the first dissertation project and will give final approval to all dissertation projects.

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.) Students in voice have additional language requirements.

COMPREHENSIVE EXAMINATIONS

A student is eligible to take the comprehensive examinations when all deficiencies (including the foreign language requirement) have been removed, when the degree residence requirement has been satisfied, and with permission of the student's permanent advisory committee. This examination is in two phases, written and oral, and must be passed as a unit. The oral examination ordinarily follows the written examination by a period of not less than two weeks. A successful candidate must receive the affirmative votes of a majority of the members of the examination committee. In case of failure, the examination may be attempted once more after a period of time determined by the examining committee.

The comprehensive examination must be taken at least one semester before completion of degree requirements, including the dissertation. Students must be registered at the time they take the examination. Students must file their application for candidacy with the Graduate School two weeks before taking the examination. Comprehensive examinations, final orals, and presentation of dissertation projects will normally not take place during the summer session.

TIME LIMIT

The student is expected to complete all requirements for the degree within seven years of his first registration.

THESIS REQUIREMENTS

All dissertation projects must be submitted in a professionally acceptable format and quality and will be kept on file in the library. Two copies of each must be submitted to the University after final approval. The permanent advisory committee will furnish additional guidelines concerning content and format.

DISSERTATION

Normally, if students show only minor weaknesses on their preliminary examinations, they may be advised to begin work on the dissertation 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.

Area Dissertation Requirements

Literature and Performance of Choral Music

- Mus. 821-3. Dissertation Project. Choral Program.
- Mus. 822-3. Dissertation Project. Choral Program.
- Mus. 823-3. Dissertation Project. Choral projects in score reading and rehearsal techniques.
- Mus. 824-3. Dissertation Project. Choral student's performance-demonstration in editing, choral arranging, and continuo realization.
- Mus. 825-3. Dissertation Project. Lecture-Recital.
- Mus. 826-3. Dissertation Project. Lecture-Recital.
- Mus. 827-1. Dissertation Document.
- Mus. 828-1. Dissertation Document.
- Mus. 830-1. Dissertation Document.
- Mus. 831-3. Repertoire Project.

Composition

- Mus. 821-3. Dissertation Project. Compositions.
- Mus. 822-3. Dissertation Project. Compositions.
- Mus. 823-3. Dissertation Project. Composition Recital (or equivalent in performance of compositions).
- Mus. 824-3. Dissertation Project. Composition Recital (or equivalent in performance of compositions).
- Mus. 825-3. Dissertation Project. Lecture-Recital.
- Mus. 826-3. Dissertation Project. Lecture-Recital.
- Mus. 833-4 to 6. Major Composition Project.

Performance: Organ, Piano, Strings

- Mus. 821-3. Dissertation Project. Solo Recital.
- Mus. 822-3. Dissertation Project. Solo Recital.
- Mus. 823-3. Dissertation Project. Chamber Music Recital.
- Mus. 824-3. Dissertation Project. Chamber Music Recital.
- Mus. 825-3. Dissertation Project. Lecture-Recital.
- Mus. 826-3. Dissertation Project. Lecture-Recital.
- Mus. 827-1. Dissertation Document.
- Mus. 828-1. Dissertation Document.
- Mus. 829-1. Dissertation Document.
- Mus. 830-1. Dissertation Document.
- Mus. 831-1. Repertoire Project.

Performance, Literature, and Pedagogy: Piano, Strings, Winds, and Percussion

- Mus. 821-3. Dissertation Project. Solo Recital.
 - Mus. 823-3. Dissertation Project. Chamber Music Recital.
 - Mus. 825-3. Dissertation Project. Research Lecture-Recital.
 - Mus. 825-3. Dissertation Project. Pedagogy Lecture.
 - Mus. 826-3. Dissertation Project. Research Lecture-Recital II.
 - Mus. 826-3. Dissertation Project. Pedagogy Lecture II.
 - Mus. 827-1. Dissertation Document.
 - Mus. 828-1. Dissertation Document.
 - Mus. 831-3. Repertoire Project (not required in Winds and Percussion).
 - Mus. 832-4 to 6. Major Document.
- (Pedagogy students may elect, upon advisement, Mus. 824-3, Chamber Music or Solo Recital, and Mus. 830-1, Document, in place of Mus. 826-3, Pedagogy Lecture II.)

Performance, Literature, and Pedagogy of Piano: Process of Group Environments

- Mus. 821-3. Dissertation Project. Recital.
- Mus. 822-3. Dissertation Project. Teaching performance.
- Mus. 823-3. Dissertation Project. Teaching performance.
- Mus. 824-3. Dissertation Project. Master classes in group setting.
- Mus. 825-3. Dissertation Project. 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 to 6. Major Document. Implemented with teaching performance.

Performance, Literature, and Pedagogy: Voice

- Mus. 821-3. Dissertation Project. Solo Recital.
- Mus. 822-3. Dissertation Project. Solo Recital.
- Mus. 823-3. Dissertation Project. Chamber Music Recital.
- Mus. 825-3. Dissertation Project. Performance Document.
- Mus. 826-3. Dissertation Project. A project on vocal literature or performance.
- Mus. 831-3. Repertoire Project.
- Mus. 832-4 to 6. Major Pedagogical Document.

Upon the recommendation of the student's permanent advisory committee, independent study (Mus. 960) may be substituted for up to a total of 4 hours of performance-related documents (Mus. 827, 828, 829, 830, 1 hour each).

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 research. At present, programs in the various historical periods, historical 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. Finally, they must show evidence of superior individual work in music theory and history, this condition to be established by the submission of one or more papers or other research projects to the chairman of the faculty unit.

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 faculty unit.

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 presenta-

tions 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. Students are required to take Musicology Seminar (Mus. 782) each semester until completion of the comprehensive examination.

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. Two academic years of preprofessional study are required to qualify for admission to the School of Pharmacy. 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.

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 by *March 1* (or until the enrollment limit is reached) 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 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 School of Pharmacy. The application deadline is March 1 or until the enrollment limit is reached. 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 is optional and is recommended for students whose overall grade-point average is below 3.0.

Requirements for Graduation

To be awarded the Bachelor of Science (Pharmacy) degree, candidates must complete the required courses indicated in the curriculum, a minimum of 9 semester hours of professional electives, and a sufficient number of additional 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 AND SECOND YEARS (PREPROFESSIONAL)

Semester Hours

Chemistry, general (with laboratory) (Chem. 103-106)	10
Chemistry, organic (with laboratory) (Chem. 331-332)	8
Biology (one year of general zoology or a combination of general zoology and botany) (with laboratory) (MCDB 105-106 or EPOB 121, 122, 123, and 124)	8
Mathematics (college algebra and trigonometry, or calculus) ..	5
Physics, general (with laboratory) (Phys. 301)	5
Economics, micro (Econ. 202)	3
English composition	6
Communication, oral	3
General education (20 semester hours)	
Psychology, sociology, or cultural anthropology	6-8
Humanities	6-8
Natural or social sciences	6-8
	68

THIRD YEAR (PROFESSIONAL)

Fall Semester

Phar. 306. Prescription Procedures	1
Ph.Ch. 370. Pharmaceutical Chemistry I	2

Ph.Ad. 381. Laws of Pharmacy	3
Ph.Ad. 483. Financial Management	3
EPOB 343. Human Physiology	4
Chem. 471. General Biochemistry	5
	18

Spring Semester

Phar. 305. Pharmacy Orientation	2
Ph.Ch. 371. Pharmaceutical Chemistry II	2
Ph.Ch. 375. Physiological and Clinical Chemistry	3
Bi.Ph. 308. Drug Action	4
Bi.Ph. 490. Pathology	4
Ph.Ad. 486. Pharmacy Management	3
	18

FOURTH YEAR (PROFESSIONAL)

Fall Semester

Phar. 410. Pharmaceutics I	4
Ph.Cl. 452. Pharmacology I	5
Ph.Ch. 472. Medicinal Chemistry I	3
Bi.Ph. 450. Infectious Disease	3
Professional Electives	2-3
	17-18

Spring Semester

Phar. 411. Pharmaceutics II	4
Ph.Cl. 453. Pharmacology II	5
Ph.Ch. 473. Medicinal Chemistry II	3
Ph.Cl. 474. Toxicology	2
Professional Electives	3-4
	17-18

FIFTH YEAR (PROFESSIONAL)

Fall Semester

Cn.Ph. 420. Clinical Pharmacy and Therapeutics I	3
Cn.Ph. 449. Clinical Pharmacokinetics	3
Cn.Ph. 426. Community Pharmacy Externship I	2
Cn.Ph. 428. Institutional Pharmacy Practice Externship I	2
Cn.Ph. 4- . Clinical Pharmacy Elective	2
Professional Electives	2-3
	14-15

Spring Semester

Cn.Ph. 421. Clinical Pharmacy-Therapeutics II	3
Cn.Ph. 422. Non-Prescription Products	3
Cn.Ph. 432. Drug-Poison Information Clerkship	2
Cn.Ph. 4- . Clinical Pharmacy Elective	2
Cn.Ph. 4- . Clinical Pharmacy Elective	2
Professional Electives	2-3
	14-15

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, aerations, 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-Pharmaceutics, Clinical 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.

Reserve Officer Training Corps Programs

ALL ROTC PROGRAMS

It is important to note that enrollment in ROTC programs is open to both men and women, and ROTC courses are open to all students whether or not they are enrolled—they are enrolled in ROTC programs.

AIR FORCE ROTC

USAF Nurse Corps

Air Force ROTC makes it possible for qualified applicants of nursing schools to enroll in its programs and upon completion of all academic and licensing requirements receive a commission as a second lieutenant in the USAF Nurse Corps.

The United States Air Force Reserve Officers Training Corps, through a cross-town agreement between the University of Colorado Health Sciences Center, School of Nursing, and the University of Colorado at Boulder, offers two programs leading to a commission in the United States Air Force upon receipt of the bachelor's degree. Students are commissioned upon the completion of the Professional Officer Course and a 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 Leadership Laboratory (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 candidates at both undergraduate and graduate levels who will have two years remaining at the University of Colorado Health Sciences Center, School of Nursing, when they enroll. Selection is on a competitive basis. Applicants should apply directly to the Professor of Aerospace Studies not later than March 15 preceding the fall term 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 students approved and qualified for future United States Air Force 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 students enrolled in the Professional Officer Course receive \$100 per month subsistence during the regular academic year. Competitive scholarships are available for two-, three-, and four-year periods to eligible men and women.

AFROTC credit for graduation is awarded by the University of Colorado. Enrollment in the AFROTC program is through the University of Colorado Continuing Education program after payment of appropriate tuition. All classes are held on the Boulder Campus. Interested students should contact the Professor of Aerospace Studies, Folsom Stadium, Gate 4, Room 225, University of Colorado, Boulder, Colorado 80309. Telephone 492-8351.

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 408 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.

Opportunities for commissioned service are available in surface, subsurface, and aviation specialties in the U.S. Navy. Opportunities in ground and aviation specialties are available in the U.S. Marine Corps. 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. All commissioned opportunities require that the student be working toward, and receive, a college degree.

U.S. ARMY MILITARY SCIENCE

The Department of Military Science offers two Army ROTC programs leading to a commission in the active Army or Reserve and National Guard programs.

Four-Year Program

The standard four-year program consists of two phases. The Basic Course, normally completed during the freshman and sophomore years, consists of courses in military science, officer career development, leadership theory and management. The Advanced Course coincides with the junior and senior years. Subject areas include leadership, methods of instruction, tactics and unit operations, military law, history, national strategy, and army policies. Completion of a six-week Advanced Camp in the summer is required prior to commissioning.

Two-Year Program

The abbreviated two-year program consists of the same courses offered in the Advanced Course. However, both undergraduate and graduate students may become qualified for this program by successful completion of a six-week summer basic camp, an on-campus summer program, or specially designed compression courses offered during the spring or fall semesters. If selected for the abbreviated program under these options, students may receive an early commission with the Reserve or National Guard while continuing their college education at the undergraduate or graduate level.

Students should contact the professor of military science for specific requirements and options available based on each student's status at the time of program entry. Students who are veterans of military service or participated in junior ROTC, Civil Air Patrol, or similar organizations may have a portion or all of the basic course requirements waived by the professor of military science.

Scholarships

Students selected for a U.S. Army scholarship receive full tuition, books, laboratory fees, classroom materials, and a monthly allowance of \$100 during each academic year. Only high school seniors are eligible to apply for four-year scholarships. ROTC students enrolled on campus as full-time students may compete for the three-, two-, and one-year scholarships. All scholarship benefits are tax free and competition is open to both men and women.

Flight Training

Students selected for the advanced course may become qualified as cadets to participate in the Army Aviation Program. These individuals will attend flight school after completion of their Officer's Basic Course while on active duty.

Course Credit

Army ROTC course credit for graduation varies with each college. Students should contact the professor of military science or dean of their college to clarify the number of credit hours to be awarded.

Course Descriptions

Following are descriptions of courses offered in the colleges and schools on the Boulder Campus. *This listing does not constitute a guarantee or contract that any particular course will be offered during a given year.*

For degree requirements, students should refer to the departmental listings in the appropriate college or school information section of this catalog. These requirements are subject to change, and students should check with their department for up-to-date information.

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. 200-3. Evolution of Human Sexuality.** Current literature on male and female supremacy is evaluated. The issue of human sexuality is placed in the context of human evolution, is related to human life cycle stages, and is examined in terms of cultural influences on its expansion.
- **Anth. 201-3. Introduction to Physical Anthropology I.** Detailed consideration of human biology, man's place in the animal kingdom, and fossil evidence for human evolution.
- **Anth. 202-3. Introduction to Physical Anthropology II.** Continuation of Anth. 201. Quantitative analysis, genetics, and race are emphasized.
- Anth. 203-1. Laboratory in Physical Anthropology I.** A lab. in human osteology and the skeleto-muscular system with an emphasis on comparative primate morphology and adaptation.
- Anth. 204-1. Laboratory in Physical Anthropology II.** Lab. 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. 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.

¹Also available through correspondence study.

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. 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 from traditional to rural proletarianism; (3) and peoples of complex societies, urban settings, squatter settlements, ghettos, and slums.

Anth. 344-3. Maritime Peoples. Anthropological studies of maritime peoples and human adaptations to maritime existence, emphasizing fishing peoples, coastal communities, and contemporary problems in marine policy and ocean management.

Anth. 380-3. Languages and People. Investigation of the roles which languages play in the building of new nations, in the spread of world religions, in migration, and in the diffusion of writing systems and other customs throughout the world.

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. The nutritional requirements of man and how they have been met by different populations: taking into account differences in soils, climate, natural resources, technology, and cultural practices.

Anth. 407-3. 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 selec-

tion, 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. 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. 444/544-3. Urban Anthropology. A comparative study of urban life.

Anth. 451/551-3. Applied Cultural Anthropology. Analysis of problems of cultural change due to contacts between people of different cultures.

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. 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.

World Ethnography (Anth. 461/561-475/575)

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. 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. 470/570-3. Ethnography of China, Japan, and Korea.

Anth. 475/575-3. Ethnography of Oceania.

Anth. 480-3. Languages of Primitive People. The methods used to record and analyze the languages of nonliterate societies. Students will be able to work with languages recorded by native speakers of nonwestern languages from around the world.

Anth. 481-3. 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. 484/584-3. Egyptian Hieroglyphics II. (General Classics 484/584.) Reading and translating hieroglyphics into modern languages.

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. 491-3. 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. 492-3. 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. 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. 538-2 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. 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. 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. 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. 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. 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. 608-3. Seminar: Ethnography of Selected Areas.

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. 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. 700-1 to 6. Master's Thesis.

Anth. 800-1 to 10. Doctor's Thesis.

Anth. 940-variable credit. Independent Study. Hours and credit to be arranged. For undergraduates only. Consent of instructor is required.

Anth. 950-variable credit. Guided Study. Directed individual research based on a specific area of specialization. Hours and credit to be arranged. For graduate students only. Consent of instructor is required.

Anth. 960-variable credit. Independent Research. For graduate students only. Hours and credit to be arranged. Consent of instructor is required.

Anth. 999-000. Candidate for Degree.

ARTS AND SCIENCES

A.S. 099-3. Developmental Expository Writing. This course is offered for add-on credit only. A review of fundamental grammar and compositional skills.

A.S. 100-3. General Expository Writing. Analysis of the essential techniques of exposition and argumentation through practical criticism of student writing and model essays.

A.S. 101-3. Expository Writing in the Humanities. Basic expository writing with an emphasis on readings and topics in the humanities.

A.S. 102-3. Expository Writing in the Social Sciences. Basic expository writing with emphasis on readings and topics in the social sciences.

A.S. 103-3. Expository Writing in the Natural Sciences. Basic expository writing with an emphasis on readings and topics in the natural sciences.

A.S. 110-3. Advanced Expository Writing.

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. 940-2 to 6. Senior Thesis for Individually Structured Major.

ASTRO-GEOPHYSICS

A.G. 111-3. General Astronomy. *Fall, Spring.* 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. Students desiring more extensive laboratory and observing experience should also register for A.G. 121.

A.G. 112-3. General Astronomy. *Fall, Spring.* 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. Students desiring more extensive laboratory and observing experience should also register for A.G. 122.

A.G. 121-1. General Astronomy Laboratory. *Fall, Spring.* 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. Coreq., A.G. 111.

A.G. 122-1. General Astronomy Laboratory. *Fall, Spring.* 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. Coreq., A.G. 112.

A.G. 113-3. Dynamic Earth I — Introduction. (Geol. 113.) *Fall.* Origin and evolution of the earth as a planet. Alternative energy resources. Composition of the earth, continental drift, and plate tectonics.

A.G. 114-3. Dynamic Earth II — The Solid Earth. (Geol. 114.) *Spring.* Basic concepts of the physics of the solid earth, earthquakes, their causes and prediction. Earth structure, earth's gravity and magnetic fields, paleomagnetism.

A.G. 115-3. Dynamic Earth III — Meteorology and Oceanography. (Geol. 115.) *Spring.* Composition and structure of the atmosphere and the oceans. Ocean-current systems, waves, and tides. Air-sea interaction. Weather phenomena. Man's impact on the ocean and atmosphere.

A.G. 125-1. Laboratory — Dynamic Earth III. *Spring.* Optional lab. covering experiments related to the subject matter of A.G. 115. Coreq., A.G. 115.

A.G. 320-3. Topics in Meteorology. (Geog. 320.) *Fall, Spring.* 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. Prer., A.G. 115 (formerly A.G. 114, Planet Earth), Geog. 100, or instructor consent.

A.G. 321-3. Topics in Modern Astronomy. *Fall, Spring.* 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. Prer., A.G. 111/112 or instructor consent.

A.G. 350, 351, 352-variable credit. Special Topics in Astro-Geophysics. Special topics intended to acquaint undergraduate students with topics of current interest and research in astro-geophysics.

A.G. 391-3. The Earth's Atmosphere and Oceans. *Fall.* The physical structure and processes occurring in the atmosphere and oceans; radiation and cloud physics; atmospheric winds and ocean currents; general circulation; gulf and jet streams; formation of severe storms. Prer., general physics and calculus.

A.G. 392-3. Planetary Physics. *Spring.* The evolution of the solar system and formation of the inner and outer planets; evolution of planetary atmospheres; results from planetary exploration with space probes; comparative planetology. Prer., general physics and calculus.

A.G. 393-3. Astrophysics. *Fall.* The structure and evolution of the sun and stars. Stellar winds, interstellar matter, and galaxies. Origin and propagation of various types of radiation, generation of energy and production of the elements in the stars, 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. 499-variable credit. Independent Study in Astro-Geophysics. Prer., instructor consent.

A.G. 505-3. Atmospheric Physics I. *Fall.* Physical processes in the atmosphere. Application of statics, atmospheric thermodynamics, cloud physics, and radiative transfer.

A.G. 506-3. Atmospheric Physics II. *Spring.* Atmospheric motions, planetary boundary layer theory, elementary turbulence theory, energy transformations, general circulation of the atmosphere. Prer., A.G. 505, A.G. 540 or consent of instructor.

A.G. 511-3. Internal Processes in Gases. *Fall.* Thermal, mechanical, and radiative processes in gases with emphasis on those

processes that are of interest in the study of planetary and stellar atmospheres and the interstellar medium.

A.G. 515-3. Introductory Plasma Physics. (Phys. 515.) *Spring.* Basic phenomena of ionized gases; static and dynamic shielding, linear waves, instabilities, particles in fields, collisional phenomena, fluid equations, collisionless Boltzmann equations, Landau damping, scattering and absorption of radiation in plasmas, elementary nonlinear processes, WKB wave theory, controlled thermonuclear fusion concepts, astrophysical applications, experimental plasma physics (laboratory). Prer., A.G. 554 or equivalent; Phys. 631.

A.G. 516-3. Intermediate Plasma Physics. (Phys. 516.) *Fall.* Continuation of A.G. 515. Topics vary yearly but include nonlinear effects such as wave coupling, quasilinear relaxation, particle trapping, nonlinear Landau damping, collisionless shocks, solitons; non-neutral plasmas; kinetic theory of waves in a magnetized plasma; anisotropy; inhomogeneity; radiation — ponderomotive force, parametric instabilities, stimulated scattering; plasma optics; kinetic theory and fluctuation phenomena. Prer., A.G. 515 or instructor consent.

A.G. 517-3. Advanced Plasma Physics. *Spring.* Continuation of A.G. 516. Radiative transfer of plasma waves, advanced kinetic theory of plasmas, spontaneous emission, transport phenomena, fluctuation-dissipation theorems, modulational instability, wave trapping and collapse, turbulence, special topics. Prer., A.G. 516 or instructor consent.

A.G. 520-2. Meteorology of the Upper Atmosphere. *Spring, alternate years.* The structure and dominant physical processes that occur in the neutral atmosphere from 20-100 km. Radiation, photochemistry, general circulation, transport phenomena. Also probing techniques, rockets, satellites, etc.

A.G. 525-3. Planetary Aeronomy. *Fall, alternate years.* 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. Introduction to Magnetospheres. (Aero. 573.) *Spring, alternate years.* Introduction to solar and stellar winds, planetary and stellar magnetospheres. Guiding center theory for particle motion, magnetospheric topology, convection, radiation belts, magnetic storms and substorms, auroras.

A.G. 533-3. The Sun. *Spring.* 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. *Fall.* 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. *Spring.* 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. *Fall.* 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. *Spring.* 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. *Fall, 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. 560-3. Introduction to Astrophysics. *Fall.* Introduction to basic astronomical data and techniques; stellar classifications; stellar motions; stellar populations, star clusters, HR diagrams, semiempirical approach to stellar evolution; survey of various astrophysical disciplines.

A.G. 562-3. Stellar Interiors. *Spring, alternate years.* 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., A.G. 560 or equivalent.

A.G. 563-3. Physics of the Interstellar Medium. *Spring, alternate years.* 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., A.G. 560 or equivalent.

A.G. 566-3. Galaxies and Cosmology. *Fall, alternate years.* 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. Prer., A.G. 560 or equivalent.

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. *Spring, 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. *Spring, 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. *Fall, alternate years.* Development of MHD equations, approximations, MHD flows, waves and shocks, double adiabatic theory, stability theory, boundary layers, convection, and turbulence. Astro-geophysical applications (will vary somewhat according to instructor). Prer., A.G. 515, 540.

A.G. 624-3. Physics of Planetary Airglows. *Fall, 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 Magnetospheric Physics. *Spring, alternate years.* Current research problems in the physics of the solar and stellar winds, terrestrial, planetary and stellar 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. Prer., A.G. 533.

A.G. 640-3. Radio Astronomy. *Fall, 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. Prer., A.G. 554.

A.G. 650, 651, 652, 653, 654, 655-variable credit. Special Topics in Astro-Geophysics. Intended to acquaint students with current research in astro-geophysics. (Topics vary each semester.)

A.G. 661-3. Stellar Atmospheres. *Alternate years.* Stellar energy distributions, radiative transfer, stellar atmospheres; line absorption coefficient, broadening mechanisms, line formation in stellar atmospheres; applications to stellar spectroscopy. Prer., A.G. 560 or equivalent.

A.G. 665-3. Observational Astronomy. *Alternate years.* 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. Prer., A.G. 560 or equivalent.

A.G. 667-3. High-Energy Astrophysics. *Spring, alternate years.* Explosive phenomena in stars and galaxies; origin and propagation of cosmic rays; nonthermal radio sources; physics of neutron stars, pulsars, and black holes; cosmic X-ray sources and gamma-ray sources. Prer., A.G. 560.

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. 403/503-1. Literature of the Sciences and Engineering. *Fall, Spring.* A survey of the structure of scientific literature and the important reference sources in each discipline. A working knowledge of the chief bibliographic services and research methodology is gained through tutorials with subject specialist librarians.

BIOLOGICAL SCIENCES

Biology—Environmental, Population, and Organismic

EPOB 100-2. Biological Methods and Principles. This is a 2-credit course designed to provide a background in biology. The course will serve as a general introduction to biological methods and principles.

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 121-3. 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 123 for students taking advanced EPOB courses.

EPOB 122-3. 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 121 for information on proficiency tests. Prer., EPOB 121; coreq., EPOB 123 for students taking advanced EPOB courses.

EPOB 123-1. General Biology Laboratory I. One 3-hr lab per week. Designed to introduce the beginning student to the process of biological thought and investigation in the laboratory setting. Consists of experiments and exercises which provide an extension of basic concepts presented in four of the main subject areas presented concomitantly in the general biology lect. course (EPOB 121): structure, function, genetics, and development of both plant and animal materials. Lab. sessions vary from familiarization with biological materials to detailed experimental analyses extending over two lab.

periods. Living materials will be employed where possible. Coreq., EPOB 121. R. Eaton.

EPOB 124-1. General Biology Laboratory II. Focuses upon diversity, physiology, and ecology of whole organisms. Provides direct experience with experimental procedures, identification of organisms, and report preparation. Prer., EPOB 123; Coreq., EPOB 122. M. Grant.

EPOB 201-2. 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. Prer., consent of instructor.

EPOB 203-3. Introduction to Biological Statistics. Lect. and discussion. 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 121-124 and Math. 110 or equivalent. S. Bernstein.

EPOB 205-3. Heredity and Society. Relevance of heredity and evolution to contemporary problems in medicine, behavior, agriculture, and other societal concerns. For freshmen and sophomores. Not for biology majors.

EPOB 302-3. 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 121-124. Staff.

EPOB 315-3. Introduction to Arctic and Alpine Environments. (Geog. 330.) See Geog. 330. Prer., two relevant courses in EPOB, geology. H. Nichols.

EPOB 316-3. 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. H. Nichols.

EPOB 318-2. 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 121-124, or MCDB 105-106, or equivalent. H. Smith.

EPOB 320-3. 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 121-124, or equivalent.

EPOB 325-2. 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 121-124. J. Bock.

EPOB 340-4. Microbiology. Lect., lab. Survey of microbiology. Emphasis on prokaryotes with general consideration of viruses as well as eucaryotic microorganisms. Includes microbiological concepts and methodology, and a survey of distinguishing characteristics of microorganisms based on structural-functional relationships. Nutritional-biochemical prototypes, and ecological roles. Consideration is given to taxonomy, growth, physical-chemical agents of control including antibiotics, metabolism, genetics, and evolution of microorganisms. Introduction to various aspects of applied microbiology is presented with emphasis on infectious diseases, basic concepts of immunology and microbial ecology. Prer., EPOB 121-124 and college chemistry. Organic chemistry recommended. W. Shulls and W. Segal.

EPOB 342-4. 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 121-124. R. Jones, T. Swain.

EPOB 343-4. Human Physiology. Three lect., one 3-hr. lab. and rec. per wk. An introduction to human physiology primarily for students in pharmacy and allied health programs. May be counted towards EPOB major. Prer., EPOB 121-124, and one year of college chemistry. Staff.

EPOB 345-3. The Biology of Human Reproduction. Anatomy and physiology of human reproduction, including sex determination, embryology, puberty, menstrual cycle, pregnancy, lactation.

menopause, sexual behavior, sexual abnormalities, and contraception. Prer., EPOB 121-124 or equivalent. R. Jones.

EPOB 346-3. The Biology of Nutrition. A functional approach to human nutrition with emphasis on the roles of nutrients under normal conditions in the biochemistry and activities of the body and its constituent cells, on the physiology of digestion, and on the chemistry, sources, and functions of macro- and micro-nutrients. Nutritional balance, interactions, and the problems and controversies in nutrition are discussed, the experimental bases for science of nutrition are explored. Prer., general biology (one year), college chemistry (one year). P. Winston.

EPOB 350-4. Plant Kingdom. Provides an introduction to the structure, function, diversity, and evolution of plants. Essential to students anticipating further botanical studies. Provides a survey of plant types with an emphasis on the diagnostic features of plants in general and major taxa in specific. Each taxon will be treated from the following points of view: identity, morphology, anatomy, reproduction, ecology, geography, evolution, fossil record, and economic uses. A general survey of elementary plant physiology, plant genetics and ecosystem producer studies will be made to provide perspective for more advanced study. Prer., EPOB 121-124. S. Shushan and P. Webber.

EPOB 351-4. Plant Anatomy and Development. An introduction to the structures of seed plants, especially angiosperms, and the developmental history of these structures. Cell types will be learned, and their location and function in plant tissues and organs will be studied. The laboratory will provide an opportunity to examine plant tissues and to prepare tissues for examination by the light microscope. The role of plant structures in the living plant will be stressed. Prer., EPOB 121-124 or equivalent. J. Bock.

EPOB 352-4. Classification of Flowering Plants. Introduction to orders and families of angiosperms and consideration of evolutionary relationships. Synopsis of current research areas in modern biosystematics placed in an historical framework. Field and laboratory identification of higher plants with introduction to local and regional flora. Prer., 121-124. R. Bye.

EPOB 353-4. Essentials of Plant Physiology. Lect., lab. Water relations, photosynthesis, respiration, germination, growth, and movements of plants. Prer., EPOB 121-122 and 123-124 or college botany and college chemistry. E. Bonde.

EPOB 361-4. Insect Biology. An introduction to evolution, ecology, physiology, and behavior of insects. Emphasis on how insects have solved problems, such as maintaining water balance or finding food, that are shared by all animals but for which there may be unique solutions among the insects. Agricultural and human health problems relative to entomology are discussed. Prer., EPOB 121-124, or equivalent zoology course. M. Breed.

EPOB 363-3. Parasitology. Lect., lab. A survey of animal parasites, including life histories; emphasis on parasites of man. Prer., EPOB 121-122 and 123-124, or college zoology. J. Bushnell.

EPOB 365-4. Animal Kingdom. Lect., lab. Survey of the animal kingdom including some protists. Emphasis on life history, ecology, evolution, anatomy, and taxonomy. Prer., EPOB 121-124. Staff.

EPOB 372-5. Principles of Comparative Vertebrate Anatomy. Lect. and lab. Phylogeny of vertebrate organ systems. Prer., EPOB 121-124 or college zoology. H. Smith.

EPOB 374-5. Developmental Biology. (MCDB 465.) See MCDB for course description.

EPOB 385-4. Comparative Animal Physiology. Lect., lab., rec. Introduction to principles of animal physiology, emphasizing physiological control systems and responses to environmental change. Prer., one year of college chemistry and EPOB 121-122 and 123-124. Comparative vertebrate anatomy (EPOB 372) is recommended. Staff.

EPOB 395-4. Introduction to Animal Behavior. 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. Behavioral ecology and the evolution of behavior also are stressed. Prer., EPOB 121-124 or equivalent, or consent of instructor.

EPOB 400/500-3. Teaching of Modern High School Biology. Lect., lab. The context in which modern biology should be taught to either

high school or college and university students. Recommended for biological science-education majors. Closed to freshmen and sophomores. Prer., EPOB 121-122 and 123-124, or equivalent, and consent of instructor. Staff.

EPOB 401-2. Teaching Biology. Offers students a one-time opportunity to assist in teaching of specific laboratory section in EPO biology under direct faculty supervision. The student must make arrangements with the faculty person responsible for the course in which he plans to assist. A student may take this course for credit only once. No student can receive independent study credit through this program. Prer., consent of instructor. Staff.

EPOB 402/502-3. Stream Biology. Geological, physical, chemical, and biological study of flowing water with special reference to streams and rivers as ecosystems. A laboratory course is offered (see EPOB 415-419/515-519). Prer., EPOB 302. Windell.

EPOB 403/503-3. Limnology. Ecology of inland waters, including a detailed consideration of physical, chemical, and biological properties of freshwater ecosystems: origins and major characteristics of lakes and streams, survey of chemical and nutrient cycles in freshwater habitats, survey of biotic composition of freshwater environments. Important themes in modern freshwater ecology are considered, including energy flow, trophic structure, eutrophication, and management of freshwater ecosystems. Prer., 121-124. W. Lewis.

EPOB 407/507-3. Animal Geography. Ecological and faunistic distribution of animals on a world basis. Prer., EPOB 302, vertebrate taxonomy and geology recommended. A. Cruz.

EPOB 409/509-3. Biometry. A demanding, problems-oriented methods course in statistical inference procedures, assumptions, limitations, and applications with emphasis on techniques appropriate to realistic biological problems; 509 includes data file management using interactive computing techniques. Prer., general biology and Math. 110 or equivalent. M. Grant.

EPOB 410-414/510-514 (2-4). Advanced Ecology. Specific aspects of ecology. Emphases are specialties of faculty. One or more courses are offered each semester. Topics which have been taught are listed here and others may be given: dynamics of mountain ecosystems, tundra ecology, ethnoecology, population dynamics, tropical and insular biology, ecology of fishes, quantitative plant ecology, arctic and alpine environments. Prer., EPOB 302. Some courses have additional prer. Staff. See *Schedule of Courses*.

EPOB 415-419/515-519 (1-2). Techniques in Ecology. Courses emphasizing application of modern ecological techniques. One course offered each semester in topics such as stream biology, aquatic biology, environmental measurement and control, techniques in geocology. Prer., EPOB 302. Some courses have additional prer. Staff. See *Schedule of Courses*.

EPOB 426/526-4. Plant Population Biology. Ecology and evolution of plant populations: Population dynamics, geographic variation, adaptive strategies and plant-animal co-evolution. Prer., genetics, ecology, evolution. Y. Linhart.

EPOB 427/527-3. Population Genetics. Theoretical groundwork of population genetics, presenting botanical, zoological, or anthropological examples. Subjects considered: stochastic and deterministic factors influencing gene frequency changes in populations, genetic load and stable equilibria, inbreeding and mixed mating systems, and speciation. For graduate and advanced undergraduate students pursuing careers in genetics, ecology, or evolution. Prer., Genetics (EPOB 320) or MCDB 384. Staff.

EPOB 428, 429/528, 529-2 to 4. Advanced Topics in Evolution. Specialized aspects of organic evolution. Courses offered on an irregular basis include origin and dispersal of flowering plants, reproductive biology of flowering plants, evolution, and speciation. Prer., EPOB 302/325. Staff.

EPOB 430, 431/530, 531-2 to 4. Advanced Genetics. Courses offered at irregular intervals dealing with specialized topics in genetics. Prer., EPOB 320. Staff.

EPOB 432, 433/532, 533-2 to 4. Techniques in Genetics. Courses offered occasionally involving specific procedures and their applications in solving genetic research problems. Prer., see *Schedule of Courses*.

EPOB 435, 436/535, 536-2 to 4. Biological Field Studies. Courses offered during the summer session and occasionally during the academic year, stressing broad areas of biology and employing field approaches. Prer., see *Schedule of Courses*.

EPOB 437 to 439-2. Biological Seminar. Designed primarily for seniors seeking Honors in EPO Biology. Separate sections may be

available for other seniors especially those interested in graduate studies. Sample topics include history of biological concepts, impact of biology on modern thought, biology and the crises of the modern world. Prer., consent of instructor. See *Schedule of Courses*.

EPOB 440-4. Pathogenic Microbiology. Lect., lab. Discussions of infectious diseases selected on basis of various classes of ethologic agents: bacteria, rickettsia, and viruses. Emphasis on characteristics of disease agents in relation to mechanisms of disease production, clinical symptoms and pathology, immunity and serological reactions, laboratory diagnosis, and epidemiology. Special consideration to basic concepts of immunology, including antigen-antibody interactions, structure and function of antibodies correlated with specificity, and structure of antigen in relation to immunological activity. Prer., EPOB 340 or equivalent. W. Shulls, W. Segal.

EPOB 442-3. 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 340 and organic chemistry. W. Segal.

EPOB 446, 447/546, 547-2 to 4. Advanced Microbiology. Courses offered each year dealing with specialized topics related to microbial biology such as immunobiology, microbial physiology, and applied microbiology. Prer., see *Schedule of Courses*.

EPOB 448, 449/548, 549-1 to 2. Advanced Microbiology Laboratory. Special techniques related to specific areas of microbial research or diagnostic work. Examples: immunobiology laboratory, microbial physiology laboratory. Prer., see *Schedule of Courses*.

EPOB 451/551-4. Plant Ecology. Lect., lab., and field work. Discussion of the ecosystem concept. Survey of the characteristics of Colorado ecosystems in detail and of North America in general; adaptation; ecological classification of plants. Prer., EPOB 121-124 or consent of instructor. J. Marr.

EPOB 453-4. Morphology of Nonvascular Plants. Lect., lab. Algae, fungi, and bryophytes. Prer., EPOB 121-124 or college botany. S. Shushan.

EPOB 454-4. Morphology of Vascular Plants. Lect., lab. Tracheophytes. Prer., EPOB 121-124 or college botany. S. Shushan.

EPOB 455, 458/555, 558-2 to 4. Advanced Botany. Special areas of botany offered each year including courses in algology, mycology, lichenology, palynology, evolution and ecology of domesticated plants, advanced classification of flowering plants, plants of Colorado, developmental plant anatomy, Cenozoic paleobotany. Prer., see *Schedule of Courses*.

EPOB 459, 460/559, 560-2 to 4. Advanced Plant Physiology. Functional aspects of botany including advanced general plant physiology, ecological plant physiology, plant growth and development in sterile culture. Prer., see *Schedule of Courses*.

EPOB 463, 464/563, 564-2 to 4. Plant Field Studies. Field-oriented courses offered at irregular intervals or during summer sessions. Example: field botany, plants of Colorado. Prer., see *Schedule of Courses*. Staff.

EPOB 465/565-5. Invertebrate Zoology. Lect., lab. Morphology, physiology, ecology, and phylogeny of invertebrates; emphasis on types not included in EPOB 361 or 363. Prer., EPOB 121-124 or college zoology. J. Bushnell.

EPOB 467, 468/567, 568-2 to 4. Advanced Invertebrate Biology. Courses dealing with specific taxa and/or special aspects of invertebrate biology. Topics offered include insect taxonomy, aquatic invertebrate zoology, biology of social insects, benthic and Aufwuchs ecology. Prer., see *Schedule of Courses*.

EPOB 469, 470/569, 570-1 to 2. Advanced Invertebrate Biology Laboratory. Laboratory courses dealing with special taxa and/or special aspects of invertebrate biology. Prer., see *Schedule of Courses*.

EPOB 472/572-4. Vertebrate Microanatomy. Lect., lab. Analysis of vertebrate histology and preparation of vertebrate tissues for light microscopic examination. Especially useful to students of vertebrate anatomy, development, and physiology. Prer., EPOB 121-124 and one of the following: comparative vertebrate anatomy, comparative animal physiology, or vertebrate embryology.

EPOB 474/574-2. Biology of Amphibians and Reptiles. Comparative morphology, taxonomy, ecology, and geographic distribu-

tion of amphibians and reptiles. For lab. see EPOB 479, 480/570, 580. Prer., EPOB 121-124 or equivalent.

EPOB 475/575-3. Ornithology. Lect., lab., discussion. 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 302 or consent of instructor. O. Williams.

EPOB 476/576-4. 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 302, or consent of instructor. O. Williams.

EPOB 477, 478/577, 578-2 to 4. Advanced Vertebrate Biology. Special aspects of vertebrate biology such as ichthyology, experimental embryology, biology of freshwater fishes, vertebrate natural history. Prer., see *Schedule of Courses*.

EPOB 479, 480/579, 580-1 to 2. Advanced Vertebrate Biology Laboratory. Laboratory courses dealing with special taxa and/or special aspects of vertebrate biology. Prer., see *Schedule of Courses*.

EPOB 481, 482/581, 582-2 to 4. Animal Field Studies. Field-oriented course in animal biology. Courses are typically taught at locations other than the Boulder campus. Prer., see *Schedule of Courses*.

EPOB 485/585-3. Vertebrate Physiology. Lect. Physiology of vertebrate organ systems with special emphasis on regulatory processes providing for adaptation to environmental pressures. Prer., EPOB 385. G. Snyder.

EPOB ½—¾*½—¾—¾. 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 385. C. Carey.

EPOB 487/587-3. Vertebrate Endocrinology. Lect. Evolutionary analysis of the chemical control and integration of physiology and behavior. Prer., EPOB 343 or 385. D. Norris.

EPOB 489, 490/589, 590-2 to 4. Advanced Animal Physiology. Specialized areas of physiology including invertebrate physiology, cell physiology, vertebrate reproduction, and others. Prer., see *Schedule of Courses*.

EPOB 491, 492/591, 592-1 to 2. Techniques in Animal Physiology. Laboratory courses dealing with special techniques employed in various aspects of physiological research. Examples: techniques in endocrinology, instrumentation, vertebrate physiology laboratory. Prer., see *Schedule of Courses*.

EPOB 497/597-3. Neurobiological Bases of Behavior. Introduction to structure and physiology of neurons followed by neuroethological analysis of how neurons are organized into assemblies which generate behavior. Emphasis on simple systems in both vertebrates and invertebrates. Prer., one upper division course in physiology or behavior. R. Eaton.

EPOB 498, 499/598, 599-2 to 4. Advanced Ethology. Special areas of ethology such as sociobiology, animal communication. Prer., see *Schedule of Courses*.

EPOB 501-1. Seminar: Introduction to Biological Research. In-depth discussions on areas of biological research represented in EPO biology. Required of all first year graduate students in EPO biology. Prer., see *Schedule of Courses*.

EPOB 504-3. Applied Ecology and Environmental Affairs. Application of ecological knowledge as an aid in solution of environmental problems involving complex, interdisciplinary, technical issues and conflicting social values. Prer., EPOB 302. D. Crumpacker.

EPOB 610 to 619-2. Seminar in Environmental Biology. Open only to graduate students.

EPOB 620 to 629-2. Seminar in Population Biology. Open only to graduate students.

EPOB 830 to 839-2. Seminar in Organismic Biology. Open only to graduate students.

Note: No student may receive independent study credit for assisting in the operation and/or teaching of any laboratory section.

EPOB 940-1 to 3. Independent Research (Undergraduate). Consent of instructor required.

EPOB 941-1 to 3. Independent Study (Undergraduate). Consent of instructor required.

EPOB 950-1 to 3. Independent Study. Consent of instructor required.

EPOB 960-1 to 3. Independent Research in Environmental Biology. Consent of instructor required.

EPOB 961-1 to 3. Independent Research in Population Biology. Consent of instructor required.

EPOB 962-1 to 3. Independent Research in Organismic Biology. Consent of instructor required.

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 humankind 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. 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 121-123-122-124, or Biol. Sci. 103. Bever, Dubin.

MCDB 311-3. Cell and Tissue Biology. *Fall.* Same as MCDB 312 except no lab., three lect./wk. This course does not carry credit toward the MCDB major or the distributed studies major with MCDB as the primary subject. Such majors must take MCDB 312. Prer., MCDB 106 or EPOB 123. Bonneville, McIntosh, Staehelin.

MCDB 312-4. Cell and Tissue Biology. *Fall.* Three lect., one lab. per wk. Major emphasis on correlation of cell and tissue fine structure and function. Laboratory provides opportunity for first-hand experience with modern techniques. Required for MCDB and distributed studies majors. Recommended for students planning careers in health sciences. Prer., MCDB 106 or EPOB 122-124. Bonneville, McIntosh, Staehelin.

MCDB 313-4. Histophysiology; Structure and Function of Vertebrate Organ Systems. *Spring.* Three lect., 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 346-2. Biology of Early Mammalian Development. *Fall.* Knowledge gained from domestic and laboratory mammals will be related to known events in human reproduction. The focus will be on the period between final maturation of germ cells through initiation of intrauterine pregnancy. Topics include test tube fertilization, embryos from virgin mothers, embryos from four-six parents, earliest genetic expressions, first signs of cellular specialization, embryo-uterus communication, cloning, and surrogate mothers. Runner.

EPOB 382-3. Human Heredity and Genetic Counseling. *Spring.* For nonbiology majors. Fundamental aspects of genetics and its contribution to the biology of humans. Genetic principles, mutations, genes in populations, genetic diseases, racial characteristics, the role of genes in intelligence. Genetic counseling and the relevance to societal issues. Prer., one year of introductory college biology. Goldstein.

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, Soll, Yarus.

MCDB 401-V, 402-V. Teaching MCD Biology. *Fall, Spring.* Practice teaching in college-level courses in MCD Biology. Students will experience laboratory teaching; participate in holding discussion sections, review sessions, and office hours; and carry out special projects. Repeatable. Prer., instructor consent.

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 biology, chemistry and physics, one of calculus, or 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. 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 423/523-1. The Plant Cell Laboratory. One meeting per week; time and place to be arranged to avoid conflicts. Limited to those taking (or who have taken) MCDB 422/522. Various algae and lower plants will be studied in conjunction with the detailed work covered in MCDB 422/522. Pickett-Heaps.

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., organic chemistry and genetics. Goldstein.

MCDB 446/546-4. Experimental Embryology. *Spring.* Two lect., two labs. per wk. Theoretical and practical aspects of investigating current problems in regulatory controls for developmental events. Emphasis will be on the evaluation of hypothesis, design of experiments, and applied laboratory techniques for study of embryologic changes. Prer., embryology or developmental 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., OCDB 312, 384 or consent of instructor. Ham.

MCDB 464/564-2. Cell and Tissue Interactions in Development. *Fall.* Seminars by students covering selected phases of embryogenesis and morphogenesis. Focus on analytic evaluation of data, critique of scientific reporting, and style of seminar presentation. Prer., embryology or developmental biology. Runner.

MCDB 465-5. Developmental Biology. (EPOB 374.) *Spring.* Three lect., two lab. per wk. Analysis of development with emphasis on vertebrates. Lectures stress molecular and cellular mechanisms. Laboratory uses live and fixed material to provide first-hand experience with developmental anatomy and with modern research techniques. Prer., general chemistry, general biology, genetics or molecular genetics. Ham, Hirsh.

MCDB 468/568-3. Mechanisms of Aging. *Fall.* Aging studied as a developmental process with emphasis on the cellular and molecular mechanisms involved. Prer., MCDB 312, 384, and 461 or 462. Ham. (Not offered 1980-81.)

MCDB 475-2. Animal Virology. *Spring.* One 2-hr. lect./wk. 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 instructor consent. Danna.

MCDB 480-2. Microtechniques. (Same as EPOB 480.) *Spring.* Training in preparation of specimens for light microscopy; designed for students needing this skill to carry out future research or as job training. Bonneville, Winston. (Not offered in 1981.)

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, 462. McConkey.

MCDB 489-3. 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. McConkey, Kuempel.

MCDB 490/590-3. Workshop in Electron Microscopy. *Spring.* (Not taught in 1981.) 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 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. (Not taught in 1981.)

MCDB 505-3, 506-3, 507-3, 508-3. Core Courses in Molecular, Cellular, and Developmental Biology I-IV. *Fall, Spring.* Classes meet six hrs. per wk. throughout fall and spring semesters. One course lasts seven weeks. The four courses are tightly integrated to provide an advanced overview of life processes at the molecular, cellular, and developmental level, as well as an introduction to current research in these areas of biology. Emphasis is placed on correlating information derived from pro- and eukaryotic cells. The courses are divided into segments, team-taught by two to four faculty. Topics include structural and functional organization of bacterial, animal, and plant cells; energy metabolism; enzymes; structure, function, and assembly of membranes, microtubules, microfilaments; photosynthesis; chromosomes; genes as units of molecular memory; DNA replication, recombination, transcription; mutation and genetic mapping; translation and posttranslational control; host-virus interactions; evolution of patterns of gene expression; hormones; morphogenesis of complex viruses and subcellular structures; inheritance of cytoplasmic and cortical structures; developmental fields in morphogenesis and regeneration; cell lineage patterns in development; cytoplasmic determinants versus morphogenetic gradients. A detailed outline of each course can be obtained from the department. Students interested in taking only one course segment can do so by signing up for MCDB 591, Special Topics, with consent of instructors.

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., Introductory biology or MCDB 501-590 or Phys. 112, 301, 302 or instructor consent. Fotino.

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 MCDB 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.

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 570-2. Molecular and Cellular Immunology. *Spring.* An introduction to modern cellular and molecular immunology, including the implications of recent advances in these fields for cellular and developmental biology, understanding of immune-related pathologies and cancers. Prer., introductory biology and molecular genetics.

MCDB 573-1. Current Topics in Neurobiology. (Same as EPOB 589.) *Fall, Spring.* One two-hr. lecture-discussion every two weeks. Invited speakers will discuss new research findings. Intended for students with at least one prior course in neurobiology. A. Bekoff, M. Dubin, R. Eaton.

MCDB 575-3. Animal Virology. *Spring.* Same as MCDB 475, with one additional meeting per week for the purpose of further discussion and a critical review of the literature. Prer., MCDB 384, Chem. 482, or consent of instructor. Danna.

MCDB 585/586-1. Current Topics in Nucleic Acid Research. *Fall, Spring.* A weekly meeting to discuss research on the structure and function of nucleic acids currently being done at CU. Formal lecture is given by a researcher and discussion of work follows. Students participate in discussion and write a short paper. *Since the course will vary each year it may be repeated twice.* Hirsh, et al.

MCDB 591, 592, variable credit. Special Topics. These course numbers are reserved for special courses such as those offered to present visiting lecturers or for courses offered one time only.

MCDB 596-2, 597-2, 598-2. Current Literature Seminar: Molecular Biology, Cellular Biology, Developmental Biology. This series of courses is designed to prepare graduate students in oral presentation and critical reading of the literature. Each section meets 2 hrs. per wk. Students speak on current topics from the literature in each of the areas, respectively.

MCDB 599-2. Seminar Practicum. Designed for graduate students to practice oral presentation of their own research, fielding questions and responding to critique. Staff.

MCDB 601-3, 602-3. Graduate Seminar. *Fall, Spring.*

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 800-1 to 10. 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.

MCDB 930-1 to 5, 935-1 to 5, 940-1 to 5. Undergraduate Independent Study in Molecular Biology, Cellular Biology, and Developmental Biology Respectively. Instructor consent required.

MCDB 960-1 to 5, 965-1 to 5, 970-1 to 5. Graduate Independent Study in Molecular Biology, Cellular Biology, and Developmental Biology Respectively. Instructor consent required.

BLACK STUDIES

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 and a more in-depth comparative analysis of select African countries.

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. *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. *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 I. *Fall.* An exploration of various Caribbean and African dance forms, both traditional and choreographed works. Other cultural arts will be studied to accompany and enhance the dance as a total cultural experience. This will include some rituals, musical accompaniment, singing and chanting, and descriptive background data of a particular dance.

Bl.St. 241-2. Afro-American Dance II. *Spring.* A continuation of Afro-American Dance I, but may be taken separately by permission of instructor. Emphasizes the growth of American Black dance from the roots of African dance. Technique, movement exploration, and improvisation includes plantation dance, Afro-American heritage dances, blues, and jazz.

Bl.St. 255-3. The Black Woman in American Society. *Fall.* A sociological and psychological examination of the black woman in American society—of myths and stereotypes, of sexism and racism—in a historical context.

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, Ngugis, and Soyinka. Also, some theoretical questions concerning second-language literatures.

Bl.St. 264-3. Traditional African Religions. (R.St. 264.) See Religious Studies for course description.

Bl.St. 270-3. African-American Art History I. (F.A. Hist. 270.) *Fall.* Survey of selected traditional West African cultures. Specific cosmological beliefs will be illustrated with visual manifestations. These manifestations are symbols of tradition for the African and art objects for the Western collector.

Bl.St. 271-3. African-American Art History II. (F.A. Hist. 271.) *Spring.* An introductory study of the visual manifestations of Black humanity in the United States. Areas considered: African continuum, slave culture arts and crafts, European influences, contemporary and sociopolitical expressions.

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. 285-3. Development of Caribbean Literature. *Fall.* (Engl. 271.) An examination of some of the important literary works of 20th-century Afro-Caribbean writers. Emphasis will be placed on the cultural, historical, and social traditions which each writer represents.

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. 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. 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. 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. 450-3. Research Methods in Black Studies I. *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. *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.) *Fall.* An advanced in-depth study of the works of prominent Afro-American novelists and poets of the traditional school, e.g., Wright, Gaines, Ellison, and Morrison. Their works will be studied in terms of their literary, intellectual, and political values.

Bl.St. 477-3. Contemporary Afro-American Literature II. (Engl. 473.) *Spring.* A nontraditional and experimental examination of the literature of the black arts movement of the 1960s and 1970s. Students will examine the works of such authors as Baraka (LeRoi Jones) Don L. Lee, William Melvin Kelly, and Ishmael Reed.

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. 910-variable credit. Independent Study. Arranged with consent of instructor.

Bl.St. 949-variable credit. Independent Study. Arranged with consent of instructor.

CENTER FOR INTERDISCIPLINARY STUDIES

Courses listed under CIS carry elective credit. Under some circumstances they may be credited to a specific major. See the *Schedule of Courses* for other current listings.

CIS 280-3. Nature of Law. (Phil. 202.) *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.

CIS 281-3. Nature of Law. (Phil. 203.) *Spring.* A continuation of CIS 280, not a prer.

CIS 480-3. Modes of Thought. Readings and discussion concerning the modes of thought appropriate to the diverse problems — theoretical, practical, or creative — that man formulates or confronts. Practice in the arts of analytical reading, clear speaking, and precise writing is encouraged. Registration by consent of the instructor.

CIS 481-3. Modes of Thought. Alternative to CIS 480 with other selected topics.

Humanities

An interdisciplinary major in humanities is offered by the Center for Interdisciplinary Studies. For requirements, 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. 102-8. 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 current offerings.

Hum. 301-3. Twentieth Century: Art, Science, and Society. Focus will be on the relationships among artistic, intellectual, political, and cultural events with selection of particular figures and movements as examples for study.

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. The Comic Sense. An interdisciplinary approach to comedy examining art, music, literature, and film from different periods. Comic theory interlaced with the study of particular works.

Hum. 304-3. The Tragic Sense. A study of some of the great tragic works of art, music, and literature from the Greeks to the 20th century. Tragic theory invoked as an aid to interpretation.

Hum. 305-4. 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./Film Stud. 308-4. Film History II. This course starts with the late 1930s and early 1940s films of Renoir, Welles, Cocteau, and Hitchcock 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. 319-3. 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 Romantic Quest; later 19th-century art and literature.

Hum. 410-3. Studies in Humanities. Prer., Hum. 101-102 or consent of instructor.

Hum. 411-3. Studies in Humanities. The heritage of humanism. Prer., Hum. 101-102 or consent of instructor.

Hum. 416-3. Myth in the Arts. (Clas. 416/516.) A study of representative myths in the art, music, and literature of the ancient and modern worlds. Recommended prer., Hum. 101-102 or Clas. 110.

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. *Spring, alternate years.* Continuation of Hum. 482. Seminar investigating problems of censorship, obscenity, etc. Prer., Hum. 482 or consent of instructor.

Hum. 940-1 to 3. Independent Study. Prer., Hum. 101-102. Consent of humanities instructor required.

Natural Science

Nat.Sci. 121-4. Physical Science for Nonscientists. (Phys. 101.) *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.

Nat.Sci. 122-4. Physical Science for Nonscientists. (Phys. 102.) *Spring.* Format of this class is similar to Nat.Sci. 121, with a continuing exploration of selected topics in physics and astronomy (e.g., sound and light waves, Einstein's theory of relativity, modern cosmology).

Nat.Sci. 123-4. Biology for Man. *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.

Nat.Sci. 124-4. Biology for Man. *Spring.* A continuation of 103 with the emphasis on man as a functioning organism. Organ systems including common malfunctions are studied around the central theme of a constant internal environment. (Note: science majors should see EPOB 121-122 and MCDB 105-106. Students may not receive credit for Nat.Sci. 123-124 in addition to EPOB 121-122 or MCDB 105-106.)

Nat.Sci. 125-6. Man and Nature. *Fall, Spring.* Selected general themes involving man's relationship to his environment are used to integrate the physical and biological sciences. Such themes include energy and its transformations, humans as knowers and controllers of nature, or humans as agents in the processes of the biosphere.

Nat.Sci. 321-3. History of Science: Ancients to Copernicus. (Phil. 341.) 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. 322-3. 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 the Reformation, Renaissance mysticism, advances in mathematics and instrumentation, and the rise of the atomistic-mechanical philosophy. Prer., upper division status or permission.

Nat.Sci. 323-3. History of Science: Newton to Einstein. (Phil. 343.) The history of physical and biological science, from the epoch-making achievements of Charles Darwin in biology to the dawn of the 20th-century revolutions in physics, chemistry, and genetics. The course deals with the successes of the mechanical philosophy of nature and its eventual problems. Prer., upper division status or permission of instructor.

Nat.Sci. 324-3. 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, continental drift, concepts of the ecosystem, and other topics. Prer., upper division status or permission.

Nat.Sci. 325-3. History of Biology. *Spring.* Survey of major themes in development of biological theory from ancient times to present, emphasizing complementary roles of observation, experiment, and technical innovation, and influence of general cultural environment on scientific advance. Readings in primary and secondary sources, lectures, discussions. Prer., upper division status or permission.

Nat.Sci. 326-3. 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.

Nat.Sci. 421-3. 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. 422-3. Environmental Studies. *Spring.* Continuation of Nat.Sci. 401. Prer., one year of college science and consent of instructor.

Nat.Sci. 910-1 to 3. Independent Study. *Fall, Spring.* Individual projects, including the opportunity to aid in the teaching activities of the staff. Consent of instructor.

Nat.Sci. 940-1 to 3. Independent Study. *Fall, Spring.* Consent of instructor required.

Social Science

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. 450-3. 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. 910-1 to 3. Independent Study. For lower division students. Consent of instructor required.

Soc.Sci. 940-1 to 3. Independent Study. Consent of instructor required.

CHEMISTRY

Chem. 100-2. Preparatory Chemistry. *Fall, Spring.* Lect. and rec. 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 or concurrent registration in Math 110. Students must perform satisfactorily in this course to go on to Chem. 103.

Chem. 101-4. Elements of Analytical, Inorganic, and Physical Chemistry. *Fall.* Lect. and lab. First course in principles of chemistry. Chem. 101-104 satisfies half the natural science requirement of the College of Arts and Sciences and meets the chemistry requirement for nursing, physical therapy and physical education. Prer., high school algebra.

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 advanced level than Chem. 101-102. Prer., one year of high school chemistry or satisfactory performance in Chem. 100.

Chem. 104-4. Introduction to Organic and Biochemistry. *Fall, Spring.* Lect., rec., and lab. Essential topics in organic and biochemistry. Chem. 101-104 or Chem. 303-104 completes the chemistry requirement for nursing, physical therapy, and physical education students, and satisfies one year of the natural science requirement. Prer., Chem. 101, 103, or 107. Chem. 104 does not replace Chem. 106 or 108 as a prer. for Chem. 331 or 335.

Chem. 106-5. General Chemistry. *Fall, Spring.* Lect., rec., and lab. A continuation of Chem. 103 for students going on to advanced chemistry. 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. A higher level, low enrollment freshman course for well-prepared students who expect to major in chemistry, chemical engineering, physics, or molecular biology. Prer., one year each of high school chemistry and physics and high score on SAT or ACT mathematics placement examination; four years of high school mathematics recommended.

Chem. 108-5. General Chemistry. *Spring.* Lect., rec., and lab. Continuation of Chem. 107. Prer., Chem. 107 or permission of instructor.

Chem. 202-4. General Chemistry. *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 lect., 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. 401-3. Modern Inorganic Chemistry. *Fall.* Lect. An introduction to modern inorganic chemistry giving undergraduates a foundation for advanced work in chemistry. Includes atomic structure, theoretical basis of the periodic table, structure and bonding in molecules and crystals, reaction mechanisms, and chemistry of selected transition and nontransition elements. Prer., Chem. 451 and concurrent 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. 440-1. 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. 450-3. Physical Chemistry. Thermodynamics and related topics with emphasis on macromolecules and biological applications. Includes thermodynamics, chemical and physical equilibria, solution chemistry, transport properties, and multiple-site binding phenomena. Alternative to Chem. 451, designed for biochemistry option and biology majors. Students may not take both 450 and 451. Chemistry majors are expected to take Chem. 481 prior to or concurrently with Chem. 450. Prer., Phys. 111, Math. 130, 230, and 240, two years of chemistry courses, or consent of instructor. Coreq., Phys. 112.

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 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. 450 or 451 or Engr. 301 or equivalent course.

Chem. 454-2. Physical Chemistry Laboratory. *Fall, 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. 450 or 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. 450 or 451 or equivalent course in thermodynamics; coreq., Chem. 452 or 453.

Chem. 471-5. Introduction to Biochemistry. *Fall.* A general survey of biochemistry for pharmacy students and other science majors (chemistry, MCDB, and biochemistry majors should enroll in the Chem. 481-482 sequence). Designed to cover the same general topics as Chem. 481-482 but with more emphasis on human biochemistry. Prer., one year of organic chemistry.

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 microorganisms, plants, and animals. Prer., Chem. 481 or equivalent.

Chem. 486-4. Biochemistry Laboratory. *Fall, Spring.* Introduction to modern biochemical techniques. Topics include enzymology, spectrophotometry, electrophoresis, affinity chromatography, radioisotopes, membrane structure, immunochemistry, and nucleic acid chemistry. Prer., Chem. 481; coreq., Chem. 450 or 451.

Chem. 501-3. Advanced Inorganic Chemistry I. *Fall.* Lect. Inorganic chemistry based on principles of bonding, structure, reaction mechanisms, and modern synthetic methods. Chemistry and properties of representative elements and their 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.

Chem. 511-1. Instructional Methods in Chemistry. *Fall.* Lecture, discussion, and practicum in teaching strategies for undergraduate chemistry courses. Includes applications of Piaget's theories to instruction in chemistry, application of Bloom's taxonomy to questioning skills, ways to tutor, reinforcement theory and writing instructional objectives, exam and quiz questions. Required of all chemistry teaching assistants. This course will not count toward a graduate degree.

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. Topics will include basic theory, instrumentation, analytical and research applications, fuel-cells and photovoltaic devices. 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.* Lect. Advanced spectroscopic techniques for structure determination in organic chemistry. Prer., Chem. 451 and 452, and 1½ years 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. Survey of Thermodynamics and Statistical Mechanics. A survey of the basic laws of phenomenological equilibrium thermodynamics and its applications to problems in chemistry. An outline of the concepts of statistical mechanics with special emphasis on the properties of perfect gases, crystals and liquid models. Prer., a basic knowledge of undergraduate physical chemistry.

Chem. 552-3. Survey of Chemical Kinetics and Quantum Mechanics. An introduction to chemical kinetics, including the phenomenological discussion of rate laws, an outline of the theories of rate constants and a survey of experimental techniques. An introduction to quantum mechanics with applications to problems in chemistry. Prer., a basic knowledge of undergraduate physical chemistry.

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. Reaction fluctuation, nucleation, and relaxation phenomena. Prer., Chem. 451, 452, or equivalent.

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 or equivalent course in quantum mechanics.

Chem. 581-3. General Biochemistry. *Fall, Spring.* Same lectures as Chem. 481. Course work includes library studies and preparation of special reports. Not open to undergraduates. Prer., one year organic chemistry.

Chem. 582-3. General Biochemistry. *Fall, Spring.* Lect. Same lectures as Chem. 482. Course work includes library studies and report preparations. Not open to undergraduates. Prer., Chem. 481 or 581.

Chem. 587-3. Advanced General Biochemistry. *Fall.* Lect. In-depth analysis of several of the following subjects: proteins, enzymes, metabolic regulation, bioenergetics, photosynthesis, lipids, nitrogen metabolism, transcription, protein biosynthesis, topics in molecular biochemistry. Prer., Chem. 482 or comprehensive biochemistry.

Chem. 588-3. Advanced General Biochemistry. *Spring.* Lect. In depth analysis of selected topics listed under Chem. 587. For the same academic year different topics will be covered in Chem. 587 and 588. Prer., Chem. 482 or comprehensive biochemistry.

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. 841-3. 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. 700-4 to 6. Master's Thesis.

Chem. 800-1 to 10. Doctor's Thesis.

Chem. 943-1 to 3. Independent Study in Chemistry. *Fall, Spring.* Consent of instructor required.

Chem. 983-1 to 3. Special Topics in Chemistry. *Fall, Spring.* *Prer.,* consent of instructor.

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. 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. 201-3. Introduction to Chicano Culture: Pre-Columbian-1848. Pre-Columbian Mexico to 1848. An analysis of Mexican history with detailed emphasis on Pre-Columbian Meso-America, the

colonial period, and the early republican years. Pre-Columbian Meso-America will be examined concerning colonial institutions and international diplomatic relations. The early republican years will focus on the northern frontier and United States relations.

Ch.St. 202-3. Introduction to Chicano Studies: 1848 to the Present. Introduction to the modern historical, political, and sociological development of Chicano culture. Comparative analysis of present Chicano conditions with those of other minorities in the United States will be made.

Ch.St. 213. Magic, Mysticism and Power. An examination of different cultural instances and conceptions of magic, mysticism, and power. Subject cultures include Chicano, Scandinavian, German, African, Italian, and ancient religions.

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. 220-3. 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. 261. Beginning La Raza Music and Dance. Traditional folkdances of Mexico will be taught, along with the history of the dance and its influences.

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. 270. American Indian Religions. (Rel.St. 270.) An examination of the history and structure of three American Indian religions: Aztec, Amazonian, and Sioux.

Ch.St. 281-3. History of Latin America. (Hist. 281.) *Fall.* See History for course description.

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. 313-3. La Chicana. 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. 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.

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. 361. Advanced La Raza Music and Dance. Advanced theory and practice of the major dances of Mexico and the Southwest. Includes jarabes, polkas, baleros, Mexican folk dance.

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.) See History for the course description.

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. 411-3. Mexican-American Folklore of the Southwest. (Span. 421.) 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. 420-3. Hispanic Culture. (Span. 420.) See Spanish for the course description.

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. 424-3. The Chicano Novel Written in Spanish. (Span. 424.) See Spanish for the course description.

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.) 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.

Ch.St. 450-3. City and Symbol in American Indian Religions. (Prer., Ch.St. 270.) See Religious Studies for the course description.

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. The Emergence of Modern Mexico. (Hist. 482.) See History for the course description.

Ch.St. 485-3. Special Topics.

Ch.St. 499-1 to 3. Independent Study.

CLASSICS

General Classics

No Greek or Latin Required

Clas. 101-3. The Study of Words. A study of English words of Latin and Greek origin, focusing on etymological meaning by analysis of component parts (prefixes, bases, suffixes) and on the main types of semantic change which the words underwent in their development.

Clas. 105-3. The World of Ancient Greeks. (Hist. 105.)

Clas. 106-3. The Rise and Fall of Ancient Rome. (Hist. 106.)

Clas. 110-3. Greek Mythology. The Greek myths are documents of early man's imagination, the source of Greek culture, and part of the fabric of the Western cultural tradition. Of particular interest to students of literature and the arts, psychology, anthropology, and history.

Clas. 111-3. Masterpieces of Greek Literature in Translation. Survey of Greek authors whose works have most influenced Western thought: Homer, Aeschylus, Sophocles, Euripides, Herodotus, Thucydides.

Clas. 112-3. Masterpieces of Roman Literature in Translation. A study of the literature, ideas, and culture of the Roman era.

Clas. 203-3. Topics in Ancient History. (Hist. 203.)

Clas. 204-3. Topics in Ancient History. (Hist. 204.)

Clas. 210-3. Women in Antiquity. (Wm.St. 210.) The evidence of art, archaeology, and literature is examined from a contemporary point of view in a study of the status of women in Greek and Roman antiquity (their roles in works of art and literature, attitudes expressed toward them, their daily lives).

Clas. 333-3. Ancient Athletics. An examination of the role of athletics and recreation in Classical Greece, Rome, and the Roman Empire (especially Constantinople) with special emphasis upon religious and political significance (Olympic Games, etc.) and the philosophical speculations on athletics by Plato, Aristotle, etc.

Clas. 361-3. The Religions of Greece. (Phil. 361.) A history of Greek and Roman religion from its Bronze Age origins to the rise of Christianity. Recommended prer., Clas. 110.

Clas. 402/502-3. The Athenian Empire and Greek Democracy. (Hist. 402/502.) A study of Greek history from 800 B.C. (the rise of the city-state) to 323 B.C. (the death of Alexander the Great). The major emphasis is upon the development of democracy in Athens. The reading is in the primary sources.

Clas. 403/503-3. Alexander and the Hellenistic World. (Hist. 403/503.) The course focuses first on the careers of Philip of Macedon and his son Alexander and second on the Hellenistic Age, especially its culture, from Alexander's death (323 B.C.) to the defeat of Cleopatra and Antony by Octavian in 31 B.C.

Clas. 405/505-3. Greek Constitutional History. A study primarily of Athenian constitutional and legal history with some consideration given to other Greek states.

Clas. 407/507-3. History of the Byzantine Empire. (Hist. 407/507.)

Clas. 408/508-3. The Roman Republic. (Hist. 408/508.) A study of the Roman Republic from its foundation in 753 B.C. to its conclusion with the career of Augustus. The major emphasis is upon the development of Roman Republican government. The reading is in the primary sources.

Clas. 409/509-3. The Roman Empire. (Hist. 409/509.)

Clas. 411/511-3. Greek and Roman Epic. A careful reading in English of the major epic poets of classical antiquity.

Clas. 412/512-3. Greek and Roman Tragedy. An intensive study of selected tragedies of Aeschylus, Sophocles, Euripides, and Seneca in English translation.

Clas. 413/513-3. Greek and Roman Comedy and Satire. A study of Aristophanes, Plautus, Terence, and Roman satire in English translation.

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. 420/520-3. Byzantine Art. (F.A. Hist. 407/507.)

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. 476/576-3. Rome, the Law-Giver.

Clas. 483/583-3. Egyptian Hieroglyphics I. (Anth. 483/583.)

Clas. 484/584-2. Egyptian Hieroglyphics II. (Anth. 484/584.)

Clas. 488/588-3. Archaeology of Ancient Near East. (Anth. 431/531.)

Clas. 495/595-3. Latin Backgrounds to English Literature: Selected Readings. Key readings from selected Latin authors influential in English literature will be studied in depth using a bilingual text; emphasis will be placed on structure, word placement, diction, and meter in order to cast light on the debts of their successors.

Clas. 515-3. Hellenistic Art and Archaeology. (Anth. 592; F.A. Hist. 515.) Topics selected from architecture, vase painting, and sculpture of the third and second centuries B.C.

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.) Topics selected from architecture, pottery, frescoes, and minor arts of the third millennium B.C. 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. 560-3. The Art of Translation. (C.Lit. 560.)

Clas. 580-3. Philosophy of Plato. (Phil. 580.)

Clas. 581-3. Philosophy of Aristotle. (Phil. 581.)

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. 930-1 to 3. Independent Study.

Clas. 950-1 to 3. Graduate Independent Study.

Clas. 999-0. Candidate for Degree.

II. Classical Philology

Cl.P. 601-1. Proseminar: Introduction to Research Methods in Classical Studies.

Cl.P. 602-3. Greek 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. 700-4 to 6. Master's Thesis.

Cl.P. 800-1 to 10. 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. Prer., Gr. 101 or instructor's consent.

Gr. 311-3. Intermediate Greek. Readings in Plato.

Gr. 312-3. Intermediate Greek. The reading of two Attic tragedies, generally one Euripidean and one Sophoclean. The major emphasis is upon learning to read the dramas with ease and comprehension. Grammar and syntax receive a good deal of attention.

Prerequisites for the following 400-level courses are Greek 311 and 312, or the equivalent.

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. 465-3. Koine and New Testament.

Gr. 493/593-3. Accelerated Beginning Greek. For advanced undergraduates and graduate students. Grammar survey, intensive reading. Both semesters required for credit.

Gr. 494/594-3. Accelerated Beginning Greek. Continuation of Gr. 493/593. For advanced undergraduates and graduate students. Prer., Gr. 493/593 or equivalent.

Gr. 500-3. Graduate Reading. Author or topic to be specified in *Schedule of Courses*. May be repeated.

Gr. 600-1. Advanced Graduate Reading. Materials to be taken from graduate reading list. May be repeated.

Gr. 622-3. Greek Lyric and Pastoral Poetry.

Gr. 930-1 to 3. Independent Study.

Gr. 950-1 to 3. Graduate Independent Study.

IV. Latin

Lat. 101-5. Beginning Latin.

Lat. 102-5. Beginning Latin. Continued. Prer., Lat. 101 or instructor's consent.

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.

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. The poetry of Propertius, Tibullus, Ovid: structure, unity, traditional influences, originality.

Lat. 425/525-3. Horace's Odes and Epodes.

Lat. 432/532-3. Lucretius. The philosophical background to Lucretius' *De Rerum Natura*; tradition and originality in Lucretius' thought and poetry.

Lat. 442/542-3. Cicero's Forensic Oratory.

Lat. 450/550-3. Sallust.

Lat. 455/555-3. Tacitus.

Lat. 461/561-3. Cicero's Philosophical Essays.

Lat. 481/581-3. Novel, Petronius.

Lat. 490-3. Teacher Training. Offered fall semester in alternate years, to be taken the semester prior to student teaching. Teaching techniques, preparation of materials, professional orientation. Prer., proficiency test in the translation of Caesar, Cicero, Vergil, Ovid.

Lat. 493/593-3. Accelerated Beginning Latin. For advanced undergraduates and graduate students. Grammar survey, intensive reading. Both semesters required for credit.

Lat. 494/594-3. Accelerated Beginning Latin. Continuation of Lat. 493/593. For advanced undergraduates and graduate students. Reading of advanced texts: Caesar, Cicero, Ovid. Prer., Lat. 493/593 or equivalent.

Lat. 500-3. Graduate Reading. Author or topic to be specified in *Schedule of Courses*. May be repeated.

Lat. 600-1. Advanced Graduate Reading. Materials to be taken from graduate reading list. May be repeated.

Lat. 611-3. Comedy.

Lat. 631-3. Vergil.

Lat. 930-1 to 3. Independent Study.

Lat. 950-1 to 3. Graduate Independent Study.

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. Application of communication principles to the study of social change. Theories, strategies, and tactics of change are considered across different levels of interaction—intrapersonal, interpersonal, intergroup, and social movements. Special attention is given to planned 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 Communication Media. Public communication systems—speech, writing, film, television, and radio—are explored in history to determine their rhetorical, dialectical, and poetic impact on culture and technology.

Comm. 315-3. Discussion. Theory and practice in group discussion processes, decision making, and participant and leader behavior combined with interpersonal laboratory. Prer., 6 hrs. Comm. and sophomore standing.

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. Prer., 6 hrs. Comm. and sophomore standing.

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.

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 media. Prer., 6 hrs. Comm., senior standing in communication, or senior standing in related fields and consent of instructor.

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., 6 hrs. Comm., senior standing, 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. Prer., 6 hrs. Comm. and senior standing.

Comm. 421/521-3. Advanced Interpersonal 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, 6 hrs. Comm. and junior standing.

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. Prer., 6 hrs. Comm. and junior standing.

Comm. 426/526-3. Communication and Conflict. (C.P.S. 426.) A communication approach to the study of conflict on several levels—intrapersonal, interpersonal, and small group. Includes field observations and analysis and training in intervention methods. Comm. 526 involves examination of selected research studies in the area of conflict 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. Prer., 6 hrs. Comm. and junior standing.

Comm. 429-3. Interracial Communication. (Soc. 405.) 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. Prer., 6 hrs. Comm. and instructor consent.

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. For Professional Year students only.

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. 464/564-3. Mass Media and Society. An investigation of the relationship between public communication systems and society. Methods of cultural study are explored. Application to problems of communication and culture are undertaken. Comm. 564 will require additional work. Prer., junior standing.

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. 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

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. 606-3. Management Communication Systems. 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. 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. 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 and 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. 826-3. 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. 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. 800-1 to 10. Doctor's Thesis.

Undergraduate Independent Study

Comm. 930-variable credit. Communication Independent Study. Prer., written consent of supervising instructor.

Comm. 935-variable credit. Communication Education Independent Study. Prer., written consent of supervising instructor.

Master's Independent Study

Comm. 950-variable credit. Communication Independent Study. Prer., written consent of supervising instructor.

Comm. 954-variable credit. Communication Education Independent Study. Prer., written consent of supervising instructor.

Doctoral Independent Study

Comm. 960-variable credit. Ph.D. Independent Study. Prer., written consent of supervising instructor.

COMMUNICATION DISORDERS AND SPEECH SCIENCE

Communication Disorders

CDSS 200-3. Voice and Diction. Elementary course for the improvement of the speaking voice. Group and individual laboratory practice.

CDSS 210-3. 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: articulation, stuttering, and language and learning disabilities. Prer., Phon. 305, 308.

CDSS 451-4. Speech Disorders II. Survey of the following disorders: cleft palate, cerebral palsy, aphasia, and voice. Prer., Phon. 305, 308.

CDSS 469-1. Observation and Cotherapy. Supervised observation and cotherapy with individuals exhibiting speech, language, and hearing problems. Prer., CDSS 450, 451.

CDSS 470-3. Audiology I. Basic principles and techniques of pure tone audiometry, hearing conservation programs in the schools and industry, and psychological aspects of hearing impairment. Required projects in screening and pure tone audiometry. Prer., Phon. 305, 308.

CDSS 471-3. Audiology II. Basic principles and techniques of clinical masking, speech audiometry, pathologies of the auditory system, impedance audiometry, and introduction to rehabilitation of the hearing impaired. Required projects. Prer., CDSS 470.

CDSS 501-1. Professional-Legal Issues.

CDSS 520-3. Psycholinguistics and Language Behavior.

CDSS 530-3. Communication and Learning Problems of Exceptional Children.

CDSS 532-3. Language Disorders of Children.

CDSS 550-4. Motor Speech Disorders.

CDSS 551-2. Articulation Disorders.

CDSS 552-2. Cleft Palate.

CDSS 553-2. Medical Backgrounds in Speech-Language Pathology.

CDSS 554-2. Fluency Disorders.

CDSS 555-2 to 3. Speech and Language of the Mentally Retarded.

CDSS 556-3. Aphasia and Related Language Disorders.

CDSS 557-2. Voice Disorders.

CDSS 567-3. Methods of Speech-Language Pathology Appraisal.

CDSS 570-2. Conservation of Hearing in Schools and Industry. Coreq., CDSS 676-1.

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 601-2. Research Methods in Communication Disorders and Speech Science.

CDSS 609-1 to 3. Problems in Communication Disorders and Speech Science.

CDSS 630-2. Theories of Language Disorders.

CDSS 631-3. Clinical Appraisal of Communication and Educational Disorders.

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 676-1 to 3. Practicum I: Conservation of Hearing.

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. Seminar: Departmental Research.

CDSS 700-1 to 4. Master's Thesis.

CDSS 794-2. Doctoral Practicum.

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 800-1 to 10. Doctor's Thesis.
 CDSS 910-1 to 3. Independent Study.
 CDSS 940-1 to 3. Independent Study.
 CDSS 950-1 to 4. Independent Study: Speech-Language Pathology.
 CDSS 951-1 to 4. Independent Study: Audiology.
 CDSS 952-1 to 4. Independent Study: Language-Learning Disabilities.
 CDSS 960-1 to 4. Independent Study: Speech-Language Pathology.
 CDSS 961-1 to 4. Independent Study: Audiology.
 CDSS 962-1 to 4. Independent Study: Language-Learning Disabilities.
 CDSS 963-1 to 4. Independent Study: Speech Science.
 CDSS 999-0. Candidate for Degree.

Speech Science

Phon. 304-3. General Phonetics. 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. 306-1. Experimental Phonetics I. Introduction to instrumentation. The application of instrumentation to the study of the processes involved in speech production and transmission.
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. 608-2. Experimental Phonetics II.
Phon. 617-1 to 3. Practicum I: Phonetics.
Phon. 717-1 to 3. Practicum II: Phonetics.
Phon. 910-1 to 3. Independent Study.
Phon. 940-1 to 3. Independent Study.
Phon. 950-1 to 4. Independent Study.
Phon. 960-1 to 4. Independent Study.

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. (Span. 464/564.)
 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. 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. (Clas. 560.)
 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. 800-1 to 10. Doctor's Thesis.
 C.L. 950-1 to 3. Independent Study.
 C.L. 999-0. Candidate for Degree.

ECONOMICS

Econ. 100-3. An Introduction to the Social System. 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. 201-3. Principles of Macro Economics. 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 Micro Economics. 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. 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. 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. 381-4. Introduction to Economic Statistics With Computer Application. Introduction to statistical methods and their applications in quantitative economic research. Prer., Math. 107, 108 or equivalent.
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. 407 and 408 may be taken in any order. There is no recommended sequence.

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. 407 and 408 may be taken in any order. There is no recommended sequence.

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. 418-1 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 non-renewable 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. 481-3. Introduction to Econometrics. Designed to give undergraduate economics majors an introduction to econometric theory. The multiple regression model and problems encountered in its application are developed in lecture and individual applied projects. Prer., Econ. 381.

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. 487/587-3. Economic Development of Latin America I. Current problems of economic development in Latin America.

Econ. 488/588-3. Economic Development of Latin America II. Continuation of Econ. 487/587.

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. 498/598-3. Senior Seminar: Research on Contemporary Economic Problems. Prer., Econ. 381, 407, 408/508, 480/580, or consent of instructor.

Econ. 507-3. Applied Economic 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 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. 581-3. Econometric Methods and Applications. Designed to introduce first-year graduate students to basic econometric theory and applications. An attempt will be made to integrate this course with the other core courses required of economics graduate students. For example, empirical examples will be drawn from the economics literature they will be reading for other classes. Prer., Econ. 381 or equivalent.

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 aggregative 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. 621. 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. 626-3. 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 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. 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. Prer., 441/541.

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. 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; transboundary 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 atten-

tion to organizational theory and the interactions among labor markets, product markets, and public policies.

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. 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. Intermediate Econometrics. Application of statistical inference to economic research. Principal topics are probability theory, statistical inference, and regression analysis. Prer., Econ. 481/581 or equivalent.

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 economic 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. 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. 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.

Econ. 900-variable credit. Independent Study. Consent of instructor and department required.

Econ. 920-variable credit. Independent Study. Consent of instructor and department required.

Econ. 930-variable credit. Independent Study. Consent of instructor and department required.

Econ. 940-variable credit. Independent Study. Consent of instructor and department required.

Econ. 950-variable credit. Independent Study. Consent of instructor and department required.

Econ. 960-variable credit. Independent Study. Consent of instructor and department required.

ENGLISH

For freshman-level composition courses, see Arts and Sciences, College Expository Writing Program (CEWP).

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. Reading and analysis of plays.

Engl. 140-3. Introduction to Poetry. Reading and analysis of poetry.

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. 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.

Engl. 252-3. Masterworks of British Literature. Close reading and study of major poems, plays, and prose works of British literature from Chaucer to Yeats.

Engl. 253-3. Modern and Contemporary Literature. Close study of significant 20th-century poetry, drama, and prose works by European and American writers. The readings will range from the 1920s to the present.

Engl. 260-3. 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. 261-3. 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. 266-3. Masterworks of American Literature. Close study of American literary classics, mainly of the 19th century.

Engl. 267-3. Modern and Contemporary American Literature. Close study of important literary works of the 20th century, with some emphasis on works written in the last decade.

Engl. 270-3. Introduction to African Literature. (Bl.St. 260.)

Engl. 271-3. Development of Caribbean Literature. (Bl.St. 285.) See Black Studies.

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. 278-3. 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. 278.

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. 281 to 289-3. Studies in Language. Intensive study of special topics in the English language.

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. Prer., Engl. 222 or equivalent preparation.

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. 381 to 384-3. Studies in Language. Intensive study of special topics in the English language.

Engl. 385-3. Literary Magazine. Participation in production of student literary magazine from soliciting manuscripts through selection, editing, copy editing, proofreading, design, layout, distribution, advertising, and accounting. Studies of the history, content, and editorial character of some literary magazines.

Engl. 390, 391, 392-3. Studies in Literature. A study of a special literary topic or major author.

Engl. 393-3. The Bible as Literature. Survey of literary achievements of the Hebrews, as represented by the King James Bible--The Old Testament.

Engl. 394-3. Chaucer: *Troilus and the Early Poems*. A close reading of Chaucer's work before *The Canterbury Tales*, with special emphasis on *Troilus and Crisedye* and its sources.

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. 440-3. Philosophy and Literature. (Phil. 473 or C.L. 484/584.) 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. 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. 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. 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. 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 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. 521-2 to 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. 522-2 to 6. Poetry Workshop. Continuation of Engl. 521.

Engl. 523-2 to 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. 524-2 to 6. Fiction Workshop. Continuation of Engl. 523.

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. Studies in Drama. Major dramatic writers.

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. Studies in the 19th Century. Covers principal movements and developments.

Engl. 550-3. Medieval Literature. Selections representative of the life and thought of the Middle Ages up to 1500.

Engl. 552-3. 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. 570-3. Anglo-Saxon.

Engl. 571-3. Beowulf: Advanced Anglo-Saxon.

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. 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. 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. 623-3. Problems in American Literature.

Engl. 632-3. Studies in Drama.

Engl. 642-3. Studies in Poetry.

Engl. 647-3. Problems in Literary Criticism.

Engl. 648-3. Problems in Literary Theory.
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 Literature.
Engl. 658-3. The Victorians. Main currents of Victorian thought in prose and poetry.
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. 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. 700-3 to 6. Master's Thesis.
Engl. 800-1 to 10. Doctor's Thesis.
Engl. 910-variable credit. Independent Study, Lower Division.
Engl. 940-variable credit. Independent Study, Upper Division.
Engl. 950-variable credit. Independent Study, Graduate Level I. 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. 960-variable credit. Independent Study, Graduate level II. See Engl. 950.

FILM STUDIES

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. There is no lab fee for filmmaking courses, but students are expected to provide their own equipment and purchase materials. The Film Studies Program maintains an equipment pool with modest registration and rental fees for students needing equipment.
Hum./F.S. 305-4. 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. 306-4. 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. Course may be repeated for credit with department consent.
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. Course may be repeated for credit with department consent.

F.S. 350-3. Intermediate Film-making, 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. Course may be repeated for credit with department consent.

F.S. 940-1 to 3. Independent Study.

See also:

Engl. 225-3. Introduction to Film Narrative.
 Comm. 260-3. Introduction to Broadcasting and Film.
 Hist. 270-3. Japanese History Through Cinema.
 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. 100-2. Basic Drawing. Orientation course including pictorial design, life drawing, still life, and landscape, using varied drawing techniques and media. May not be repeated.
F.A. 101-3. Basic Drawing. Recommended for F.A. majors instead of F.A. 100. 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. Emphasis is placed on the human figure as a vehicle for creative drawing. Course involves lecture, studio work, 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. May not be repeated.

F.A. 121-3. Basic Painting. Recommended for F.A. majors instead of F.A. 120. 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. 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. 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, 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 and metal plate lithography with an emphasis on individual creative development and further development in color printing processes. 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. 444-3. Papermaking. Students will learn both two-dimensional and three-dimensional papermaking techniques. Paper pulp as an art medium will be stressed and students will make their own paper mold. Prer., upper division standing.

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.

F.A. 544-3. Graduate Papermaking.

Sculpture

F.A. 150-2. Basic Sculpture. Orientation course involving three-dimensional form, expressive problems based on the human figure, and nonobjective form relationships in various sculptural materials. May not be repeated.

F.A. 151-3. Basic Sculpture. Recommended for F.A. majors instead of F.A. 120. May not be repeated.

F.A. 250-3. Lost Wax Casting. Technical studies in bronze, aluminum, and plastic casting. Prer., F.A. 150 or 151. May not be repeated.

F.A. 251-3. Experiments in Sculpture Media. Studies in sound, light, kinetic form, etc. Prer., F.A. 150 or 151. 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. 363-2. Art for the Elementary Teacher. (Formerly F.A. 469.) For majors in elementary education, with emphasis on art in the elementary school.

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 Fibers. Introduction to and exploration of materials available for use by the art educator 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 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. 564-variable credit-1 to 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.) *Spring.* 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. 599.) *Spring.*

Video

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.

Seminars

F.A. 403/503-3. Art of the Last Decade, Trends and Criticism. A selective study of significant areas of visual art of the last decade, including major critical opinions. Prer., 20 hours of fine arts.

F.A. 491/591-3. Special Topics.

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. 498-2. Art Seminar. For fine arts honor students and advanced undergraduates. Requires a considerable amount of outside reading in the fields of aesthetics and art history. Discussion group will meet one evening each week. Admission by consent of instructor only.

F.A. 598-2. Graduate Art Seminar.

Visiting Artist

F.A. 497/597-3. Visiting Artist Studio. Advanced undergraduates and graduates are provided opportunities for interviews and critiques

of their work by nationally and internationally known artists. Emphases: providing continuous input concerning significant developments in art and giving students comprehensive views of contemporary issues concerning art. May be repeated. Prer., portfolio review.

F.A. 598-2. Graduate Visiting Artist Seminar. A forum in which the visiting artists interact with the class in whatever format the artist chooses: discussions, reports, or group projects of some other nature.

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. 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 Mubammad 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. 416/516-3. Modern Sculpture From Rodin to the Present. An extensive 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. 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 Africa and Oceania.** Native arts of non-Western peoples of Africa and Oceania. 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. 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. 477/577-3. Women Artists From the Middle Ages to the Present.** Fall. A survey of women's art in the West with emphasis on painting and sculpture. Prer., a survey of art history or instructor's consent.
- 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 European Painting.** Spring. History of painting in the Netherlands, France, and Germany in the 15th and 16th centuries. Prer., F.A.H. 282 or consent of instructor.
- F.A. H. 483/583-3. Art in France, 1500-1750.** Spring. Examines the developing French style through the various foreign influences, the impact of classicism, and finally the efflorescence of that uniquely French expression, the Rococo, and its reflections in Germany and Austria. Prer., F.A.H. 282.
- 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.
- F.A. H. 485/585-3. Spanish and Netherlandish Painting in the 17th Century.** Spring. A critical survey of Baroque painting in Spain, Flanders (modern Belgium), and the Dutch Republic. Despite obvious cultural differences among Holland, Catholic Flanders, and Spain, the common thread of Baroque vision will be traced through the three cultures.
- 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. Prer9, 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. 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. 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. 580-3. 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. Consult departmental office for policies and procedures relating to registration.

F.A. 930 to 949-variable credit (1 to 3). Undergraduate Independent Study.

F.A. 950 to 969-variable credit (1 to 3). Graduate Independent Study.

F.A.H. 930-variable credit (1 to 3). Undergraduate Independent Study.

F.A.H. 940-variable credit (1 to 3). Undergraduate Independent Study.

F.A.H. 950-variable credit (1-3). Graduate Independent Study.

F.A.H. 960-variable credit (1 to 3). Graduate 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. 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. 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. 303-3. 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. 306 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. Does not count toward major in French.

Fr. 316-3. Romance Literature in English Translation II. See Span. 316. Does not count toward major in French.

Fr. 370-3. Scientific and Technical French. Prer., second-year French or equivalent. To enable students to learn technical and scientific vocabulary for use in translating articles, technical data, and specifications and in general make use of their French in the industrial world. Not open to freshmen.

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 311-312, 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. 415/515-3. Generative Phonology of French. (Through Independent Study.) Prer., Fr. 406/506 or consultation. Mayer.

Fr. 420/520-3. Topics in French Civilization: 19th and 20th Centuries. *Spring.*

Fr. 421/521-3. French Civilization Through World War II. *Fall.*

Fr. 425/525-3. Medieval, and Renaissance Readings. Jensen or Kail.

Fr. 431/531-3. Seventeenth-Century French Tragedy and Poetry. Three-year cycle. Barchilon.

Fr. 432/532-3. Seventeenth-Century French Prose. Three-year cycle. Barchilon.

Fr. 433/533-3. Molière and 17th-Century French Comedy. Three-year cycle. 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.* Frey.

Fr. 443/543-3. Nineteenth-Century French Novel. *Spring, alternate years.* Frey.

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. Three-year cycle. 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.

Fr. 501-2. Advanced Phonetics. *Alternate years.*

Fr. 544-3. Paris in the 19th-Century Novel. Authors studied include Balzac, Flaubert, Hugo, George Sand, Stendhal, and Zola. Upon sufficient demand.

Fr. 597-2. College Foreign Language Teaching. (Ger. 597, Ital. 597, Span. 597.) *Fall.* Required for TAs and graduate part-time instructors. Baker.

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. Provencal. (Span. 607.) Three-year cycle. Jensen. Zago.

Fr. 611-2. Stylistics of French. Three-year cycle.

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. One graduate seminar offered per year; centuries vary.

Fr. 629-2. Rabelais. Kail.

Fr. 634-3. French Classicism. Barchilon.

Fr. 638-2. Eighteenth-Century French Comedy. Kail, Stavan.

Fr. 655-3. Modern French Poetry. Ketchum.

Fr. 671-2. Voltaire. Stavan.

Fr. 672-2. Racine. Barchilon.

Fr. 675-2. Montaigne. Kail.

Fr. 676-2. Rousseau. Stavan.

Fr. 700-4. Master's Thesis.

Fr. 800-1 to 10. Doctor's Thesis.

Fr. 940-1 to 3. Independent Study: Language. Upon consultation only.

Fr. 945-1 to 3. Independent Study: Literature. Upon consultation only.

Fr. 950-1 to 3. Independent Study. Upon consultation only.

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. 105-5. Accelerated Italian for Reading and Research. Prer., upper division undergraduates and graduates. A full year condensed into one semester; designed especially for students who have knowledge of another Romance language.

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. 22-3. Second-Year Italian Reading, Grammar, and Composition. *Spring.* Continuation of Ital. 211.

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. 212 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. 212 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 toward 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 toward 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. 360-1 to 3. Theatre Workshop. *Spring.* Depending on demand or on three-year cycle. Prer., upon consultation.

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. 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 Provencal 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. *Fall.* No knowledge of Italian necessary.

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. 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. 470/570-3. Dante: *Purgatorio* and *Paradiso*.

Ital. 492/592-3. Italian Literature of the 19th Century.

Ital. 493/593-3. Italian Literature of the 20th Century. A study of the Italian novel and short story in the period from World War I to the present.

Ital. 700-4. Master's Thesis.

Ital. 940-1 to 3. Independent Study. Upon consultation only.

Ital. 950-1 to 3. Independent Study. Upon consultation only.

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 the 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. 198-3. World Regional Geography. Using the concept of development as an organizing framework, each of the world's regions is geographically analyzed, compared with the United States, and placed in global perspective.

Geog. 199-3. Introduction to Human Geography. A systematic introduction to the broad field of human-environment relationships. Topics covered include growth and distribution of populations, the location of economic activities, location trends in urban communities and the relationships between people and 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 and geographic interpretation of U.S. and selected foreign maps.

Geog. 320-3. Topics in Meteorology. (A.G. 320.) *Fall and Spring.* See Astro-Geophysics for course description.

Geog. 330-3. Introduction to Arctic and Alpine Environments. (EPOB 315.) 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. Natural Hazards. *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 and Resource Management. 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 human 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. Latin America. Regional study of Latin America. National and regional overview of culture, history, resources, population, socioeconomic change, and other contemporary geographic problems. Hill.

Geog. 383-3. Historical Geography of the United States. A study of human adjustment to and alteration 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. Prer., Math. 110 or equivalent.

Geog. 402-3. Statistics for Earth Sciences. (Geol. 477.) See Geology for the course description.

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 geography or equivalent.

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 geography or equivalent.

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 320 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 or equivalent.

Geog. 431-4. Principles of Geomorphology. (Geol. 463.) See Geology for the course description.

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. Quick.

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 infrequently.* 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.

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. Geography of American Cities. 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.

Geog. 462/562-3. Urban Geography: Social. An analysis of the social, behavioral, political, and demographic factors which influence the development and maintenance of communities in contemporary urban environments, with primary emphasis on U.S. cities. Palm.

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 relations between geography and politics, especially as a background for better understanding of international affairs. Topics such as frontiers and boundaries, power analysis, electoral geography, resource utilization, and strategic concepts are included. Myers.

Geog. 472/572-3. Historical Geography of Europe. *Offered infrequently.* A study of how humans have 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.

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 of 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. 341 and 342. 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 and 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 human 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. 497-2. Honors. Independent research and thesis for majors who have maintained a superior scholastic performance in their overall program and also within the major. For superior students who wish to attain honors in the field.

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. Offered infrequently. 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. 460/560.) 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. 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. 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.

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. 602-3. Data Processing in the Earth Sciences. (Geol. 615.) Offered occasionally. See Geology for the course description. 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. Application of research methods to selected problems. Instructor and topic will vary and will be announced. Course may be repeated under different topics with adviser's approval.

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. The Arctic and Alpine Environments. (EPOB 510, Geol. 640.) 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. Offered alternate years. 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 or Hill.

Geog. 700-6. Master's Thesis.

Geog. 800-1 to 10. Doctor's Thesis.

Geog. 930-1 to 3. Undergraduate Independent Study. By special arrangement with faculty. Only for students presenting strong geography preparation. Prer., consent of instructor and departmental approval.

Geog. 950-2 to 3. Graduate Independent Study. Independent research for graduate students only. Prer., consent of instructor and departmental approval.

GEOLOGICAL SCIENCES

The following courses are not open to majors in geological sciences: Geol. 103, 104, 113, 114, 370, and 397.

Geol. 101-4. Introduction to Geology I. Introductory geology for majors and nonmajors. 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. Introductory geology for majors and nonmajors. 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. Similar in topics to Geol. 101 but closed to geology majors. Three lect. per wk.

Geol. 104-3. Introduction to Geology II. Similar in topics to Geol. 102 but closed to geology majors. Three lect. per wk. Prer., Geol. 103 or equivalent.

Geol. 113-3. Our Dynamic Earth I. (A.G. 113.) See Astro-Geophysics for the course description.

Geol. 114-3. Our Dynamic Earth II. (A.G. 114.) See Astro-Geophysics for the course description.

Geol. 115-3. Our Dynamic Earth III. (A.G. 115.) See Astro-Geophysics for the course description.

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. 201-2. Advanced Introductory Geology. One lect. and one lab. or field trip per wk. Advanced topics in introductory geology, geochemistry, and geophysics; for potential geology majors who have taken an 8-hr. course in beginning geology. Prer., Geol. 101 and either 102 or 153 with grade-point average of 2.5, Math. 110, and either Chem. 103 or Phys. 111.

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. 101-102/153-201, Chem. 106, Math. 130, or consent of instructor. Warner.

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. 101-102/153-201, Math. 110. Braddock.

Geol. 340-4. Evolution of Continental Ecosystems. An enquiry into the evolution of important ecosystems of the past and present. Biological and geological data for reconstructing ecosystems will be discussed in detail and applied to creating scenarios of past ecosystems. Vertebrates and their structure will be emphasized.

Geol. 341-4. Introductory Paleontology. Collection, identification, classification, and uses of fossils in paleoecology, evolution, and biostratigraphy. Prer., Geol. 102/153, 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. 102/153. Eicher.

Geol. 347-3. Introductory Petrology. An introduction to the petrology of igneous, metamorphic, and sedimentary rocks. Emphasis is placed on theories of origin and on studies of hand samples using a 10-power hand lens, supplemented by an introductory coverage of thin section petrography. Prer., Geol. 301. Walker, Larson, Munoz.

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. Warner.

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. Curtis.

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. 405/505-3. 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. 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., Geol. 301, Phys. 111-112. Warner.

Geol. 411-4. Field Geology. Methods of geologic mapping including plane table surveying and photogrammetry. Prer., Geol. 312.

Geol. 412/512-4. 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. Braddock.

Geol. 417/517-4. Optical Crystallography. Prer., general physics or principles of physics.

Geol. 431/531-4. Sedimentation. Study of processes that influence the characteristics of sedimentary rocks. Prer., Geol. 101-102/153-201, 301, 342, introductory course in chemistry. Walker.

Geol. 436/536-3. 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. Andrews.

Geol. 437/537-1. Glacial Geology Laboratory.

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. 453-3. 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. Kisslinger, Spetzler.

Geol. 460/560-4. Mountain Geomorphology. (Geog. 432/532.) 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. 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. Harrison.

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. Atkinson.

Geol. 495-3. Natural Catastrophes and Geologic Hazards. Survey of historic and prehistoric natural disasters, their cause and potential for recurrence. Meteorite impact, earthquakes, volcanic eruptions, tsunamis, landslides, floods, magnetic reversals, and major extinction events. Prer., one year of science. Stern.

Geol. 501-0. Journal Club.

Geol. 502-0. Journal Club.

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. Stern.
- Geol. 524-1. Introduction to X-Ray Crystallography.** *Not offered every year.* Elements of theory and practice of X-ray diffraction by crystalline solids. Prer., consent of instructor. Larson and Munoz.
- Geol. 525-3, 526-3. Introduction to Ore Deposits.** A survey of processes of ore formations, with examples drawn from selected districts. Field trips to representative deposits. Prer., Geol. 301. Atkinson.
- Geol. 526-4. Advanced Topics in Ore Deposits.** Field mapping and laboratory studies of ore deposits, with emphasis on petrology, wall-rock alteration, and ore mineralogy. Prer., Geol. 526, 411, 347 or instructor's permission. Atkinson.
- Geol. 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. 101. Munoz.
- 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. Discussion of natural waters. Prer., college chemistry, mineralogy. Previous exposure to computer programming is recommended. 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 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. 533-3. High Temperature Geochemistry.** *Offered in alternate years.* Discussion of the geochemistry of the magmatic and high temperature environments. The role of stable and radio-isotopes and trace elements in interpreting terrestrial evolution. Prer., Geol. 301.
- 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. Curtis.
- 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. 463/563, 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. 543-2. Soil Laboratory Methods.** Physical and chemical methods of research in soils. Analyses include particle size, carbonate, organic matter, iron, aluminum, phosphorous, and clay mineralogy. Prer., Geol. 544 or consent. Birkeland.
- 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. 463/563 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.
- Geol. 552-3. Paleocology.** *Not offered every year.* Environmental factors, relation of fossils to their depositional environment, and paleoecological interpretations and syntheses. Prer., Geol. 341-342.
- 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, paleoecology, 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. Structural Geology III.** Stress-strain relationships and rheological properties of rocks. Summary of experimental deformation of rocks and minerals. Prer., Geol. 412/512 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.** *Offered alternate years.* Introduction to seismic wave theory. Seismology and the internal structure of the earth, including density distribution and chemical composition. Prer., Phys. 321 and either Math. 443 or A.Math. 236.
- Geol. 597-3. Earth and Planetary Physics II.** *Offered alternate years.* The earth's gravity field by surface and satellite techniques. Reduction of gravity observations and isostasy. Potential theory. Tides. Description, analysis, and origin of the earth's magnetic field. Prer., Phys. 321, 331 and either Math. 443 or A.Math. 236.
- Geol. 598-3. Earth and Planetary Physics III.** *Offered alternate years.* The solar system; theories of its origin, meteorites. Distribution of radioactive materials; age dating. Heat flow through continents and the ocean floor; internal temperature distribution in the earth, mantle convection. Origin of the oceans and atmosphere. Prer., basic courses in geology, physics and mathematics recommended. Harrison.
- 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 and plate tectonics. Prer., structural geology, petrology, or consent of instructor. Warner.
- Geol. 615-3. Data Processing in the Earth Sciences.** (Geog. 602.) Advanced statistical analysis, multivariate statistics, time series, classification models. Prer., Geol./Geog. 477 or equivalent or consent of instructor. Caine.
- Geol. 627-var. Advanced Topics in Thermodynamics and Mineralogy.** Current problems in thermodynamics as applied to mineralogy and petrology are discussed in seminar format. Individual student research will be required. Prer., Geol. 527. Munoz.
- 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. The Arctic and Alpine Environments.** (EPOB 630, Geog. 630.) Concentration on multidisciplinary aspects of en-

vironmental 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. 463/563 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. (M.E. 678.) 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. *Not offered every year.* 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. 700-4 to 6. Master's Thesis.

Geol. 800-0 to 10. Doctor's Thesis.

Geol. 940 to 949-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. 950 to 959-variable credit. Independent Study.

Geol. 970-3. Plan 2 Master's Research.

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. 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. 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, theatre, 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. 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. Knowledge of German required. Prer., junior standing or above, or upon consultation. 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. 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. 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. 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. 518-3. Old Norse. Introduction to grammar and vocabulary of Old Norse. Selected readings in prose and poetry. 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. 543-3. Goethe's Early Dramas and Faust I.

Ger. 544-3. Goethe's Faust I*.

Ger. 547-3. Schiller I. Blomster.

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. 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. 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. 700-6. Master's Thesis.

Ger. 710-3. Seminar in German Literature.

Ger. 711-3. 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. 800-0 to 10. Doctor's Thesis.

Ger. 910-variable credit. Independent Study. Prer., permission of instructor and approval by the department.

Ger. 940-variable credit. Independent Study. Prer., permission of instructor and approval by the department.

Ger. 950-variable credit. Independent Study. Prer., permission of instructor and approval by the department.

Ger. 960-variable credit. Independent Study. Prer., permission of instructor and approval by the department.

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 Languages and Literatures

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.

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. 910-variable credit. Independent Study. Prer., permission of instructor.

Scand. 940-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. 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. 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. 940-variable credit. Independent Study. Prer., permission of instructor.

HISTORY

Hist. 101-3. History of Western Civilization.¹ Lectures and class discussions on the development of western civilization from its beginnings in the ancient near East to the time of the establishment of the first modern states in the 18th century.

Hist. 102-3. History of Western Civilization.¹ A survey course dealing with political, economic, social, and intellectual developments in European history from the 17th century to the present. Similarities and contrasts between European states will be underscored, as well as Europe's changing role in world history.

Hist. 103-3. Introduction to Asian History: The Middle East and India. An introductory survey of the history of the Middle East and India. Attention is divided equally between the traditional civilizations of Islam and Hinduism and patterns of modernization and nation-building in the 20th century.

Hist. 104-3. Introduction to Asian History: China and Japan. Introductory survey of the history of China and Japan, covering the main features of the traditional civilizations of these areas as well as more recent phenomena such as modernization, nationalism and revolution in the 19th and 20th centuries.

Hist. 105-3. The World of the Ancient Greeks. (Clas. 105.) This survey course presents the emergence, major accomplishments, and decline of the world of the ancient Greeks from the Bronze Age civilizations of the Minoans and Mycenaeans to the career of Alexander the Great.

Hist. 106-3. The Rise and Fall of Ancient Rome. (Clas. 106.) A survey of ancient Roman history from the origins of the city to the decline of the Roman Empire in the Western Mediterranean and the emergence of the Byzantine Empire in the Eastern Mediterranean.

Hist. 141-3. The History of England. Deals with the period from Roman time to the 17th century. Covered are social, political, and constitutional affairs which contributed to the creation of the English nation.

Hist. 142-3. The History of England. The period from the 17th century to the present. Political, economic, social, and imperial developments which contributed to the creation of the modern industrial and democratic state are the major issues covered.

Hist. 151-3. The United States to 1865.¹ A survey of American history from the first settlement until the end of the Civil War.

¹Also available through correspondence study.

Hist. 152-3. The United States Since 1865.¹ A general survey of the social, economic, political, and cultural development of the United States from the close of the American Civil War to the present.

Hist. 181-3. History of Latin America: The Colonial Experience.

Hist. 182-3. History of Latin America: The National Experience.

Hist. 203-3. Topics in Ancient History. (Clas. 203.)

Hist. 204-3. Topics in Ancient History. (Clas. 204.)

Hist. 205-3. Encounters With History. A topical and experimental approach to the study of history, using team-teaching and multimedia methods designed to explore ways in which encounters with history are meaningful educational experiences in the modern world. Prer., permission of instructor.

Hist. 207-3. History of Christianity I: To the Reformation. A general introduction to the history of Christianity from its beginnings through the first period of the Protestant Reformation. Examines religious life and the church in relation to the social and cultural setting.

Hist. 208-3. History of Christianity II: From the Reformation. A general introduction to the history of Christianity from the Reformation to the present. Examines religious life and the church in relation to the social and cultural setting.

Hist. 211-3. Culture and Institutions of the Middle Ages. Political, institutional, and cultural history of Europe from the 4th to the 12th centuries.

Hist. 212-3. Culture and Institutions of the Middle Ages. Political, institutional, and cultural history of Europe from the 13th to the 15th centuries with particular attention to the disintegration of the medieval order resulting from the national state, the secularization of society, and the decline of the church.

Hist. 215-3. Afro-American History I. (Bl. St. 215.) See Black Studies for course description.

Hist. 216-3. Afro-American History II. (Bl. St. 216.) See Black Studies for course description.

Hist. 219-3. Topics in European Intellectual History. Lectures deal with a variety of themes which vary each semester. Main focus is usually some aspect of 19th- or 20th-century thought such as: Marxism, Romanticism, Nazism, Existentialism, the novel and history, etc. Check with instructor.

Hist. 235-3. Problems in German History: Nazi Germany. Concerned with the origins of German National Socialism, with the rise of the National Socialist movement to power, and with Nazi social and racial policies. Prer., Western Civilization sequence.

Hist. 248-3. Topics in 18th-, 19th-, and 20th-Century English History. Issues dealing with major historical developments such as industrialization, or the careers of prominent individuals such as Winston Churchill are considered in depth. Designed for freshmen and sophomores.

Hist. 258-3. History of Colorado. Emphasizes the historical variety and ethnic diversity of Colorado. Along with traditional themes in Colorado history, such as the gold rush, attention will be given to Indian and Hispanic activity and culture.

Hist. 270-3. History of Japan Through Cinema. This course uses commercial feature-length films as a vehicle for looking at different chronological periods and understanding life and times. The films of Kurosawa, Mizoguchi, Ozu, and other leading directors will be used.

Hist. 271-3. History of the Modern Far East.¹ Nineteenth-century development of China and Japan as the traditional Far Eastern nations, plus the more recently emerged Asian states. Principal themes: expanding European imperialism, unequal treaties, impact of the West on Asia, and the beginnings of Asian nationalism.

Hist. 272-3. History of the Modern Far East.¹ A continuation of Hist. 271. This course deals with recent and contemporary developments in the Far East and Southeast Asia. Included are historical aspects of the Vietnam war.

Hist. 298-3. History of Women in the United States. An examination of the role of women—social, economic, political—in American history from Colonial times to the present.

Hist. 301-3. Selected Readings in Ancient History.

Hist. 302-3. Selected Readings in Medieval History.

Hist. 303-3. Selected Readings in Renaissance and Reformation.

Hist. 304-3. Selected Readings in Early Modern Europe.

Hist. 305-3. Selected Readings in European Intellectual History.

Hist. 306-3. Selected Readings in Early English History.

Hist. 307-3. Selected Readings in Britain Since 1688.

Hist. 308-3. Selected Readings in Comparative European History.

Hist. 309-3. Selected Readings in Modern European History.

Hist. 310-3. Selected Readings in German History.

Hist. 311-3. Selected Readings in Early American History.

Hist. 312-3. Selected Readings in the American West.

Hist. 314-3. Selected Readings in American Society and Thought.

Hist. 315-3. Selected Readings in Urban American History.

Hist. 316-3. Selected Readings in American Diplomatic History.

Hist. 317-3. Selected Readings in Recent American History.

Hist. 318-3. Selected Readings in Japanese History.

Hist. 319-3. Selected Readings in Modern Middle East History.

Hist. 320-3. Selected Readings in Recent Chinese History.

Hist. 321-3. Selected Readings in Latin American History.

Hist. 322-3. Selected Readings in Latin American History.

Hist. 323-3. Selected Readings in Russian History.

Hist. 331-3. Research Seminar: Ancient History.

Hist. 332-3. Research Seminar: Medieval History.

Hist. 333-3. Research Seminar: Renaissance & Reformation.

Hist. 334-3. Research Seminar: Early Modern Europe.

Hist. 335-3. Research Seminar: European Intellectual History.

Hist. 336-3. Research Seminar: Early English History.

Hist. 337-3. Research Seminar: Britain Since 1688.

Hist. 338-3. Research Seminar: Comparative European History.

Hist. 339-3. Research Seminar: Modern European History.

Hist. 340-3. Research Seminar: German History.

Hist. 341-3. Research Seminar: Early American History.

Hist. 342-3. Research Seminar: The American West.

Hist. 344-3. Research Seminar: American Society and Thought.

Hist. 345-3. Research Seminar: Urban American History.

Hist. 346-3. Research Seminar: American Diplomatic History.

Hist. 347-3. Research Seminar: Recent American History.

Hist. 348-3. Research Seminar: Japanese History.

Hist. 349-3. Research Seminar: Modern Middle East.

Hist. 350-3. Research Seminar: Recent Chinese History.

Hist. 351-3. Research Seminar: Latin American History.

Hist. 352-3. Research Seminar: Latin American History.

Hist. 353-3. Research Seminar: Russian History.

Hist. 361-3. The Indian in North American History. By discussing pre-European social and cultural developments, the longevity and continuity of human history in North America is explored. By examining the ways in which Indian societies responded to incoming Europeans, the Indian's role in North American history is demonstrated.

Hist. 372-3. Teaching History. Designed for students who will become teachers of history at the elementary or secondary levels. Explores the varieties and uses of history and ways to relate history to student concerns.

Hist. 378-3. Japan at War. History of Japan at war from the feudal period through World War II, with emphasis on the 20th century.

Hist. 383-3. Rural Societies of Mexico, 1800-Present. Reflections of Mexico in the 20th century: the Mexican novel and oral autobiographies. Examinations of sociological narratives and novels of the Revolution of 1910 and postrevolutionary Mexico as a basis for understanding Mexico since 1900.

Hist. 384-3. The Cuban Revolution. An examination of the historical background to revolution in Cuba and of social, economic, and political change since 1959.

Hist. 385-3. Latin America: Dependency and Development in the 20th Century. An examination of the impact of economic dependency on Latin American society, politics and culture, focusing particularly on the period since 1930.

Hist. 391-3. History of Zionism and Israel. An examination of Zionist ideas, the Zionist movement, and the emergence of the Jewish state of Israel in the 19th and 20th centuries.

Hist. 398-3. Women in Victorian England. Looking at changing roles, status of women in a period of expansion; impact of industrialization on working women, sexuality, family planning, expansion of women in education, politics and the professions, the single women crisis, women's rights.

¹Also available through correspondence study.

- Hist. 400/500-3. Women in Asian History.** Examines the traditional role of women in Japanese history and assesses the extent to which women in various walks of life have departed from the traditional role.
- Hist. 401/501-3. Women and Society in Industrial Europe.** Examines the impact of industrialization and related social change on women in modern European history. Topics will include: work, family, sexuality, and women in movements for social and political change. Prere., Hist. 102 or equivalent and upper division standing.
- Hist. 402/502-3. The Athenian Empire and Greek Democracy.** (Clas. 402.) See Classics for course description.
- Hist. 403/503-3. Alexander and the Hellenistic World.** (Clas. 403.) See Classics for course description.
- Hist. 404/504-3. The Scientific Revolution, 1543-1687.** The history of scientific development and its relation to other intellectual and social characteristics of the 16th and 17th centuries.
- Hist. 407/507-3. History of the Byzantine Empire.** (Clas. 407.) Approaches Byzantium as the heir to the Greco-Roman tradition, paying considerable attention to the lines of continuity with the ancient past but recognizing discontinuity as well. Readings will present a survey of Byzantine history and civilization.
- Hist. 408/508-3. The Roman Republic.** (Clas. 408.) See Classics for course description.
- Hist. 409/509-3. The Roman Empire.** (Clas. 409.) This intense survey of Imperial Roman history will begin with the Roman Revolution and end with an examination of the passing of centralized political authority in the Western Mediterranean. Emphasis will be on life, letters, and personalities of the empire.
- Hist. 411/511-3. Social Foundations of European Civilization.** The study of the social structures of Europe and their relationship to political, religious, and economic institutions from A.D. 400-1500.
- Hist. 412/512-3. Intellectual History of Medieval Europe.** Changing theories and realities of relationship between religious and secular elements of medieval civilization with particular emphasis on the evolution of the medieval empire and the culture of the universities and schools.
- Hist. 413/513-3. Constitutional and Legal History of England to 1485.** The origins and development of the legal and political institutions and concepts of England. Special reference and emphasis is accorded the implications of those developments to contemporary American and English systems.
- Hist. 414/514-3. Constitutional and Legal History of England to 1714.** Continuation of Hist. 413 with emphasis on the Tudor and Stewart constitutional crises down to the accession of the Hanoverian Dynasty.
- Hist. 415/515-3. History of Science From the Ancients to Sir Isaac Newton.** A history of science from the Pre-Socratics to Isaac Newton, underscoring major intellectual themes in scientific thought and the historical context in which they developed.
- Hist. 417-3. Pre-Colonial History of West Africa.** Survey of West African history from earliest times through the state systems to the European beginnings and the slave trade.
- Hist. 419/519-3. European Intellectual History, 1750-1870.** Treats the major developments in European thought from the Enlightenment to Nietzsche. Special attention given to the individuals whose ideas have had the greatest influence on modern intellectual history, e.g. Rousseau, Hegel, Herder, Marx, Kierkegaard, Baudelaire, Darwin, and others. Prere., upperclass standing or consent of instructor.
- Hist. 420/520-3. European Intellectual History, 1870-Present.** Topics which receive particular emphasis: Nietzsche and the youth revolt against middle class society, the literary and artistic avant garde (Impressionism to Existentialism), the psychoanalytic movement, the European Right and Left, Post-WW II European thought. Prere., upperclass standing or consent of instructor.
- Hist. 422/522-3. History of World War II.** A history of World War II, with emphasis on the military, political (including diplomatic), economic, and social aspects of the conflict that occurred in Asia from 1937-1945 and in Europe from 1939-1945.
- Hist. 423/523-3. Europe During the Renaissance.** Explores the history and culture of Western Europe, ca. 1300-1520. Comprehensive in scope, with analysis of political, economic, social, religious, intellectual, and artistic matters. Discusses the significance of the Renaissance for the origins of modern civilization.
- Hist. 424/524-3. Age of the Reformation.** Examines two major, interrelated topics: the political and social history of the 16th century in western and central Europe and the momentous religious changes of the reformation and their cultural consequences.
- Hist. 425/525-3. War and the European State, 1618-1793.** A study of the development of the European states in response to international power struggles in the 17th and 18th centuries (up to the French Revolution).
- Hist. 426/526-3. The Age of Reason, Montaigne to Voltaire.** A study of major European intellectual trends from the late 16th century through the Enlightenment.
- Hist. 427/527-3. History of East-Central Europe to 1815.** History of Eastern theocratic empires of Turks and Hapsburgs from the 15th to 19th centuries, the development of political consciousness of various peoples comprising these empires, conflicts between Eastern theocracies, and rising secularism of Western Europe, culminating with the Napoleonic Wars.
- Hist. 428/528-3. History of East-Central Europe Since 1815.** Problems connected with dissolution of East European empires at the end of WW I, the formation of the nation states, the viability of these states in the 20th century, and the restoration of the imperial order after WW II.
- Hist. 430/530-3. History of France Since 1815.** A survey of French political, economic, and social institutions with analysis of domestic and foreign policies as well as discussion of French creativeness in the arts in the 19th and 20th centuries.
- Hist. 431/531-3. Nineteenth-Century Europe.** Beginning with the impact of the French revolutionary and Napoleonic eras and ending with the causes of WW I, the course deals with the political, economic, and social institutions of the European states in the 19th century.
- Hist. 432/532-3. Twentieth-Century Europe.** Involved with European political, economic, and social institutions from WW I to the present, with emphasis on 20th-century communism and fascism and developments in the western European democracies.
- Hist. 433/533-3. French Revolution and Napoleon.** The causes of the French Revolution are analyzed. Covers in detail the basic political, economic, and social changes and the legacy in Europe and the world of the French revolutionary and Napoleonic eras.
- Hist. 434/534-3. Colonial America, 1600-1750.** A survey of the settlement and development of the American Colonies with emphasis on the social, economic, political, and intellectual foundations of the United States.
- Hist. 435/535-3. German History to 1848.** A cultural, political, and social history of Germany up to and including the revolutions of 1848. Particular emphasis will be placed upon the political history of Prussia and upon such cultural phenomena as German romanticism.
- Hist. 436/536-3. German History Since 1849.** A cultural, political, and social history of Germany since 1849. Particular emphasis will be placed upon German unification, Bismarckian foreign policy, the rise of neo-Romanticism, Weimar politics, and the rise of National Socialism.
- Hist. 443/543-3. Tudor England.** An examination of the Tudors and the developments (constitutional, political, imperial, and artistic) of Renaissance England under this remarkable dynasty.
- Hist. 444/544-3. Stuart England.** An examination of England in its age of greatest political crisis and hurried transformation from nearly absolute monarchy to a parliamentary oligarchical form of government.
- Hist. 447/547-3. England; Age of Revolution, 1688-1832.** Deals with the major political, social, and economic events and movements in England between the accession of James II and the passage of the first Reform Act.
- Hist. 448/548-3. England in the Age of Collectivism.** Deals with the major themes of British history from the passage of the Reform Act of 1832 to the present.
- Hist. 449/549-3. The Gilded Age.** Examines the social and economic changes which transformed American life during the years 1870-1900. Labor violence, agrarian protest, political corruption, and racial and ethnic conflict are some of the consequences of those changes.
- Hist. 451/551-3. The American Revolution.** A survey of the events leading to the War of Independence and the creation of the United States.
- Hist. 453/553-3. Civil War and Reconstruction.** Describes the forces at work in the antebellum period that led to sectional warfare; the

social, economic and political changes effected by the war; the American agency of reconstruction; and the long-range results of that difficult era.

Hist. 455/555-3. U.S. Economic History: Lecture. A survey of economic growth in the United States, with emphasis on the development of agriculture, manufacturing, commerce, transportation, and public regulation of enterprise during the past century.

Hist. 456/556-3. Jacksonian America. Will focus on the creation of the American party system and the political events that shaped it, sectionalism, slavery, moral reform, and the way the party system was destroyed.

Hist. 457/557-3. The Early American Frontier. Examination of the westward movement from the colonial period through 1850 in the region east of the Mississippi, with major stress on unique problems of societies on the successive frontiers and their relationship to the determination of national policies.

Hist. 458/558-3. The Later American Frontier. Deals primarily with the Trans-Mississippi west during the 19th century, the westward advance of various frontiers, and their influence upon national development. Emphasis upon the economic factors and the associated cultural and social growth of the region.

Hist. 459/559-3. The American Southwest. Focusing on the region's three main peoples (Indian, Hispanic, and Anglo), this course will emphasize the dynamics of inter-ethnic relations. Indian migrations, Spanish conquest and Indian response, Mexican-Indian interaction, and Anglo domination are some of the themes discussed.

Hist. 460-3. Mexican-American Southwest. History of Mexican-Americans. Tracing their origins to the Spanish conquest of Mexico and colonization of the borderlands; Southwest colonial society and relations with Indians; impact of American conquest; development of Mexican-American society.

Hist. 461-3. Popular Culture in America to 1900.

Hist. 462-3. Popular Culture in America: The 20th Century. Continuation of Hist. 462.

Hist. 463/563-3. American Society and Thought to 1865. Concerned with the American family and community in different social environments. Looking at families of different ethnic, religious, and class backgrounds; observing how they are changed by the passage of time, new economic conditions, or new political institutions.

Hist. 464/564-3. American Society and Thought Since 1865. Primarily concerned with family roles and community values, and how they are altered by economic, demographic, and intellectual changes. Some of the most important themes will be acculturation, changing occupational opportunity, the idea of success, and popular culture.

Hist. 465/565-3. U.S. History, 1929-1952: Lecture. A survey of American history, 1929-1952, with attention to domestic and foreign policy issues. Emphasis will be placed upon the Great Depression, WW II, the Cold War, the Korean conflict, and the Truman administration's Fair Deal.

Hist. 466/566-3. U.S. History, 1948 to the Present: Lecture. Emphasis on the Eisenhower years, the New Frontier, the Great Society of the 1960s, American involvement in Vietnam and popular reaction to that conflict, the Nixon domestic and foreign policies, and the social and economic problems of the 1970s.

Hist. 467/567-3. Diplomatic History of the U.S. to 1914.¹ Traces the rise of the United States from the status of a weak new nation to that of an imperial world power with interests everywhere.

Hist. 468/568-3. Diplomatic History of the U.S. Since 1914.¹ Traces the rise of the United States to a position of dominance from 1900 until the present. Not only describes the events of diplomatic history but seeks to explain the economic, social, and intellectual roots of foreign policy.

Hist. 470/570-3. History of Urban America. Surveys the growth of American cities and urban life styles from the 18th century to the present. Compares the role of cities, their structure and problems, during three stages of growth—commercial, industrial, and modern.

Hist. 472/572-3. History of Modern Chinese Intellectual Thought. An upper division survey of the major intellectual movements in modern China from Ch'ing Neo-Confucianism, empiricism, nationalism, to Chinese communism.

Hist. 473/573-3. History of Traditional China. Survey of major traditions in philosophy, art, politics, society, and economy of China during the premodern period.

Hist. 474/574-3. History of Modern China. A survey of political, social, and economic events in China since 1750.

Hist. 475/575-3. Ancient and Medieval Japanese History. Beginning with the long prehistoric and protohistoric period, continues into the age of the bureaucratic state, then focuses on Japan's exceptionally long feudal experience which brought Japan to the Meiji Restoration of 1868.

Hist. 476-3. Modern Japanese History. Beginning with early modern Japan in the late feudal period, proceeding into the spectacular and rapid modernization of the Meiji era, including Japan's prewar experience of democracy and peaceful diplomacy. Concludes with WW II and postwar reforms.

Hist. 479/579-3. United States Military History to 1900. The development of military and naval art of war in American history, in its peacetime and wartime aspects from colonial times to the end of the Spanish-American War. Emphasis: the increasing influence of technology upon warfare after 1850.

Hist. 480/580-3. Military History: Lecture. A survey of America's national defense and war efforts from the Spanish American War to the present, with emphasis on the causes and consequences of modern conflicts.

Hist. 481/581-3. History of Mexico to 1821. Beginning with the roots and evolution of Pre-Columbian civilizations and concluding with the gaining of Mexican Independence in 1821. Emphasis on the society and culture of the Aztecs and Mayans, the Spanish conquest of Mexico, and the colonial regime of New Spain.

Hist. 482/582-3. The Emergence of Modern Mexico. Survey of Mexican history continues with the establishment of independence in 1821, examines the upheavals of the Mexican Revolution, and culminates with recent events in Mexico.

Hist. 483/583-3. Brazil and Argentina Since Independence. Traces the development of Brazil and Argentina through the 19th century to the present. Special attention is given to comparative topics and to significant trends such as the military in politics, eras such as the Vargas and Peron regimes.

Hist. 485/585-3. History of Spain. Covers the reigns of Isabella and Ferdinand to the present with special emphasis on state formation and the Hapsburg empire in Western Europe from 1516-1700, urban and rural societies, and the Spanish Civil War, 1936-39.

Hist. 488/588. The Medieval Middle East. An examination of Islam from 600 to the early modern period. Attention is divided equally between (1) Arab, Iranian, and Turkish political and economic history and (2) the arts and sciences characteristic of the civilization of Islam (theology, philosophy, mysticism, etc.)

Hist. 489/589-3. The Modern Middle East. Primarily from 1800 to the present. Attention is divided equally between (1) political history and international relations in the region and (2) patterns of economic, social, and cultural modernization in the main countries of the region.

Hist. 490/590-3. History of Flight and Space Exploration. A survey of the history of flight in the atmosphere and beyond. Attention will be given to the origin and evolution of lighter-than-air, heavier-than-air, and rocket-powered craft employed in space exploration.

Hist. 491/591-3. The Arab-Israeli Problem. An examination of the clash between modern Jewish and modern Arab nationalism over the area of Palestine/Israel since the late 1800s. The course concludes with a simulation exercise in which students work through a hypothetical crisis.

Hist. 493/593-3. History of Russia Through the 17th Century.¹ The establishment and expansion of the Russian state and the development of the political, economic, and social machinery necessary to administer it. From ancient times to the reign of Peter the Great and the proclamation of a Russian empire.

Hist. 494/594-3. Imperial Russia.¹ A survey of the major cultural, social, and economic changes from the reign of Peter the Great through the first Russian revolution of 1905.

Hist. 495/595-3. The Russian Revolution and the Soviet Regime.¹ Soviet Russia from the February Revolution of 1917 to the fall of Khrushchev. Begins with a description of the early careers and ideas of Lenin, Trotsky, and Stalin, and thereafter covers in detail the significant domestic and international events.

Hist. 496/596-3. The Soviet Union, 1929-Present. An examination of the growth of the USSR to the status of world power from Stalin's rise to the present time.

¹Also available through correspondence study.

Hist. 497/597-3. Russian Intellectual History. A survey of the ideas and, where appropriate, the activities of the major Russian thinkers from the late 18th century to the Soviet period.

Hist. 498-3. Senior Colloquium.

Hist. 499-variable credit. Honors Thesis. Prer., Hist. 498.

Hist. 505-3. The New South.

Hist. 506-3. History of British Empire/Commonwealth.

Hist. 517-3. Greek Inscriptions. (Gr. 570.)

Hist. 521-3. History of Colorado.

Hist. 541-3. History of Africa to 1850.

Hist. 542-3. History of Africa From 1850.

Hist. 550-3. A Political History of Africa.

Hist. 560-3. Mexican-American Southwest.

Hist. 586-3. Old South and National Disunion.

Hist. 587-3. History of Southern Africa.

Hist. 600-3. Historical Methods: Introduction to the Professional Study of History. The purposes, materials, and techniques of historical scholarship. Theory, practice, and criticism.

Hist. 601-3. Historiography: Introduction to the Professional Study of History. Covers some of the major historiographical schools and concerns that have emerged during the course of the discipline's development in Europe and the United States.

Hist. 602-3. Teaching History in Higher Education.

Hist. 613-3. Readings in 17th-Century Europe.

Hist. 614-3. Readings in 18th-Century Europe.

Hist. 615-3. Readings in the History of Science.

Hist. 616-3. Readings in the History of Science.

Hist. 621-3. Readings in Medieval History.

Hist. 828-3. Readings in History of East-Central Europe.

Hist. 632-3. Readings in Renaissance History.

Hist. 633-3. Readings in 16th-Century History.

Hist. 634-3. Readings in European Intellectual History.

Hist. 635-3. Readings in Modern German History.

Hist. 643-3. Readings in Modern European History.

Hist. 646-3. Readings in African History.

Hist. 647-3. Readings in English History Since 1688.

Hist. 648-3. Readings in British Commonwealth.

Hist. 649-3. Readings in the American Revolution.

Hist. 650-3. Readings in American Colonial History.

Hist. 651-3. Readings in U.S. History, 1776-1815.

Hist. 653-3. Readings in U.S. History, 1860-1900.

Hist. 654-3. Readings in the American Southwest.

Hist. 656-3. Readings in Comparative Ethnohistory.

Hist. 658-3. Readings in the American West.

Hist. 660-3. Readings in Feminism and Social Change.

Hist. 661-3. Readings in the History of American Women.

Hist. 663-3. Readings in U.S. Society and Thought.

Hist. 664-3. Readings in the History of the American Family.

Hist. 665-3. Readings in U.S. History, 1929-1952.

Hist. 666-3. Readings in U.S. History, 1948-Present.

Hist. 668-3. Readings in American Diplomatic History.

Hist. 670-3. Readings in the History of Urban America.

Hist. 671-3. Readings in Chinese History.

Hist. 675-3. Readings in Modern Japanese History.

Hist. 676-3. Readings in Modern Indian History.

Hist. 681-3. Readings in Latin American Colonial History.

Hist. 682-3. Readings in Latin American National History.

Hist. 683-3. Readings in Mexican American Southwest.

Hist. 685-3. Introduction to Historic Preservation. A survey of historic preservation programs and the techniques employed by private and public agencies at the local, state, and national levels to safeguard America's heritage.

Hist. 690-3. Introduction to Archival Management: Lecture. The evolution of archival and manuscripts repositories and the methods employed to preserve and make available to researchers public and private records; covers the acquisition, arrangement, and description of records, and techniques for making them available for reference.

Hist. 691-3. Readings in Middle Eastern History.

Hist. 693-3. Readings in Modern Russian History.

Hist. 695-3. Readings in the History of European Women.

Hist. 697-3. The Russian Revolutionary Movement.

Hist. 700-4 to 6. Master's Thesis.

Hist. 712-3. Seminar: Ancient History.

Hist. 721-3. Problems in Medieval History.

Hist. 723-3. Latin Paleography.

Hist. 727-3. Seminar: Early Modern Europe, 16th-18th Centuries.

Hist. 728-3. Seminar: East Central Europe.

Hist. 732-3. Studies in Renaissance Culture.

Hist. 733-3. Studies in the 16th Century.

Hist. 734-3. Seminar: Modern European History.

Hist. 736-3. Seminar: History of Modern Germany.

Hist. 738-3. Seminar: French Revolution and Napoleon.

Hist. 740-3. Seminar: European Intellectual History.

Hist. 741-3. Seminar: History of the British Empire.

Hist. 742-3. Seminar: African History.

Hist. 746-3. Seminar: English History, 1688-Present.

Hist. 750-3. Seminar: Early American History.

Hist. 752-3. Seminar: Middle Period of American History, 1840-1876.

Hist. 754-3. Seminar: Modern European Diplomatic History.

Hist. 758-3. Problems in the History of the American Frontier.

Hist. 760-3. Problems in the History of the American Southwest.

Hist. 763-3. Seminar: American Society and Thought.

Hist. 765-3. Seminar: U.S. History, 1929-1952.

Hist. 766-3. Seminar: U.S. History, 1948-Present.

Hist. 768-3. Seminar: American Diplomatic History.

Hist. 770-3. Seminar: History of Urban America.

Hist. 772-3. Seminar: Modern Chinese History.

Hist. 776-3. Seminar: Modern Japanese History.

Hist. 781-3. Seminar: Latin American History.

Hist. 782-3. Seminar: Latin American History.

Hist. 785-3. Training in Historic Preservation. Training in government agencies in the Denver area to give students opportunities for practical experience in various applications of historic preservation.

Hist. 790-3. Training in Archival and Records Management Procedures. Practical training in archival and records management through on-the-job experience in public and private archival and records management programs operative in the Denver area.

Hist. 792-3. Seminar: Islamic History.

Hist. 794-3. Seminar: Modern Russian History.

Hist. 800-0 to 10. Doctor's Thesis.

Hist. 940-949-variable credit. Independent Study — Undergraduate Level.

Hist. 950-959-variable credit. Independent Study — Graduate Level I.

Hist. 960-969-variable credit. Independent Study — Graduate Level II.

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. 200-3. Introduction to Linguistic Science. A survey of the field of linguistics and an introduction to the methodology of linguistic analysis.

Ling. 211-3. Writing Systems of the World. An overview of the structural features of human languages and a review of the different ways these are represented in selected ancient and modern writing systems.

Ling. 330-3. Linguistic Analysis. Intensive practice in the analysis and description of language data. Prer., Ling. 200.

Ling. 343-3. Semantics. Theoretical and practical study of meaning in natural language. Both semantic theories and semantic phenomena from diverse languages are considered. Does not treat techniques for improving the use of language.

Ling. 350-3. Language and the Public Interest. A study of language in public and private use, with concentration on semantic devices as found in the language of political propaganda, advertising, business, and government, as well as in the everyday use of language between and among people.

Ling. 401/501-3. The Nature of Grammars. Approaches to the description and explanation of language structure, language change, and language acquisition. Prer., Ling. 200. 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 Panini 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. 440/540-3. 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. 200.

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. 200 or graduate standing.

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. 200 or graduate standing.

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, 461/561, 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. 200 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. 200, 330, 401, 493.

Ling. 633-3. Phonological Analysis and Theory. Offered yearly. 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. Offered yearly. Techniques for analysis and description of grammatical systems. Prer., Ling. 401/501.

Ling. 641-2. Phonological Theory. Offered every third semester. 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. Offered every third semester. 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. 643-3. Semantic Theory. Offered every third semester. Current developments in the theory of linguistic semantics. Truth-conditional theories. Generative linguistic theories. Semantic

theories of communicative competence. Integration of these theories in the development of a combined theory of semantics and pragmatics. Prer., Ling. 501 and 540; Phil. 244 or equivalent.

Ling. 697-3. Advanced Diachronic Linguistics. Offered every other year. 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. 717-3. Areal Linguistics. Offered irregularly. Study of linguistic features shared by numerous languages or dialects within a given region, usually Africa or North America. The particular area or areas studied, however, will depend on the interests of the instructor and of the students. Prer., consent of instructor.

Ling. 724-2. History of Linguistics. Offered irregularly. 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., consent of instructor.

Ling. 738-2. Seminar: General Dialectology. Offered irregularly. Principles of general dialectology with emphasis on problems involving geographical and social factors. Prer., consent of instructor.

Ling. 740-3. Advanced Syntax. Offered irregularly. 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. Offered irregularly. Advanced topics in phonological theory. Prer., any two of Ling. 401/501, 493/593, 633, 641.

Ling. 750-2. Field Methods. Offered irregularly. 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. 797-3. Seminar: Diachronic Linguistics. Offered irregularly. Advanced topics in the theory of language change or in the reconstruction of language history. Prer., Ling. 697 or consent of instructor.

Ling. 700-4 to 6. Master's Thesis.

Ling. 800-1 to 10. Doctor's Thesis.

Ling. 910-1 to 3. Independent Study. Prer., consent of instructor.

Ling. 920-1 to 3. Independent Study. Prer., consent of instructor.

Ling. 930-1 to 3. Independent Study. Prer., consent of instructor.

Ling. 940-1 to 3. Independent Study. Prer., consent of instructor.

Ling. 950-1 to 3. Independent Study. Prer., consent of instructor.

Ling. 960-1 to 3. Independent Study. Prer., consent of instructor.

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.

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.

Romance Linguistics

For Romance Linguistics, see French and Italian.

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., 1 ½ 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., two years of high school algebra or Math. 101 or equivalent.

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., two years of high school algebra or Math. 101 or equivalent. Demonstration of proficiency in algebra is required by an examination to be given during the first week of the course. Students with a C or better in college algebra are not required to take this examination.

Math. 110-5. College Algebra and Trigonometry.³ 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., 1 ½ 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. Students who have taken Math. 230 may not use Math. 111-112 for the humanities requirement. 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.

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.¹ 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 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.

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. 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.

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. 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. *Not offered every year.* 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,

¹Also available through correspondence study.

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. 446/545-3. Applied Topics in Complex Variables. Applications of complex variables with emphasis on the classical functions (e.g., Legendre, Bessel) defined by differential equations, especially their asymptotic properties and their behavior under changes of variable. Lablace and Fourier transforms. Other topics as interest and time permit. Prer., Math. 445.

Math. 447/549-3. Introduction to Partial Differential Equations I. Initial and 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, 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., C.S. 210 and 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 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. *Not offered every year.* 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.

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 by¹.

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. 507-3. Advanced Calculus III. Same as Math. 433.

Math. 509-3. Advanced Finite Mathematics II. Same as Math. 414.

Math. 510-3. History of Mathematics. Same as Math. 472.

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. 517-3. Boolean Algebras. Same as Math. 453.

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 Pontriagin; controllability, applications. Prer., Math. 432, 443.

Math. 543-3. Ordinary Differential Equations. Same as Math. 443.

Math. 545-3. Applied Topics in Complex Variables. Same as Math. 446.

Math. 546-3. Theory of Automata.¹ (C.S. 546.) 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. 549-3. Introduction to Partial Differential Equations I. Same as Math. 447.

Math. 550-3. Introduction to Partial Differential Equations II. Same as Math. 448.

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 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, nonparametric 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. 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.

Math. 673-3, 674-3. Topics in Logic. Selected advanced topics in logic or foundations to be chosen by the instructor.

Math. 681-3, 682-3. Advanced Probability Theory.¹ Independent random variables, processes with independent increments, martingales, Brownian motion, stochastic integrals, and diffusions. Prer., Math. 531 and 532.

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. 893-3. 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. 899-3. Seminar.

Math. 700-4 to 6. Master's Thesis.

Math. 800-1 to 10. Doctor's Thesis.

Math. 910-1 to 3. Independent Study.

Math. 940-1 to 3. Independent Study.

Math. 950-1 to 3. Independent Study.

Math. 960-1 to 3. Independent Study.

MUSEUM

Musm. 401-4/501-3. 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. Staff.

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 instructors 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. 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. 452/552-4. Malacology. (EPOB 467/567.) *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. 940-variable credit. Independent Study. Prer., consent of instructor.

Musm. 950-variable credit. Independent Study. Prer., consent of instructor.

MUSIC

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

Mus. 183-3. Appreciation of Music.

Mus. 275-3. Introduction to American Music.

Mus. 276-3. Music and Drama (1000-1970).

Mus. 277-3. World Music.

Mus. 382-3. Music Literature I.

Mus. 383-3. Music Literature II.

Mus. 464-3. History of Jazz.

Mus. 489-3. Latin American Music.

Mus. 379-3. Twentieth-Century Music and Media.

ORIENTAL AND SLAVIC LANGUAGES AND LITERATURES

Chinese

Language Courses

Chin. 101-5. Beginning Chinese. *Fall.* Introduction to modern standard Chinese (Mandarin).

Chin. 102-5. Beginning Chinese. *Spring.* Continuation of Chin. 101.

Chin. 211-5. Second-Year (Intermediate) Chinese. *Fall.* Reading, speaking, and writing contemporary Chinese. Prer., Chin. 102.

Chin. 212-5. Second-Year (Intermediate) Chinese. *Spring.* Continuation of Chin. 211.

Chin. 311-3. Third-Year (Advanced) Chinese. *Fall.* Emphasis on reading a wide variety of modern Chinese prose, both literary and expository. Prer., Chin. 212.

Chin. 312-3. Third-Year (Advanced) Chinese. *Spring.* Continuation of Chin. 311.

Chin. 411-3. Readings in Modern Chinese Literature I. *Fall.* A literary study of selected works of modern authors. Prer., Chin. 312.

Chin. 412-3. Readings in Modern Chinese Literature II. *Spring.* Continuation of Chin. 411, with special emphasis on the works of Lu Hsun.

Chin. 421. Introduction to Classical Chinese. *Fall.* Systematic introduction to the classical language, based on Han and pre-Han materials. Prer., Chin. 212.

Chin. 422. Readings in Classical Chinese. *Spring.* A study of selected texts of classical literature, both poetry and prose, mainly from the Six Dynasties and T'ang eras.

Chin. 930-variable credit. Independent Study.

Chin. 950-variable credit. Independent Study.

Literature Courses (In English)

Chin. 481-3. Chinese Poetry in Translation. *Fall.* A study of ancient and medieval poetry as an expression of traditional Chinese culture and aesthetics. Special attention to major poets of the T'ang dynasty.

Chin. 482-3. Chinese Fiction in Translation. *Spring.* A study of major works of traditional fiction and of the development of the narrative form. Special attention to the short story and novel in the Ming and Ch'ing dynasties.

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. 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. 930-1 to 3. Independent Study.

Literature Courses (In English)

Jap. 221-3. Language and Patterns of Thinking and Behavior in Japanese Culture.

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.*

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. 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. 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. 700-variable credit. Master's Thesis.

Russ. 930-variable credit. Independent Study.

Russ. 950-variable credit. Independent Study.

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. 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. 800-1 to 10. (16 to 24 maximum). Doctor's Thesis.

Slav. 930-variable credit. Independent Study.

PHILOSOPHY

Phil. 100-3. Introduction to Philosophy. An introduction to the fundamental questions of philosophy through a study of the ideas of several major philosophers.

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. A philosophical introduction to problems of religion, such as the existence of God, faith and reason, religious language, etc., also available through correspondence study.

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. 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. 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. 202-3, 203-3. Nature of Law I and II. (CIS 280, 281.) An examination of the nature of law with focus on its underlying principles and its historical and comparative development.

Phil. 209-3. Philosophy and Psychology. Interdisciplinary course on issues where philosophy and psychology meet; for example, topics such as self-hood, 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. Major Social Theories. Introductory study of major philosophies of the past in relation to political, economic, and social 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. 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.

All courses at the 300 level require 6 hours of philosophy unless otherwise indicated.

Phil. 300-3. History of Philosophy. Ancient and medieval. No prer.

Phil. 301-3. History of Philosophy. Modern. No prerequisite.

Phil. 302-3. Ethical Theory. A study of major issues and theories in ethics. Prer., 6 hrs. of philosophy or instructor's consent.

Phil. 310-3. Chinese Philosophy. An examination of various schools of Chinese philosophy including Confucianism, Taoism, Buddhism, and Neo-Confucianism. No prer.

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. 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.

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. 321.)

Phil. 342-3. History of Science, Copernicus to Newton. (Nat.Sci. 322.)

Phil. 343-3. History of Science, Newton to Einstein. (Nat.Sci. 323.)

Phil. 344-3. Perspectives of 20th-Century Science. (Nat.Sci. 324.)

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. 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. 404-3. Twentieth-Century Philosophy. Study of two or three major philosophies prominent during the present.

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. 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. A 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. 444/544-3. Mathematical Logic. Prer., Phil. 244.

Phil. 460-1. Theology Forum Seminar. Discussions on a variety of theological and philosophical topics. Some reading, much discussion, occasional guest speakers. Students may enroll for repeated credit with permission of instructor to a maximum of 3 hours.

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. (Engl. 440, Comp. Lit. 484/584.) 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, 310. Comparison of Oriental philosophical traditions with Western traditions, with special attention to methods of comparison.

Phil. 491-3. Single Philosopher. 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. 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.

All courses at the 500 and 600 levels require 12 hours of philosophy unless otherwise indicated.

Phil. 500-3. Medieval Philosophy.

Phil. 508-3. Ethics. Representative positions in normative ethics and meta-ethics.

Phil. 509-3. Philosophy and Psychological Theory. (Same as Phil. 409.)

Phil. 510-3. Topics in the History of Philosophy.

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. 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. A 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. 586-3. Philosophy of Wittgenstein.

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. 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. 620-3. Seminar: Ethics.

Phil. 630-3. Seminar: Epistemology.

Phil. 645-3. Seminar: Metaphysics.

Phil. 646-3. Seminar: Phenomenology.

Phil. 690-3. Master's Research.

Phil. 700-4 to 6. Master's Thesis.

Phil. 800-1 to 10. Doctor's Thesis.

Phil. 940-variable credit. Independent Study.

Phil. 950-variable credit. Independent Study.

Courses in other individual philosophers will occasionally be given. Prer., consent of instructor.

PHYSICAL EDUCATION AND RECREATION

Physical Education

P.E. 197-1. Recreational Dance Forms. Dance techniques. Open to dance, physical education, and recreation majors.

P.T. 199-0. Introduction to Physical Therapy. An introduction to the field of physical therapy and information regarding requirements for the pre-physical therapy curriculum.

P.E. 225-2. Advanced First Aid. Standardized Red Cross certification for immediate care. CPR included.

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. 260-1. Activities of Low Organization.

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 sports and health. Includes study of the systems of the body and their functions. Prer., EPOB 121-122 or Biol. Sci. 103-104, chemistry, or Anth. 201-202.

P.E. 270-3. Physiology of Human Performance. The effects of various types of exercise upon body structure and function. Prer., P.E. 290 (P.E. majors), P.E. 269, or consent of instructor.

P.E. 275-2. Sports Officiating.

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. 293-3. Survey of Contemporary Health. A survey of selected health problems of contemporary man.

P.E. 295-3. Environmental Health. The impact of the environment on man's health including the effects of population, pollution, communicable diseases, and climate.

P.E. 298-1 to 3. Practicum in Physical Education. Practical experience in coaching or teaching in organized situations with direct supervision.

P.E. 320-3. Sport and American Society. Introduction to sport as one of the most pervasive human activities in America. Relationship of sport to various social institutions and processes. Utilizing a multidisciplinary approach to subject matter taken from physical education, sociology, psychology, American literature, religious studies, and anthropology. Not open to P.E. majors.

P.E. 323-3. Health and Physiological Values of Exercise. Physiological adaptations to exercise with consideration of the

biophysical values of exercise in maintaining fitness and health throughout an individual's life span.

P.E. 342-3. Nutrition and Health. The basic principles of nutrition and their relationship to health.

P.E. 346-3. Introduction to Adaptive Physical Education. Overview of adapted 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; laboratory sessions and individual research projects are required.

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. 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. 415-3. Management of Aquatic Programs. Designed to provide the necessary techniques, management skills and knowledge required to administer modern aquatic programs.

P.E. 417-3. Physical Education in the Elementary School. Activities, program planning, teaching methods for grades 1-6. Prer., P.E. 260, 290, and 350. A 2.5 grade-point average is required.

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. 437-2 to 8. Internship in Physical Education. Opportunity for field/laboratory work in a variety of different settings.

P.E. 440-3. Methods and Materials for Teaching Health. Methods used in teaching of health and safety in secondary schools.

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. 446-3. Prevention and Treatment of Athletic Injuries.

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; applications made to sports performance and 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. Prer., P.E. 290, 350, and 7 of 10 required credits

completed or current enrollment in professional activity courses P.E. 235-268. A 2.5 grade-point average is required.

P.E. 467-3. Exercise Science Laboratory Techniques. Laboratory procedures and biomedical instrumentation pertinent to measuring and evaluating human performance.

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. 497-3. Senior Seminar.

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. 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. 514-3. Current Trends in Teaching Physical Education. 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 Programs. 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. 531-3. Trends in Recreation. Analysis of changing political, social, economic, and industrial orders and the possible influences on leisure-time pursuits.

P.E. 534-3. Joint School-Community Recreation. Special emphasis on administrative problems in rural communities and situations calling for coordination of recreation agencies.

P.E. 538-3. Recreation Leadership at the Administrative Level. 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. Analysis, synthesis, and evaluation of administrative organization and operations of community recreation/leisure delivery systems. Course includes a community assessment project.

P.E. 552-3. Physical Growth and Motor Development. 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. 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. 560-3. Physiological Basis for Physical Activity. 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. 562-3. Advanced Techniques of Athletic Training. 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. 563-3. Sports Medicine. 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. 566-3. Human Performance Laboratory Techniques. Laboratory procedures and biomedical instrumentation pertinent to human performance laboratories are presented through lecture and laboratory participation.

P.E. 570-3. Sociological Basis for Physical Education. An examination of the interrelationships between human movement and sociocultural variables with emphasis upon the social structure and dynamics of sports groups.

P.E. 572-3. Motor Learning. 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 or behavioral psychology.

P.E. 575-3. Psychology of Sport. Behavioral phenomena associated with sport, the participant, and coach. Prer., educational psychology, psychology or learning.

P.E. 579-3. Psychological Basis for Human Performance. 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. 580-3. Historical Basis of Physical Education and Recreation. 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. 585-3. Interpretation of Physical Education. 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. 588-3. Philosophical Basis of Physical Education and Recreation. An analysis of the various philosophies influencing educational thought and their implementation in health, physical, and recreation education.

P.E. 592-3. Applications of Statistics in Health, Physical Education, and Recreation. 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. Presentation of special aspects of current practices, materials, and trends in physical education.

P.E. 610-3. Evaluation and Accountability in Physical Education. 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. 620-3. Administration of Physical Education and Athletics. 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. 638-3. Recent Research and Literature in Recreation. 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. 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. 662-3. Metabolic Adaptation to Exercise. 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. 690-3. Methods of Research in Health, Physical Education, and Recreation. 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. 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.

P.E. 920-variable credit. Elective Activity. Only by consent of departmental chairman.

P.E. 930-1 to 3. Independent Study: Physical Therapy.

P.E. 940-1 to 3. Independent Study: Physical Education.

P.E. 950-1 to 3. Independent Study. Consult adviser on topics; subject field arranged to meet needs of individual student.

Recreation

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. 212-3. Recreational Activities. Theory, practice, and innovation of softball, volleyball, golf, and archery, as well as individual and dual games for the handicapped.

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.

Rec. 222-2. Camp Leadership. Modern principles of camping, camp programs, and counselor training.

Rec. 300-3. Leisure and Society. Analysis of factors contributing to leisure and work life styles in our technological society. Examination of those psychological, sociological, and philosophical forces supporting or detracting from man's search for leisure. Not open to P.E. majors.

Rec. 310-3. Principles of to Community Recreation. An overview of community recreation including professional preparation, programs, facilities, fiscal management, relation to other community services, and administrative responsibilities.

Rec. 317-1 to 4. Fieldwork in Community Recreation. The study of organizational structures in various types of recreational setting 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. 320-3. Principles of Outdoor Recreation. 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. 327-1 to 4. Fieldwork in Outdoor Recreation. See course description under Rec. 417.

Rec. 330-3. Principles of 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. 337-1 to 4. Fieldwork in Therapeutic Recreation. See course description under Rec. 417.

Rec. 340-3. Principles of 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. 347-1 to 4. Fieldwork in Commercial Recreation. See course description under Rec. 417.

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. Prer., Rec. 201.

Rec. 403-3. Public Recreation Facilities. The variety of areas and facilities utilized by the public in their leisure pursuits. Planning, management, maintenance, financing, and programming of the various areas and facilities will be studied.

Rec. 405-3. Organization and Evaluation in Recreation. The study of organizational structures of the several types of recreational services. Evaluative techniques used to determine the effectiveness of these structures are related to administration of programs, policies, and publics. Prer., Rec. 201.

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. Prer., Rec. 310 and 201.

Rec. 418-10. Internship in Community Recreation. Orientation to the total program including progressive steps toward full responsibility. Prer., Rec. 317.

Rec. 420-3. Management of State and Federal Parks and Recreation. Lect., fieldwork and lab. Experience in parks and recreation ad-

ministration. Problems in management, evaluation of park and recreation facilities. Prer., Rec. 320 and 201.

Rec. 428-8. Internship in Outdoor Recreation. See course description under Rec. 418. Prer., Rec. 427.

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 and 201, or consent of instructor.

Rec. 434-3. Clinical and Community Aspects of Therapeutic Recreation. Examination of selected clinical and community therapeutic recreation service programs for the purpose of evaluating the impact of various models of service delivery on special populations.

Rec. 941-1 to 3. Independent Study in Community Recreation. Prer., consent of instructor.

P.E. 942-1 to 3. Independent Study in Outdoor Recreation. Prer., consent of instructor.

P.E. 943-1 to 3. Independent Study in Therapeutic Recreation. Prer., consent of instructor.

P.E. 944-1 to 3. Independent Study in Commercial Recreation. Prer., consent of instructor.

PHYSICS

Phys. 101-3, 102-3. Physical Science for Nonscientists. (Nat. Sci. 121, 122.) Two lect. per wk. plus one lab.-demonstration. Topics range from Newtonian mechanics to modern physics. Emphasizes the social and historical aspects of physics and its connection to the humanities.

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. 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.

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. 297, 298, 299-variable credit. Special Topics in Physics. Various topics not normally covered in the curriculum; offered intermittently depending on student demand and availability of instructors.

Phys. 301-5, 302-5. General Physics.¹ Three demonstration lectures, one recitation, and one lab. per wk. plus four evening exams in the semester. Phys. 301 covers mechanics, heat, and sound; 302 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. 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 301-302. 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. 305-3. Topics in the History and Philosophy of Physics. Topics will vary from year to year and may include scientific methodology, the role of experiment and case studies in the history of physics. Prer., one year of physics or consent of instructor.

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 Schroedinger 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. 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. 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. 497, 498, 499-variable credit. Special Topics in Physics. Various topics not normally covered in the curriculum; offered intermittently depending on student demand and availability of instructors.

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.

Phys. 505-3. Science Communication Seminar. 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. 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.

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. 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.

¹Also available through correspondence study.

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 nonequilibrium systems. Topics covered in Phys. 644 include kinetic theory, degenerate gases, marocanonical 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.

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, 696, 697, 699-variable credit. Special Topics in Physics. Various topics not normally covered in the curriculum; offered intermittently depending on student demand and availability of instructors.

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. 800-1 to 10. 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 until the manuscript is in acceptable form to be submitted for publication.

Phys. 940-variable credit. Independent Study. Selected topics for undergraduate independent study. Subject matter to be arranged. Prer., consent of instructor.

Phys. 950-variable credit. Selected Topics for Graduate Independent Study. Subject matter to be arranged. Prer., consent of instructor.

POLITICAL SCIENCE

Note: A course listed below is not necessarily offered every year.

American

Lower Division

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. Not open to those who have credit in P.Sc. 101 and/or 102.

Upper Division

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. 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

¹Also listed under Theory.

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. 432-3. Public Administration. A comprehensive basic course which considers the power of organization, the problem of bureaucracy, the determination of organizational objectives, decision making, the allocation of resources, organizational structure, staffing problems, and the evaluation of institutional performance.

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. 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.

P.Sc. 444-3. Contemporary Culture and Politics.¹ 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.¹ 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. 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.

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.

International/Comparative

Lower Division

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. 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. 222-3. Introduction to International Relations. 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.

Upper Division

P.Sc. 313-3. 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. 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. 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. 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

¹Also listed under Theory.

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. 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. 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. 422-3. Seminar: Foreign News Coverage in the Press. Comparative studies of the distribution and significance of international news published in American and foreign newspapers and news magazines. Involves original empirical research and theoretical/analytic work.

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. 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.

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. 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. 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.

Theory

Upper Division

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. 439-3. History of Political Philosophy. Study of the main political philosophies and political issues of the Western culture, from Plato to the 20th century.

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.¹

P.Sc. 445-3. American Political Thought.¹

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. 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 Systematic Political Science Inquiry. The application of systematic research methods to problems of political science inquiry. Students can define their own individual substantive areas of research concern or engage in a common project established by the class in consultation with the instructor. The types of research methods used and the speed of their introduction depend on the substantive problem areas chosen for research.

¹Also listed under American.

Other Courses in Political Science

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.

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. 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. 210-3. Introduction to Public Policy Analysis. A study of the policy making processes in American government, the factors which shape public decision, and the issues and questions which are relevant to political inquiry.

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. 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. 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 and consent of instructor.

P.Sc. 481-3. Honors in Political Science Seminar. Writing and discussion of selected topics in political science. Critical review of the major methodological and conceptual features of the discipline. Students will prepare their honors papers in seminar.

P.Sc. 940-1 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. 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: Urban Public Policy. Focus on the formulation, revision, and outcomes of public policy in American urban communities. Some comparative Canadian and European literature also used.

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. Fitch, Reid.

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. (Cragmor Campus.)

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. 477 or consent of instructor. Busey, Fitch.

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. (Cragmor Campus.)

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. 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

¹Also available through correspondence study.

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. 565-3. Comparative Politics and Ideologies. Scholarly analysis and instruction on the contrast between contemporary totalitarianism and liberty under law. Taught by outstanding professors from leading universities in the United States and abroad. Designed primarily for social science teachers, graduate students, newspapermen, clergymen, and radio and television commentators. Offered only during the summer as an institute. Rozek.

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.

See also P.Sc. 509 listed under American Government, 538 listed under Public Administration, and 590 listed under Empirical Theory and Methodology.

Empirical Theory and Research Methodology

P.Sc. 546-3. 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. 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. (Denver Campus.)

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.

See also P.Sc. 549 listed under Law and Politics, 537 listed under Public Administration, and 553 listed under American Government and Politics.

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. F. Beer, 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. 572-3. Soviet Foreign Policy. Seminar on the foreign policy of the Soviet Union, its relation to Marxism-Leninism and/or Russian nationalism, as well as to the international Communist movement. Special attention will be focused on the impact of domestic and foreign factors and science and technology on policy formation. Rozek.

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. 541-3. Seminar: Selected Political Theories. Selected political philosophies or theories in classical or modern political thought. Cummings, Mewes, Paul, Reid.

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. 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, Paul, Reid.

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. 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. 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. 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.

P.Sc. 630-3. Field Study in Public Administration. For students who have not had government experience. Studies and reports are made while students have full- or part-time administrative traineeships, internships, or similar positions in government agencies or in government-related organizations. Consent of instructor required. Null, Lorch. (Cragmor Campus.)

See also P.Sc. 509 and 553 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 and department chairman. 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. of lect. and one 2-hr. lab. per wk. Introduction to descriptive and inferential statistics and to their roles in psychological research. Topics include correlation, regression, *t* test, analysis of variance, and selected nonparametric statistics. Required of psychology majors. 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 in the required 30 hours for a psychology major.

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. 300-3. 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. 400-3. 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. An honors thesis consists of (1) a critical review of some aspect of the psychological literature, (2) a scholarly analysis of a major psychological issue, and/or (3) an empirical research project. See psychology honors director for further information.

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 and Biological 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. 406/506-3. 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 human beings: 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. An analysis of peripheral and central mechanisms involved in the transduction and interpretation of experience. Special attention will be given to vision and audition; major theories in these areas will be discussed in terms of the research they have inspired. 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. 424-3. Teaching of Psychology. Students will receive concrete experience in the teaching of general psychology under supervision of a psychology faculty member. Alternative pedagogical strategies will be discussed. Prer., 16 hrs. of psychology with grade of B or better plus instructor's consent.

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. 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.

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. 520-3. Current Issues in Human Infancy. Examination of theoretical issues and experimental methods in the study of human infant behavior and development. Specific topics vary with current interests of students and instructor. Prer., consent of instructor.

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. 526-3. Mammalian Neuroanatomy. Topic covers microscopic anatomy and function of different brain regions. Emphasis on correlation between structure and function, particularly at cellular and synaptic level. Course includes brain dissection, description of neuroanatomical and neurohistological techniques, and an introduction to the ultrastructure of neurons. Prer., Psy. 405 or EPOB 420 or MCDB 418 or consent of instructor. Fifikova.

Psy. 527-3. Neuronal Plasticity. Describes the current state of knowledge on the types of changes which occur in the nervous systems as a result of lesions or altered environment during development. These changes are examined relative to factors that provoke them, to their significance for the organism, and to the mechanisms that underlie them. The course is a contribution to the understanding of such phenomena as behavioral plasticity and recovery of function after injury. Prer., Psy. 526 or consent of instructor. Fifikova.

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. 531-3. Proseminar: Developmental Psychology—Sensory Development. An intensive coverage of selected topics in sensory development. Emphasis will be on the role of experience in the development of neural mechanisms of human sensory systems. Considerable attention will be given to understanding the historical foundations of current problems. Open to graduate students or senior undergraduate majors with consent of the 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. 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. 566-3, 567-3. 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. 568-3, 569-3. 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. 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.

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. 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. 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. 660-2. Practicum in Community Psychology. Direct field experience in community psychology and community mental health settings for Ph.D. candidates in clinical and social psychology only. Instructor consent.

Psy. 681-2. 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. 662-3. 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. 671-3. Practicum in Clinical Psychology. Direct clinical experience for Ph.D. candidates in clinical psychology only.

Psy. 672-3. 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. 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. 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.

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. 800-1 to 10. Doctor's Thesis.

Psy. 949-1 to 3. Independent Study. *Fall, Spring.* Prer., junior standing, consent of instructor, consent of psychology director of undergraduate studies.

Psy. 959-1 to 3. Independent Study.

Psy. 999-0. Candidate for degree.

RELIGIOUS STUDIES

R.St. 162-3. Religious Dimension in Human Experience. A critical study of religion as individual experience and social phenomenon; varieties of religious language (symbol, myth, ritual, scripture, etc.); and varieties of religious experience: Asian, western, archaic.

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. A study of Christian origins, the historical person of Jesus, the Christian movement in the Greco-Roman world, and the four canonical gospels in their historical setting.

R.St. 240-3. Prehistoric Religions. An examination of the beliefs, rituals, and world views of peoples who lived before writing and civilization during the long, global epoch of hunting, gathering, and archaic cultivation. Palaeolithic burials, "Venus" figurines, cave art; Eskimo shamanism; Australian Aboriginal religion; megalithic monuments.

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 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. An examination and interpretation of mythic visions of America as a religious place and Americans as special human beings. Focus is on European, Anglo, Indian, Mexican, and Black visions of America.

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. 300-3. The Christian Tradition. An exploration of the evolution of Christian theology, myth, ethics, ritual, and social institutions. Prer., R.St. 260 or consent of instructor.

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. Prer., R.St. 162 or consent of instructor.

R.St. 305-3. Zoroastrianism. An exploration of the myths, theology, rituals, ethics, and social institutions of Zoroastrianism, in historical perspective. Prer., R.St. 260 or consent of instructor.

R.St. 310-3. Judaism. An exploration of Jewish religious experience and its expression in thought, ritual, ethics, and social institutions. Prer., R.St. 260 or consent of instructor.

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 Shinto, Buddhism, and Confucianism within the development of Japanese culture. Prer., R.St. 262 or consent of instructor.

R.St. 345-3. Religions of Egypt. A historical and analytical survey of religious beliefs and practices in Egypt from ancient times to the present, including the Pharaonic, Jewish, Coptic Christian, Islamic, and folk traditions. Prer., R.St. 260 or consent of instructor.

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 beliefs and practices through an examination of the Qur'an, Muhammad's life, ritual practices, law and theology, mysticism, and social institutions. Prer., R.St. 260 or consent of instructor.

R.St. 370-3. 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. Prer., R.St. 340 or consent of instructor.

R.St. 380-3. Religion and Psychology. An examination of the relation between religion and psychology in the understanding of human nature; religious methods (prayer, meditation, conversion, and mysticism), and the psychology of conviction as it related to religious diversity. Prer., R.St., 162 or consent of instructor.

R.St. 385-3. Chinese Religion. (Chin. 385.) A study of classical Confucianism, Taoism, Buddhism, and Neo-Confucianism within the historical context of Chinese culture. Prer., R.St. 262 or consent of instructor.

R.St. 395-3. Topics in Religious Studies. Intensive study of a selected area or problem in religious studies.

R.St. 400-3. Topics in New Testament. In-depth study of a selected book, passage, theme, or topic pertaining to the New Testament. Prer., R.St. 196, 300 or consent of instructor.

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. Prer., R.St. 320 or consent of instructor.

R.St. 440-3. Chinese and Japanese Buddhist Scriptures. In-depth study of Buddhist scriptures in translation belonging to the main schools of thought, from popular Buddhism to Zen. Prer., R.St. 340 or 385.

R.St. 450-3. City and Symbol in American Indian Religions. An examination of the relationship between cosmo-magical thought and

urban organization in Aztec, Maya, Inca civilizations. Prer., R.St. 270 or consent of instructor.

R.St. 460-3. Crisis Cults and Millenarian Movements. An examination of crisis cults from the variety of perspectives which constitute millenarian studies. Focus on causes, charismatic leaders, millenarian visions, and the impact of prophecies that fall on cult members. Special emphasis will be given to the crisis in scholarship created by attempts to study these religious outbursts. Prer., 6 hrs. R.St. courses.

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. 485-3. Taoism. (Chin. 485, Phil. 485.) The historical development and influence of the Taoist tradition in Chinese culture, focusing on classical philosophical Taoism, religious Taoism, and neo-Taoism. Prer., R.St. 385 or consent of instructor.

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-Hujwiri, Al-Ghazali, and Rumi. Prer., R.St. 360 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, phenomenology, and anthropology.

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. 920-variable credit. Independent Study.

R.St. 940-variable credit. Independent Study.

SOCIOLOGY

Soc. 112-3. Introduction to Social Research. An introductory survey of social research methodology, touching upon research design, measurement, sampling, interviewing, participant observation, elementary statistics, use of computer programs, and presentation of results. When possible, an actual research project is undertaken to provide practical experience in applying research methods.

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. 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. Endo, Rivera.

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, Gimenez.

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. Bynder.

Soc. 200-3. Sociology of Death and Dying. The causes of death, who dies, the experience of dying (nursing homes, emergency rooms, intensive care, hospices), ethical and political issues: right to life, right to death, euthanasia, bionics, genetic engineering, cryogenics, environmental and occupational health. Gimenez, Moen.

Soc. 206-3. Sex Roles and Stratification I. An examination of the causes and consequences of sex differentiation and sex stratification at the individual and societal levels. Emphasis on historical and cross-cultural context of sex roles and sex status. Major theories of sex stratification are reviewed. Nielsen.

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 Sociology of Survival. Explores global survival issues such as overpopulation, poverty, pollution, and environmental degradation in terms of socioeconomic organization, technology, environment, and population dynamics.

Soc. 221-3. Elementary Population Studies. Elements of demography, natality, mortality, international and internal migration, population growth, population policy. Cuzzort, Gimenez, Moen.

Soc. 222-3. Human Ecology. Ecological organization and processes in urban, rural, and regional areas.

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. 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. 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.

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,

¹Also available through correspondence study.

questionnaire construction, interviewing procedures, coding, etc.) and elementary statistics. How to conduct a survey in a Chicano population. Rivera.

Soc. 325-3. Sociology of Nonviolence. This history, dynamics, and structure of nonviolent action as both a form of collective behavior and a personal life style. Special attention is given to conscientious objection to war and to civil disobedience.

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. Pinto.

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. 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 over- and under-consumption in technologically developed and developing societies.

Soc. 370-3. Women, Development, and Fertility. An investigation of the consequences of social and economic development for women and the relationships of the status of women and fertility; fertility and development. Gimenez, Moen.

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. 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. Sociological analysis of women's place in the mode of production and social organization. The course will focus upon the transition from feudalism to capitalism and the impact of capitalistic development upon the status of women in contemporary developed and third world nations.

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 II. 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. 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).

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 patterns, 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, Templeton.

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. Kjolseth.

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 ethno-methodology.

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. 441/541-5. 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, Pinto.

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. 453-3. 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. Hunter, Pinto.

Soc. 455-3. 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. 458/556-3. 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. 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. Pinto.

Soc. 463-6. Research Methods in Sociology. Teaches quantitative research methods, most particularly methods of survey research. Topics included will be sampling, measurement, interviewing, computer methods, and statistical analysis. Class will design and execute a survey research project from start to finish. Students will prepare a research paper on the basis of data collected in the project.

Soc. 464-6. Field Experience in Sociology. Emphasizes ethnographic techniques, intensive interviewing, direct observation, and participant observation. Students will conceptualize and execute a field research project, including data collection, analysis, and a report on some on-going social setting.

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 Systems. Exploring conflict resolution theory and method as applied to interpersonal, intergroup and interorganizational conflict. Special attention given to environmental disputes in Colorado.

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. Gimenez.

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. Population Studies: Fertility and Mortality. Sociological causes and consequences of different levels of fertility, mortality, and population growth. Course emphasizes methods, theory, and practical applications. Gimenez, Moen.

Soc. 484/584-3. Population Studies: Migration and Distribution. As mortality and fertility rates decline, migration is becoming the main determinant of population growth and distribution, especially in the U.S. The course will cover theory and methods but concentrate on social issues related to migration. Gimenez, Moen.

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. 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. 489-3. 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. 211 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. 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. 494-4. Photography in Sociology. Designed to sharpen the student's observational skills by offering practice in still photography as a tool for discovering and interpreting social settings, conditions, and concepts. Surveys range of uses of photography in social research, explains basic camera techniques, how to design field studies, and ways of integrating visual and verbal texts. Each student will design and carry out a field project.

Soc. 495-3. 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. 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. 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. 500, 501-3. Proseminar: Sociology. Systematic review of theory, method, and subject matter in sociology. Higman, Mercer, Wanderer.

Soc. 502-3. 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. 503-3. 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. 504-3. Research Practicum in Demographic Methods. A survey of demographic data, demographic methods, social indicators, ecological analysis, and cohort analysis. Individual research in area of interest. Prer., Soc. 502 and Soc. 503.

Soc 505-3. Research Practicum in Survey Methods. Practical experience in performing sample surveys. Emphasis is placed upon sampling, questionnaire construction, interviewing skills, scaling, coding, and computerized data analysis. Prer., Soc. 502 and Soc. 503.

Soc. 506-3. Research Practicum in Ethnographic Methods. Explores methods, problems, and potentials of field work research, utilizing primarily qualitative methods of gathering and analyzing data of social situations. Primary purpose of field work is to learn to systematically observe people *in situ*, finding them where they are, staying with them in a role acceptable to them which allows intimate observations of their behavior, and reporting it in ways useful to social science but not harmful to those observed. Prer., Soc. 502 and 503.

Soc. 507-3. Research Practicum in Dialectical and Historical Methods. An introduction to dialectical logic and methods for use in the analysis of historical data will be followed by the formulation of group and/or individual research projects to be completed during the semester. Practical experience in conducting historical research is emphasized. Prer., a required graduate theory course and a required graduate methods course.

Soc. 508-3. 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. 510-3. 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. Hunter.

Soc. 515-3. Social Theory. Adams, Hanson, Higman, Mercer.

Soc. 516-3. Social Theory. Adams, Hanson, Higman, Mercer.

Soc. 519-3. 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. 521-3. Human Ecology. Dynamics of the distribution of populations in rural, metropolitan, suburban, and ex-urban areas in the U.S. and other countries.

Soc. 523-3. Models of Social Processes. 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. 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. 532-3. Sociology of Ideas. Social existential bases of human mental products; critical analysis of theories and methods employed in the field.

Soc. 535-3. 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. 540-3. 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. 546-3. Social Change and Policy Planning. A course giving students experience in writing research proposals, journal articles, project reports, and the like. Students' writing efforts will be criticized from stylistic, scientific, and managerial perspectives. Emphasis will be placed upon efficient use of library materials, computerized searches of relevant literature, and writing for the appropriate audience.

Soc. 547-3. 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. 555-3. The Family. Recent trends in research and theory with emphasis on the American family. Mercer.

Soc. 561-3. Sociology of Religion. Comparative analysis of religion as a social institution. Templeton, Pinto.

Soc. 565-3. 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. 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. 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. 577-3. Sociological Analysis of Organizations. An examination of theory and research in the field of formal organization. Special attention is given to problems of organizational change and to the difficulties a social scientist working in a bureaucratic organization might encounter.

Soc. 586-3. 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. 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. 588-3. 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. 595-3. Criminology. Theories of causation of crime as a social phenomenon; theories of punishment and disposition of cases.

Soc. 597-3. Sociological Approaches to Resource Usage. An examination of the relationship between various forms of social systems and the efficient utilization of resources. A consideration of the influence of society on the demand for energy and of available energy on social systems.

Soc. 599-3. 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. 601-3. Graduate Seminar.

Soc. 603-variable credit. Guided Research in Sociology. Consent of a staff member required.

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. 614-3. Social Theory: Contemporary World Problems. Macro-level structural theories of underdevelopment, overpopulation, food scarcity, and resource depletion. Current policies attempting to cope with such problems will be critically assessed.

Soc. 615-3. Social Theory. Adams, Hanson, Higman, Mercer.

Soc. 618-3. 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. 623-3. Human Fertility. Provides students an opportunity to specialize in research on human fertility with social factors in fertility differentials being stressed.

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. 640-3. 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. 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. 689-3. 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. 800-1 to 10. Doctor's Thesis.

Soc. 910-variable credit. Independent Study in Sociology. Consent of instructor required.

Soc. 940-variable credit. Independent Study in Sociology. Consent of instructor is required.

Soc. 950-variable credit. Guided Readings in Sociology. Prer., consent of a staff member.

Soc. 999-variable credit. Candidate for Degree.

SPANISH AND PORTUGUESE

Spanish

Span. 101-5. Beginning Spanish. *Fall, Spring.* Course will offer students a firm command of Spanish grammar. Recitation sections will reinforce structures discussed in lecture. Grammar will be used as point of departure for development of oral skills. Reading, writing will be stressed to a lesser degree.

Span. 102-5. Beginning Spanish. *Fall, Spring.* Continuation of Span. 101. Prer., Span. 101 or placement.

Span. 105-5. Beginning Spanish Review. *Fall, Spring.* An intensive review of the structures of Span. 101-102. Attention to reading, writing, and vocabulary building.

Span. 211-3. Second-Year Spanish. *Fall, Spring.* Grammar review. Study of Hispanic culture, civilization, literature, and art. Prer., Span. 102 or 105 or placement.

Span. 212-3. Second-Year Spanish. *Fall, Spring.* Grammar review. Study of Hispanic culture, civilization, literature, and art. Prer., Span. 211 or placement.

Span. 301-3. Pronunciation, Diction, and Conversation. *Fall.* A practice in conversation with emphasis on pronunciation and diction

together with exercises in oral composition and review grammar. Prer., Span. 212, or equivalent.

Span. 302-3. Conversation and Oral Composition. *Spring.* A practice in conversation with great emphasis in both oral and written composition. Prer., Span. 301 or equivalent.

Span. 303-3. Professional Spanish for Business I. *Fall.* Includes the study of terminology and techniques used in business transactions and the interpretation and understanding of the ideas expressed in business letters and simple documents. Prer., Span. 301, 302.

Span. 304-3. Professional Spanish for Business II. *Spring.* A practical business course including writing, interpreting, and elementary translation. Some attention is given to the writing of resumes and application letters, as well as to the entire job-search process. Prer., Span. 303.

Span. 305-3. Spanish Linguistics. *Fall.* Spanish phonology with practical exercises. 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. A survey of the leading writers of Spain from 1939 until the present. In-depth studies of three or four narrative authors will balance the more superficial introduction to the works of other important authors. Prer., Span. 212 or equivalent.

Span. 332-3. Nineteenth-Century Spanish Literature. *Fall, Spring.* Main currents of Spanish peninsular literature of the 19th century. Prer., Span. 212 or equivalent.

Span. 334-3. Twentieth-Century Spanish-American Novel and Essay. *Fall.* Introduction to the contemporary Spanish-American novel and short story. Prer., 3 hours literature at 300 level.

Span. 335-3. Spanish-American Novel and Essay to 20th Century. *Fall, Spring.* An introductory reading course of 19th-century Spanish-American novelists and essayists including relevant literary, philosophic and religious background. Prer., Span. 212 or equivalent.

Span. 400/500-3. Mexican-American Culture of the Southwest. *Spring.* (Ch.St. 400.) (Does not count toward Spanish major.)

Span. 401/501-3. Advanced Rhetoric and Composition I. *Fall.* Designed to improve written expression in Spanish. Detailed study of the nuances of grammar points most difficult for students. Attention will be given to errors in student compositions and to the various styles of written Spanish. Prer., Span. 302.

Span. 402/502-3. Advanced Rhetoric and Composition II. *Spring.* A continuation of Span. 401 with an emphasis on original work by students. Composition assignments will include the development of dialogues, synthesis of works by noted authors and original poems by students. Review of grammar when need is indicated. Prer., Span. 401.

Span. 405/505-3. Structure of Modern Spanish. *Spring.* Contemporary Spanish grammar from a practical perspective. A study of difficult grammatical structures with exercises. An introduction to important topics from a theoretical basis. Prer., Span. 305.

Span. 406-3. Problems of Business Translation in Spanish I. *Fall.* The development of skills in English-Spanish and Spanish-English translation and interpreting. Prer., Span. 304 or equivalent.

Span. 407-3. Problems of Business Translation in Spanish II. *Spring.* Legal and commercial documents are studied, prepared and discussed to enable students to perform successfully in real translation situations. Prer., Span. 406 or equivalent.

Span. 408/508-3. Spanish in Multilingual Societies. *Spring.* Linguistic and sociolinguistic characteristics of the Spanish language in bilingual and multilingual regions. Spanish dialects in the United States. Interplay between Spanish, English, and other languages. 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.* Image of woman in Spanish literature through centuries and works by representative female writers.

Span. 412/512-3. Women in Spanish American Literature. *Spring.*

Span. 415/515-3. Masterpieces of Spanish Literature. *Fall.* A general survey of Spanish peninsular literature, including a study of the principal authors, works, and literary movements.

Span. 416/516-3. Masterpieces of Spanish-American Literature. *Spring.* A general survey of Spanish-American literature, including a study of the principal authors, works, and literary movements.

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. 424-3. The Chicano Novel Written in Spanish. (Ch.St. 424) The study and analysis of the Chicano novelists who write in Spanish.

Span. 425/525-3. Literature of Argentina, Uruguay, and Paraguay. A survey of the development of the principal literary genres of Argentina, Uruguay, and Paraguay.

Span. 430/530-3. Generation of 1898. Thorough coverage of selected works by Unamuno, Baroja, Valle-Inclán, Azorín, and A. Machado. The significance of the generation's contribution to Hispanic literature will be made.

Span. 441/541-3. Modernism. A study of background, influences, tendencies, themes and style of modernism; its principal authors and works, including Spanish versification and form.

Span. 450/550-3. Nineteenth-Century Spanish Novel. The study of selected readings representative of trends in the Spanish novel of the 19th century and their relationship with novels of other major European countries.

Span. 451/551-3. Contemporary Spanish-American Novel. A study of representative Spanish-American novels of the 20th century.

Span. 452/552-3. Golden Age Drama. The study of the works of the principal dramatists of the 17th century.

Span. 453/553-3. Golden Age Prose.

Span. 457/557-3. Hispanic Poetry. A study of the major formal and technical aspects of Hispanic poetry.

Span. 462/562-3. Don Quixote.

Span. 464/564-3. International Literary Relations. (C.Lit. 464/564.) *Fall.*

Span. 493-1 to 4. Languages Internship for Professions. *Fall, Spring.* Enrollment only with instructor's consent. Participants interested in public service or management-oriented careers in government or business will be able to work as interns in public sector agencies or in private industry, on campus or abroad.

Span. 495/595-3. Methods of Teaching Spanish. *Fall, Spring.* Course will familiarize students with current methodology and techniques in foreign language teaching. Peer-teaching coupled with opportunity to teach mini-lessons will provide students with actual teaching experience in the foreign language classroom.

Span. 532-3. Spanish Literature Since the Spanish Civil War. (Denver Campus only.)

Span. 555-3. Spanish Contemporary Novel. Eight or nine Spanish novels of special significance published since the Spanish Civil War will be analyzed and placed in historical perspective. An attempt to understand the leading literary, philosophical, and political currents of contemporary Spain will be made.

Span. 556-2. Spanish-American Theatre.

Span. 559-2. Twentieth-Century Spanish Drama. Beginning with Benavente and ending with contemporary playwrights, the leading figures and works of the Spanish theatre of this century will be studied. An effort to understand Spanish theatre as part of the larger European scene will be made.

Span. 591-3. Testing Foreign and Second Language Skills. Provides both knowledge and skills for testing learning or acquisition of another language. Divided equally, it deals with different ways to test linguistic skills, with test theory and research, and with standardized and commercial F.L. instruments.

Span. 594-3. Teaching Culture in the Foreign/Second Language Classroom. Familiarization with current views on culture and its role in foreign language teaching. Students will learn to identify important cultural aspects and various techniques to teach them.

Span. 595-3. Methods of Teaching Spanish.

Span. 598-2. Educational Media in the Foreign Language Classroom. This course is designed to familiarize the foreign language teacher with the technique of selection, preparation and application to multimedia aids in the teaching of foreign languages.

Span. 605-3. Spanish Phonology. Theories on Spanish phonology from classical phonemics to generative and natural generative phonology. An examination of recent theories as they relate to major Spanish dialects.

Span. 606-3. Spanish Syntax. An examination of contemporary theories of syntax as they apply to Spanish. A detailed study of major grammatical topics concerning Spanish.

Span. 610-3. History of the Spanish Language. The evolution of Latin to Spanish. Analysis of the linguistic impact of other languages on Spanish lexicon.

Span. 611-3. Seminar in Hispanic Literature I. Selected topics in Spanish literature.

Span. 612-3. Seminar in Hispanic Literature II. Selected topics in Spanish American literature.

Span. 614-3. Medieval Spanish Literature. Study of medieval works, authors and themes. Principal influences from other literatures. Reading in Old Spanish.

Span. 633-3. Golden Age Drama. The development of the Spanish *comedia* during the 17th century, as revealed in the works of the major dramatists and some of their less known imitators; the Spanish *comedia* as an application of a dramatic theory and the culmination of a dramatic tradition.

Span. 635-3. The Spanish-American Novel and Short Story to World War II. A study of the development of the novel and short story prior to World War II.

Span. 636-3. The Spanish-American Novel and Short Story From World War II to the Present. A study of the development of the novel and short story from World War II to the present.

Span. 637-2. Spanish-American Literature of the Colonial and Independence Periods. A study of selected authors and works of the period of the discovery, the colonial period, and the period of independence.

Span. 650-3. Spanish-American Poetry From Modernism to the Present. A study of principal movements and tendencies of Spanish American poetry from 1920 to the present, including principal authors and representative works.

Span. 651-3. Nineteenth-Century Drama In Spain. The study of the works of the principal dramatists of the 19th century from Romanticism to the early works of Benavente, inclusive.

Span. 652-2. Romances.

Span. 653-3. Seminar: Spanish Peninsular Poetry. A study of principal movements and tendencies of Spanish 12th-century poetry including principal authors and representative works.

Span. 654-3. Picaresque Novel. The study in depth of the major representative picaresque novels of the 17th century with particular attention to origins and development of the genre, their function as a comment on society of the period, and their impact on future novelistic development.

Span. 655-3. Spanish Contemporary Novel. Emphasis is on the major trends and characteristics of the Spanish novel since 1942 until the present, with special study of seven or eight selected novels of that period.

Span. 663-2. Spanish-American Essay.

Span. 691-3. Seminar: Hispanic Linguistics. A major topic from an important area such as phonology, syntax, history of the Spanish language, Hispanic linguistics and literature, or applied Hispanic linguistics will be announced. This topic will be studied in detail during the semester.

Span. 695-3. Seminar: Language and Language Learning. Topics such as bilingual education, psychology of second-language acquisition, will be the focus of each seminar. One topic per course.

Span. 700-4. Master's Thesis.

Span. 705-3. Spanish Historical Grammar. Grammar. Tracing the development of Vulgar Latin to Romance to Old Spanish to Modern Spanish. Study of phonological, morphological and syntactical developments.

Span. 712-2. Seminar: Major Figures of Spanish-American Literature.

Span. 713-2. Seminar: Major Figures in Spanish Peninsular Literature.

Span. 800-1 to 10. Doctor's Thesis.

Span. 910-1 to 3. Independent Study.

Span. 940-1 to 3. Independent Study.

Span. 950-1 to 3. Independent Study.

Span. 960-1 to 3. Independent Study.

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. 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. Topics: Luso-Brazilian Civilization. *Fall.* Prer., two years of any other romance language.

Port. 404/504-3. Topics: Luso-Brazilian Civilization. *Spring.* 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. 940-1 to 3. Independent Study.

Port. 950-1 to 3. Independent Study.

THEATRE AND DANCE

Theatre

Thtr. 111-3. Introduction to Drama. Reading and analysis of plays.

Thtr. 270-3. Introduction to Theatre. 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. Special sections are available for theatre majors only.

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. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.

Thtr. 322-1 to 3. Practicum in Technical Theatre. Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.

Thtr. 323-1 to 3. Practicum in Theatre Management. Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.

Thtr. 324-1 to 3. Practicum in Acting. Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.

- Thtr. 325-1 to 3. Practicum in Playwriting.** Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.
- Thtr. 326-1 to 3. Practicum in Directing.** Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser.
- Thtr. 327-1 to 3. Practicum in Theatrical Make-up.** Practical production projects within the designated area of theatre. Theatre majors may repeat course to a maximum of 8 credits with consent of departmental adviser. 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. Section 801 for theatre majors only, available by audition.
- 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.** Explores the element of dress as a part of the dramatic event. Theoretical and practical projects are used to understand 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. 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 with consent of departmental adviser. Prer., Thtr. 321.
- 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 with consent of departmental adviser. Prer., Thtr. 322.
- 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 with consent of departmental adviser. Prer., Thtr. 323.
- 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 with consent of departmental adviser. Prer., Thtr. 324.
- 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 with consent of departmental adviser. Prer., Thtr. 325.
- 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 with consent of departmental adviser. Prer., Thtr. 326.
- 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. Prer., Thtr. 327. Not offered every year. See *Schedule of Courses*.
- 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. Course available by audition only.
- 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.** The study and practice of scenic design with an emphasis on the study of design theory, color, and space. Special emphasis is placed on two-dimensional and three-dimensional presentation of ideas.
- Thtr. 477/577-3. Costume Design.** Study and application of the principles of design as applied to stage costume with special emphasis on the two-dimensional presentation of ideas. Prer., Thtr. 377 or consent of instructor.
- Thtr. 479-3. Theatre Practice (Music Theatre).** Study of and participation in various styles of dance in music theatre.
- 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. 484/584-3. Acting IV.** A concentrated study of one or two major styles of acting in the Oriental and Occidental theatres, such as Greek, Shakespearean, Restoration, Peking Opera, Kabuki, Noh, Classical Indian, etc. To be offered whenever a specialist of a particular acting style is in residence. Prer., Acting III or 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.
- 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. 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. Course available by audition only.
- 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 play and presentation before an audience under supervision of instructor. Prer., Thtr. 474 or 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. 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.

Thtr. 930-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 940-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 950-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 960-1 to 3. Independent Study. Prer., written consent of instructor.

Thtr. 970-1 to 3. Independent Study. Prer., written consent of instructor.

Interpretation

Intp. 250-3. Introduction to the Art of Oral Interpretation. Analysis and performance of plays and short stories.

Intp. 350-3. Oral Interpretation of Literature. Analysis and performance of narrative and lyric poetry, dramatic monologue, and verse drama. Prer., Intp. 250 or consent of instructor.

Intp. 352-3. Voice. Intense concentration upon the understanding, training, and effective use of the vocal instrument.

Intp. 450/550-3. Advanced Oral Interpretation. Analysis and performance of fiction and nonfiction. Emphasis upon scripting and ensemble performance.

Intp. 451/551-3. Advanced Oral Interpretation. Analysis and performance of poetry. Focus on modern poetry. Scripting and choric performance included.

Intp. 452/552-3. Dramatic Interpretation: Tragedy. Theory of tragedy as basis for analysis, scripting, and performance of literature. Relationship of world view and dramatic style. Focus upon selected periods and playwrights, including the Greeks and Elizabethans.

Intp. 453/553-3. Dramatic Interpretation: Comedy. Theory of comedy as a basis for analysis, scripting, and performance of literature. Relationship of world view and dramatic style. Focus upon selected periods and playwrights, including Moliere, Shaw, and Chekhov.

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. 598-1 to 3. Recital-Interpretation.

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. 700-1 to 4. Master's Thesis.

Intp. 930-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 940-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 950-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 960-1 to 3. Independent Study. Prer., written consent of instructor.

Intp. 970-1 to 3. Independent Study. Prer., written consent of instructor.

Dance

Dnce. 151-1. Dance Techniques: Recreational Dance Forms. Open to dance, physical education, and recreation majors, and by consent of instructor.

Dnce. 181-2. Dance Techniques: Ballet. Fall. Open to dance majors and by consent of instructor.

Dnce. 182-2. Dance Techniques: Ballet. Spring. Open to dance majors and by consent of instructor.

Dnce. 183-2. Dance Techniques: Ballet. Fall. Open to dance majors and by consent of instructor.

Dnce. 184-2. Dance Techniques: Ballet. Spring. Open to dance majors and by consent of instructor.

Dnce. 185-2. Dance Techniques: Ballet. Fall. Open to dance majors and by consent of instructor.

Dnce. 186-2. Dance Techniques: Ballet. Spring. Open to dance majors and by consent of instructor.

Dnce. 187-2. Dance Techniques: Ballet. Fall. Open to dance majors and by consent of instructor.

Dnce. 188-2. Dance Techniques: Ballet. Spring. Open to dance majors and by consent of instructor.

Dnce. 191-2. Dance Techniques: Modern Dance. Fall. Open to dance majors and by consent of instructor.

Dnce. 192-2. Dance Techniques: Modern Dance. Spring. Open to dance majors and by consent of instructor.

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.

Dnce. 196-2. Dance Techniques: Modern Dance. Spring. Open to dance majors and by consent of instructor.

Dnce. 197-2. Dance Techniques: Modern Dance. Fall. Open to dance majors and by consent of instructor.

Dnce. 198-2. Dance Techniques: Modern Dance. *Spring.* Open to dance majors and by consent of instructor.

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. 380-3. 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. 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. 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, 314, 380, 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. 492/592. History of Dance in the 20th Century. *Spring.* Development of modern dance from Isadora Duncan to the present through lectures, discussions, critical reviews, and films.

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. 494-3. 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. 579-1 to 3. Dance Practice.

Dnce. 589-2. Problems in Dance.

Dnce. 592-3. History of Dance in the 20th Century. *Spring.* Same as Dnce. 492 plus a graduate paper.

Dnce. 594-3. Dance Repertory. Same as Dnce. 494 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. Prer., Dnce. 497 or consent of instructor. Not offered each year. Check current *Schedule of Courses*.

Dnce. 598-1 to 3. Studio Concert. Prer., consent of instructor.

Dnce. 600-2. Readings in Dance. A survey of dance literature.

Dnce. 610-2 to 4. Choreography. Advanced compositions choreographed and presented for public performance and criticism.

Dnce. 615-3. 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. 620-2. 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. 624-2. Problems in Organization and Administration of Performing Groups. Not offered each year. Check current *Schedule of Courses*.

Dnce. 700-4. Master's Thesis.

Dnce. 930-1 to 3. Independent Study. Prer., written consent of instructor.

Dnce. 940-1 to 3. Independent Study. Prer., written consent of instructor.

Dnce. 950-1 to 3. Independent Study. Prer., written consent of instructor.

Dnce. 960-1 to 3. Independent Study. Prer., written consent of instructor.

Nonmajor Dance Courses

Not offered every year. Check current *Schedule of Courses*.

Dnce. 101-1, 102-1, 103-1, 104-1. Beginning Ballet.

Dnce. 105-1, 106-1. Intermediate Ballet.

Dnce. 107-1, 108-1. Advanced Ballet.

Dnce. 131-1, 132-1, 133-1, 134-1. Jazz Dance.

Dnce. 141-1, 142-1. Beginning Modern Dance.

Dnce. 143-2, 144-2. Intermediate Modern Dance.

Dnce. 145-2, 146-2. Advanced Modern Dance.

WOMEN STUDIES

Wm.St. 200-3. Introduction to Women Studies. The variety of women's roles and statuses are examined from an interdisciplinary and cross-cultural perspective with the goal of generating and evaluating various theoretical explanations for the differential access to power of women and men. Includes consideration of psychology and physiology, sex roles and socialization, marriage and the family, work and economics, history and social change.

Wm.St. 201-3. Contemporary Issues. Examines current social, political, and economic issues related to women. Includes consideration of women of all social classes and ethnic backgrounds, primarily in the United States. Possible topics include violence against women, women in the labor force, reproductive freedom, women in poverty, sexuality, the women's movement. Prer., Wm.St. 200.

W.S. 300-3. Women Studies Practicum. Students work on special projects in community agencies serving women. Work in the agencies, together with class discussions, lectures and reading, provide students with a way to integrate women studies theory with the practical experience of working with community women.

W.S. 400-3. Seminar: Special Topics. Advanced interdisciplinary course, organized around a specific topic, problem, or issue relating to women in culture and society (such as women and public policy, women's role in world development, women and work). Course work includes discussion, reading, and written projects.

Wm.St. 402-3. Research Seminar. Students work in groups on research projects related to women (such as oral histories or women in management). Projects are designed to introduce students to basic research techniques, to develop research skills, and to contribute to knowledge of contemporary and historical Rocky Mountain women.

Wm.St. 940-variable credit. Independent Study. Provides students with an opportunity to do interdisciplinary independent work in the area of women studies. For more information, contact the Women Studies office.

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 accounting systems for business organizations; cost analysis 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. 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 ef-

forts, 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. 960-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 ENVIRONMENT AND POLICY

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 108.

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 interrelationships 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. Helpful to have Math. 107 and 108 or equivalent.

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. 960-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. 660.

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. 500-3. Improvement of Instruction in Business Education. This course is intended to update experienced teachers from both high schools and colleges in current materials and methods in the skills as well as general areas of business.

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. 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. 960-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

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.

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. 960-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. 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. 215 or equivalent.

I.S. 470/570-3. 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. 350, 465/565, or equivalent.

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. 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. 960-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; advertising 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, and 6 additional hours in marketing.

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 advertis-

ing, 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. 960-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. 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.

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 in small work groups in organizations. Focuses on how and why individuals act as they do in interpersonal relationships and in small groups. Develops interpersonal and small group skills. 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 Work Organizations. Explores the impact of key management and behavioral science theories, concepts, and practices on individual productivity, satisfaction, growth, and development. Prer., B.Ad. 640 or equivalent.

Or.Mg. 632-3. Managing Behavior in Task Groups. A study of interpersonal competence in organizations. Topics include group formation and development, leadership, power, conflict, conformity, cohesiveness and task effectiveness. Prer., B.Ad. 640 or equivalent.

Or.Mg. 636-3. Organization Design. Design of organization structure and its impact on organizational processes. Analysis of alternative organization patterns and factors affecting organization design. 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 HUMAN RESOURCES

PHR 434/534-3. Labor and Employee Relations. Analysis of legal, political, social, and managerial aspects of collective bargaining and employee relations. Prer., Or.Mg. 330 or B.Ad. 504.

PHR 438/538-3. Personnel Administration: Employment. Study of development and implementation of personnel systems, with emphasis on job analysis, selection, and performance appraisal. Prer., Q.M. 201 and Or.Mg. 330 or B.Ad. 504.

PHR 439/539-3. Personnel Administration: Legal and Social Issues. Study of legal issues related to equal employment opportunity, affirmative action, occupational safety and health, and compensation, with emphasis on program implementation and evaluation. Reviews legal questions, guidelines and procedures, and regulatory agencies. It is recommended that students take PHR 434 and 438 before this course. Prer., Or.Mg. 330 or B.Ad. 504.

PHR 441/541-3. Personnel Administration: Planning, Development, and Compensation. Study of human resource planning models, developing human resources, and compensation systems. Includes internal and external equity, budgeting, and analysis of employee benefit systems. Prer., PHR 438/538.

PHR 634-3. Seminar: Labor and Employee Relations. Issues in all areas of industrial, labor, and employee relations. Emphasis on research findings in industrial, labor, and employee relations through applied problems, NLRB and court decisions, arbitration cases, and conflict management models. Prer., PHR 534 or B.Ad. 640.

PHR 638-3. Seminar: Personnel Administration. Issues in all areas of personnel administration. Emphasis on research findings on human resources applications through applied models, survey methods, and other applied behavioral concepts. Prer., PHR 538 or 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; Prer., Q.M. 201. Open to Juniors only.

Pr.Mg. 440/540-3. Production and Inventory Planning and Control. Study of the design, implementation, and control of integrated production and inventory planning and control systems. Topics include demand forecasting, capacity planning and master scheduling, inventory management, material requirements planning, and shop floor controls. Organizations studied include manufacturing, service (including urban services), and government. It is recommended 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, Measurement, and Productivity Management. Study of the design of jobs in manufacturing, service, and public organizations. Topics include job specialization versus job enlargement, work measurement, determining job standards, job health and safety, the impact of automation on job design, and productivity measurement and management systems. 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, consulting with local organizations, and other experiential activities. It is recommended that graduate students take Pr.Mg. 647 in lieu of this course. Prer., Pr.Mg. 440/540.

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. 960-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, 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. Objectives and models of operations research and their application in a managerial setting. Inventory models and control, simulation, linear programming topics, network models. Prer., Q.M. 201.

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 and Development. 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. 305 for undergraduates; R.Es. 300 or equivalent and Fin. 305 or equivalent 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. 960-variable credit. Independent Study. With the consent of instructor under whose direction the study is undertaken.

School of Education

UNDERGRADUATE TEACHER EDUCATION

T.Ed. 200-3. Writing for Your Profession. This course is designed to help individuals in business and the professions improve their writing. Special attention is given to report writing and correspondence.

T.Ed. 300-3. Career Life Planning. Designed for the student whose career plans are uncertain. Focuses on identification and understanding of one's abilities, interests, and experiences. Emphasis on self-exploration, field experience, and effective job search strategies.

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. 320-1 to 3. Expressive Arts in the Elementary School. An exploration of the expressive arts for the consumer and the place of art, music, health, and physical education in the elementary school classroom.

T.Ed. 375-1 to 4. School-Based Group Tutorial I. Teaching experience in small groups in an elementary or secondary school setting.

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 Law and Freight Claims Procedures. An analysis of the legal aspects of the transportation systems. Issues include carrier liability, transportation contracts, damages, freight claim preparation, licensing, and practicing before regulatory agencies. Prer., 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. 960-variable credit. Independent Study. With consent of instructor under whose direction the study is undertaken.

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, educational media, etc. For junior and senior high school levels.

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, mainstreaming, 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. 460-5. Instructional Assistant Laboratory—Elementary. A variety of experiences and assignments in the public schools.

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. 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.

EDUCATION

Educ. 500-3. 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.

Educ. 501-3. 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.

Educ. 502-3. 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.

Educ. 503-3. Basic Statistical Methods. Introduction to descriptive statistics including graphic presentation of data, measures of central tendency and variability; correlation and prediction; and basic inferential statistics, including the t-test and one-factor analysis of variance.

Educ. 504-3. Introduction to Disciplined Inquiry. Consideration of various research approaches and methodologies including experimental and quasi-experimental methods; anthropological and case study methods; evaluative research and field studies; correlational and ex post facto research; and sociological, historical, and philosophical research. Topics will include information retrieval and library research, the role of the computer, research criticism, and proposal writing.

Educ. 505-3. 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.

Educ. 506-3. Mirrors and Models. Investigation and development of systems for analyzing the teaching-learning process.

Educ. 507-3. Elementary School Curriculum. An integrating course dealing with the history, development, problems, and practices of the curriculum of the elementary school.

Educ. 508-3. 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.

Educ. 509-3. Junior and Senior High School Curriculum. Principles, trends, problems, and practices in the curriculum of the junior and senior high schools.

Educ. 510-3. 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.

Educ. 511-3. Advanced Child Growth and Educational Development. A review of knowledge of human growth and applications of this knowledge. Prer., Educ. 501.

Educ. 512-3. 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., Educ. 501.

Educ. 513-3. 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.

Educ. 514-3. 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.

Educ. 515-3. Kindergarten Education. The kindergarten movement. Characteristics of young children. Testing and evaluation. Parent-teacher cooperation.

Educ. 516-3. Children's Literature. Reading and evaluation of books for children, children's interests in reading, important authors and illustrators, poetry, folk literature, and trends.

Educ. 517-2 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.

Educ. 518-3. 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.

Educ. 519-3. 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.

Educ. 520-3. 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., Methods in Elementary Mathematics or its equivalent and elementary teaching experience.

Educ. 521-3. Advanced Science in Elementary Schools. Emphasis on experimental programs and implementation of these newer programs. Supervision and curriculum development considered.

Educ. 522-3. 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.

Educ. 523-3. 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.

Educ. 524-3. 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.

Educ. 525-3. 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.

Educ. 526-3. 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.

Educ. 527-3. Diagnostic and Remedial Techniques of Reading. Causes of low reading ability and techniques employed in teaching the poor reader; diagnosis, motivation, and skills.

Educ. 528-1 or 2. Reading Conference. Visiting authorities in reading, lectures, demonstrations, discussion groups, films, exhibits, field trips, etc.

Educ. 529-3. Teachers, Materials, and Learning. Provides experienced elementary and preschool teachers with an opportunity to become involved, at an advanced adult level, with a range of concrete materials in sciences, arts, and social studies, and to discuss the implications of their own learning for their work in schools.

Educ. 530-3. Introduction to Research in Reading, English, and Language Arts, K-12. Aim and objectives: the language arts skills — reading, writing, speaking, listening; literature for adolescents; English as a second language. For experienced teachers. Required seminar for master's students in reading, English, and language arts. May be repeated.

Educ. 531-3. Pro-Seminar in Reading, English, and Language Arts, K-12. With a different focus each semester, this course may be taken more than once by M.A. students who wish to study various aspects of reading, children's literature, adolescent literature, language skills, and oral and written composition.

Educ. 532-3. Literature for Adolescents. Reading and evaluation of books for junior and senior high school pupils. Emphasis on modern literature.

Sec.E. 532-4. Pro-Seminar 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.

Educ. 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.

Educ. 535-3. 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.

Educ. 536-3. Curriculum in Secondary Mathematics. Investigation of curriculum projects in secondary school mathematics, program development, history and trends, program and course objectives, and pertinent research.

Educ. 537-3. 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.

Educ. 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.

Educ. 539-3. 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.

Educ. 540-3. Special Topics. Designed to meet needs of graduate students with topics of pertinent interest.

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Educ. 543-3. Skill Development in Experiential Education. A field-based course designed to upgrade the outdoor skills and the ability to use alternative living environments for the outdoor educator, the traditional classroom teacher, and the alternative educator. Colorado's mountains, rivers, and urban environment are utilized in the class.

Educ. 544-3. Theory and Practice of Experiential Education. An introduction to the theoretical underpinnings in philosophy, psychology, and the natural and social sciences of the experiential and alternative education movements. Practical applications in schools and public and private agencies are observed and analyzed.

Educ. 545-3. Bilingual and Multicultural Education. Includes various components of bilingual education curricula methodology. 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.

Educ. 546-3. Materials and Methods in Bilingual/Multicultural 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.

Educ. 547-3. Preschool Through College Curriculum for Bilingual/Multicultural Education. An analysis of curriculum

programs and the application of principles and innovation for the education of ethnic-racial students at all levels of school.

Educ. 548-3. The Teaching of Reading in Bilingual and Multicultural Education. Comparative analysis of current and emerging philosophies, programs, materials, and instructional practices for the teaching of reading in the bilingual classroom.

Educ. 549-3. Research and Evaluation in Social and Multicultural Foundations. A course designed to meet the evaluation and research needs of practicing educators, with an emphasis on statistical and naturalistic observational techniques, and designing and constructing evaluation instruments. It is specifically geared to the needs of those working in such nontraditional settings as the bilingual classroom, alternative school, outdoor educational environment, in addition to the needs of the traditional classroom teacher.

Educ. 551-3. 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.

Educ. 552-3. Laboratory in Personal Appraisal. Taken in conjunction with Educ. 551, 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.

Educ. 553-3. 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., Educ. 551 and 552.

Educ. 554-3. 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., Educ. 551, 552, and 553.

Educ. 555-3. 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. Prer., completion of Educ. 551, 552, and 553, and either completion or concurrent enrollment in Educ. 554 and instructor consent.

Educ. 556-3. Counseling Strategies in Agency Settings. Explores the role and function of the counselor in agency settings with emphasis on the underlying historical and theoretical concepts.

Educ. 557-3. 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.

Educ. 558-3. Introduction to Educational Technology. 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.

Educ. 559-3. 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.

Educ. 560-3. 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.

Educ. 561-3. 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.

Educ. 562-3. Administration of Education Technology 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.

Educ. 563-3. Research in Educational Technology. 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.

Educ. 564-3. Computers in Education. Designed to provide educators, preservice and in-service with literacy in modern educational computing technology. Content will focus upon instructional and administrative computing applications with hands-on experiences stressed.

Educ. 565-3. Survey of Exceptional Children. Types of physically, mentally, and socially handicapped children; methods of diagnosis; suggested educational adjustments; and teaching techniques.

Educ. 566-3. Introduction to the Gifted Student. Assists the teacher in identifying, understanding, and challenging children with unusual abilities.

Educ. 567-3. 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.

Educ. 568-3. Education of the Mentally Retarded. Study of characteristics and needs of educable and trainable mentally retarded children.

Educ. 569-3. Characteristics of the Emotionally Disturbed. One two-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.

Educ. 570-3. Introduction to Learning Disabilities. One two-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.

Educ. 572-3. Methods for the Emotionally Maladjusted Child. One two-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.

Educ. 573-3. Research and Evaluation in Special Education. One two-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.

Educ. 574-3. 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.

Educ. 575-3. Methods and Materials for the Learning Disabled. Teaching strategies and materials in psychomotor, perception, memory, cognition, language, and academic areas for the learning disabled.

Educ. 576-3. Consulting with Preservice Student Teachers. Working with and supervising preservice education student teachers who are doing case studies with mildly handicapped learners.

Educ. 577-3. International and Comparative Education. A comparative study of education in other countries, with an emphasis on the role of education in developing nations. Political, social, and economic policies and ideologies are analyzed for their relevance to the development process.

Educ. 578-3. Individualizing Instruction. An individualized course which aids teachers in individualizing programs in their schools.

Educ. 579-3. Adolescent Psychology for the Teacher. A review of selected topics in adolescent behavior.

Educ. 580-3. 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., Educ. 501.

Educ. 581-3. Analysis of Learner Behavior. A systematic survey of current theory in motivation and learning with emphasis on analysis of classroom behavior. Prer., Educ. 501.

Educ. 582-3. 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.

Educ. 583-3. Sociological Perspectives of Education. 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.

Educ. 584-3. Pro-Seminar in the 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.

Educ. 585-3. 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.

Educ. 586-3. 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.

Educ. 587-3. 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.

Educ. 588-3. 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.

Educ. 589-2. Seminar: School Administration. Students develop and analyze case studies using organizational behavior concepts.

Educ. 590-3. Administration of Special Programs. A course designed to meet the needs of persons administering special programs in such areas as bilingual education, experiential/alternative and outdoor institutions, and special education.

Educ. 591-2. Educational Supervision. Stimulation and guiding the in-service professional growth of teachers. Evaluation of teacher activities in relation to pupil growth. Supervisory procedures and techniques.

Educ. 592-3. Organization and Administration of Reading Programs. Identifying, selecting, organizing classroom procedures and materials for general and remedial instruction, K-12.

Note: The five workshop numbers below are designed to provide areas where the unique needs and interests of teachers and educational leaders may be presented. The length of the workshop may vary from one to five weeks.

Educ. 593-1-4. Workshop in Educational Administration, Supervision, and Curriculum.

Educ. 594-1-4. Workshop in Research and Evaluation Methodology.

Educ. 595-1-4. Workshop in Instruction and Curriculum in Content Areas.

Educ. 596-1-4. Workshop in Social, Multicultural, and Bilingual Foundations.

Educ. 597-1-4. Workshop in Educational and Psychological Studies.

Educ. 600-3. 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., Educ. 504.

Educ. 601-3. 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., Educ. 600.

Educ. 602-3. 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., Educ. 601; some proficiency in matrix algebra and a background in mathematical statistics is desirable.

Educ. 603-3. Methods of Survey Research and Assessments. Theory and techniques involved in each stage of survey research, including problem formulation, questionnaire development, interview surveys, assessing reliability and validity, sampling plans, data reduction (e.g., factor analysis), and analysis of continuous and categorical data. Prer., Educ. 600 or consent of instructor.

Educ. 604-3. Methods of Naturalistic Research. Psychological and philosophical basis of naturalistic inquiry (i.e., ethnography, case study, field work) in educational research. Methods of observation, in-depth interviewing, documentary analysis, data analysis, confirmation and narration. Reading of exemplary works. Prer., Educ. 600 or instructor consent.

Educ. 605-3. Psycho-Educational Diagnostics I. Individual appraisal of human abilities; interpretation and application of individual intelligence data in the school setting. Prer., Educ. 503 and one previous graduate course in measurement and appraisal.

Educ. 606-3. Psycho-Educational Diagnostics II. Personal appraisal of the individual with emphasis upon educational application of projective personality data. Prer., consent of instructor.

Educ. 607-3. 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., Educ. 502, 601, or consent of instructor.

Educ. 608-3. 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., Educ. 502, 504 or consent of instructor.

Educ. 609-3. 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.

Educ. 610-3. 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.

Educ. 612-3. 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.

Educ. 613-2. Problems in Junior High School/Middle School Education. Case studies and seminar approach to theory and practice on an advanced level.

Educ. 614-2. Student Activities Curriculum. Principles, problems, and procedures for improvement of extra-class activities, student councils, home rooms in the secondary school, etc.

Educ. 615-3. Curricular Theories. Intensive study of current theories of public school curriculum related to trends in actual practices in elementary and secondary schools.

Educ. 616-3. 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. Includes work in the theory of evaluation, the methodology of evaluation, and practicum in evaluation of curricula. Prer., one course in curriculum.

Educ. 618-3. Curriculum Construction. Methods of constructing and revising curricular programs. Procedures for securing and utilizing data concerning educational needs in curriculum decision-making.

Educ. 619-3, 620-3, 621-3. Special Topics. Designed to meet needs of graduate students with topics of pertinent interest.

Educ. 622-3. Research Analysis in Reading, English, and Language Arts. Required of all doctoral candidates. Critical analysis and evaluation of published research studies in reading, English, and language arts; principles of internal and external validity; and preparation of critique abstracts.

- Educ. 623-3. 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.
- Educ. 624-3. 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.
- Educ. 625-3. 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.
- Educ. 626-3. 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.
- Educ. 627-3. Educational Media Research and Evaluation.** Surveys 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.
- Educ. 628-3. History and Philosophy of Education.** Traces the development of educational theory and practice from ancient times to the present day with an emphasis on contemporary philosophies and trends.
- Educ. 629-3. Research in Social and Multicultural Foundations.** An analysis of research in the social and multicultural foundations, with an emphasis on bilingual, multicultural, sociological, experiential, and philosophical research.
- Educ. 630-3. Teaching Internship in Social, Multicultural, and Bilingual Foundations.** A one-semester teaching internship in undergraduate or graduate foundations course. For social foundations doctoral students only.
- Educ. 631-3. Advanced Practicum in Counseling.** Supervised counseling experience, report writing, and case staffing procedures with emphasis on professional staff collaboration.
- Educ. 632-3. 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.
- Educ. 633-3. 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.
- Educ. 634-2. 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.
- Educ. 635-2. 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.
- Educ. 636-3. Administration and Supervision of the Elementary School.** For administrators and teachers. Purposes, practices, and trends in administration and educational leadership.
- Educ. 637-3. Administration and Supervision of Middle Level and Secondary Schools.** Current administrative principles and practices essential to effective organization and management, with emphasis on the educational leadership of the principal.
- Educ. 638-2. 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.
- Educ. 639-3. 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.
- Educ. 640-2. School Business Management.** Planning processes in education; specifying activities; budget account systems; cost-effectiveness studies; management function and roles. Prer., Educ. 585 and 588.
- Educ. 641-3. 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.
- Educ. 642-2. 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.
- Educ. 643-2. 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.
- Educ. 644-3. 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.
- Educ. 645-3. Introduction to the Study of Higher Education.** Background and development of American higher education, including organization, personnel, curriculum and related issues, problems and trends. Prer., T.Ed. 646, 648, 677.
- Educ. 646-3. Topics in Higher Education.** Analysis of specific current issues in areas other than governance. Prer., consent of instructor.
- Educ. 648-4. Planning and Budgeting in Higher Education.** 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.
- Educ. 649-3. 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.
- Educ. 650-3. 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.
- Educ. 651-3. 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.
- Educ. 653-3. Pro-Seminar in Research in Instruction and Curriculum.** Weekly discussion of current research.
- Educ. 654-3. 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., Educ. 600.
- Educ. 655-3. Seminar: Research Methodology.** Offered alternate years. Selected topics for advanced study in educational research, statistics, measurement, and evaluation. Prer., Educ. 601.
- Educ. 656-2. Seminar: Elementary Education.** Students work on individual topics and report orally and in writing. Prer., instructor consent.
- Educ. 657-2. 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.
- Educ. 658-2. Research Seminar in Secondary Education.** Survey of landmark and major contemporary research literature of secondary education. Design, data collection, analysis, and conclusions for non-psychological research. Critiques of methods studies. Prer., Educ. 503 and 504.
- Educ. 659-2. Seminar: Science Education.** For advanced students in this subject area. Individual topics and research. Prer., Educ. 521 or 537 and teaching experience.
- Educ. 660-2. 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 Educ. 520 or 535 and teaching experience.

Educ. 661-3. 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.

Educ. 662-3. 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.

Educ. 663-2. Seminar: Junior and Senior High School Education. For advanced students. Problems, theories, and trends in secondary education. Includes field work and individual projects.

Educ. 664-3. Seminar in Bilingual and 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.

Educ. 665-3. Seminar in Experiential Education. A seminar for advanced students, analyzing current theories and practices in experiential programs in traditional public and alternative school settings.

Note: Prerequisite for enrollment in Educ. 667, 668, 669, 670, 671, and 672, is admission to a doctoral program in the School of Education.

Educ. 667-3. Seminar: Guidance. Specific topics will depend on needs and interests of students in any particular class.

Educ. 668-3. Seminar: Advanced Counseling Theory. Comparative evaluation of differing theoretical systems and constructs relevant to counseling application.

Educ. 669-3. Seminar: Counseling Research. In-depth study and analysis of published research in counseling.

Educ. 670-3. Seminar: College Student Personnel Administration. Research and problems in the organization, administration, and evaluation of student personnel services in institutions of higher education.

Educ. 671-3. 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.

Educ. 672-3. 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.

Educ. 673-3. Seminar: Learner Behavior. Intensive study of selected topics in the analysis and modification of human behavior in educational situations. Prer., Educ. 581 and consent of instructor.

Educ. 674-3. Seminar: Human Learning. Intensive study of selected topics in cognition and memory, with applications to educational situations. Prer., Educ. 512 and consent of instructor.

Educ. 675-3. Seminar: Human Development. Intensive study of selected topics in growth and development, with applications to educational situations. Prer., Educ. 511 and consent of instructor.

Educ. 676-3. Seminar: Special Education. Problems approach to issues of learning disorders (emotionally disturbed and/or learning disabled). Prer., consent of instructor.

Educ. 677-2. Seminar: Higher Education. Analysis of specific problems and practices in the field of higher education. Open only to students with previous course work or experience in higher education. (May be taken twice for 2 semester hours credit each enrollment.) Prer., consent of instructor.

Educ. 678-3. Seminar: School Psychology. Selected topics in the field of school psychology including consideration of current practice and literature. Prer., consent of instructor.

Educ. 679-3. Research Seminar: Educational Psychology. Intensive review of special topics in the application of psychological science to educational practice. Prer., Educ. 501.

Educ. 680-3. Seminar: Social Foundations of Education. This course is designed for doctoral students in any specialization in education and focuses on social science perspectives on education (e.g., sociology, anthropology, political science, economics).

Educ. 681-3. Advanced Seminar: School Law. An in-depth examination of the American legal process as it pertains to administra-

tion, planning, and delivery of educational programs. Involves self-selected research followed by individual or group presentations.

Educ. 682-2. Doctoral Seminar: Curriculum. Advanced course relating to theory and practice in curriculum-building. Includes both elementary and secondary levels.

Educ. 683-2. Doctoral Seminar: Junior High School/Middle School Education. For advanced students. Problems, theories, and trends in secondary education. Includes field work and individual projects.

Educ. 684-2. Seminar: Educational Supervision. Students work on individual topics and report orally and in writing.

Educ. 685-2. 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.

Educ. 700-4. Master's Thesis.

Educ. 701-2. Master of Education Report.

Educ. 750-1 to 4. Readings in Administration, Supervision, and Curriculum.

Educ. 751-1 to 4. Readings in Research and Evaluation Methodology.

Educ. 752-1 to 4. Readings in Instruction and Curriculum in Content Areas.

Educ. 753-1 to 4. Readings in Social, Multicultural, and Bilingual Foundations.

Educ. 754-1 to 4. Readings in Educational and Psychological Studies.

Educ. 755-1 to 4. Practicum in Administration, Supervision, and Curriculum.

Educ. 756-1 to 4. Practicum in Research and Evaluation Methodology.

Educ. 757-1 to 4. Practicum in Instruction and Curriculum in Content Areas.

Educ. 758-1 to 4. Practicum in Social, Multicultural, and Bilingual Foundations.

Educ. 759-1 to 4. Practicum in Educational and Psychological Studies.

Educ. 760-1 to 4. Educ. 761-1 to 4. Practicum I and II: The Educationally Handicapped. Supervised field experiences with learning-disordered children (emotionally disturbed and/or learning disabled). Full time for eight weeks, minimum 320 clock hours. Prer., consent of instructor.

Note: Prerequisite for enrollment in Educ. 762, 763 and 764 is the completion of Educ. 551, 552, and 553 and either completion or concurrent enrollment in Educ. 554 and instructor consent.

Educ. 762-3. 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.

Educ. 763-3. 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.

Educ. 764-3. 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.

Educ. 765-4, 766-4. Reading Clinic Procedures I, II. Supervised diagnosis of reading problems; evaluation instruments; pertinent research; case study approach. Prer., Educ. 527 or consent of instructor.

Educ. 785-6. Practicum in Secondary Guidance. Provides in-depth practical experience in counseling in secondary schools.

Educ. 786-6. Practicum in Agency Counseling. In-depth, supervised practical experience in counseling in agency settings.

Educ. 787-6. Practicum in College Student Personnel. Supervised practice in college student personnel work.

Educ. 800-1 to 10. Doctor's Thesis.

Educ. 801-0 to 8. Doctor of Education Dissertation.

Educ. 950-1 to 4. Independent Study.

Educ. 951-1 to 4. Independent Study in Administration, Supervision, and Curriculum—Master's.

Educ. 952-1 to 4. Independent Study in Instruction and Curriculum in Content Areas—Master's.

Educ. 953-1 to 4. Independent Study in Social, Multicultural, and Bilingual Foundations—Master's.

Educ. 954-1 to 4. Independent Study in Educational and Psychological Studies—Master's.

Educ. 960-1 to 4. Independent Study.

Educ. 961-1 to 4. Independent Study in Administration, Supervision, and Curriculum—Doctor's.

Educ. 962-1 to 4. Independent Study in Research and Evaluation Methodology—Doctor's.

Educ. 963-1 to 4. Independent Study in Instruction and Curriculum in Content Areas—Doctor's.

Educ. 964-1 to 4. Independent Study in Social, Multicultural, and Bilingual Foundations—Doctor's.

Educ. 965-1 to 4. Independent Study in Educational and Psychological Studies—Doctor's. Prer., permission of instructor required on all internships.

Educ. 980-1 to 4. Internship in Administration and Supervision. Educ. 981-1 to 4. Internship in Research and Evaluation Methodology.

Educ. 982-1 to 4. Internship in Instruction and Curriculum in Content Areas.

Educ. 983-1 to 4. Internship in Social, Multicultural, and Bilingual Foundations.

Educ. 984-1 to 4. Internship in Educational and Psychological Studies.

Educ. 985-1 to 4. Internship in Curriculum.

Educ. 990-0. Candidate for Degree.

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 Science of Flight. Science of flight, its history and fundamental engineering concepts. Basic understanding of lift and drag, airfoils, and aerodynamic shapes. Elements of aircraft performance, stability, and control.

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. 203-3. Mechanics I. (M.E. 281.) Elements of vector algebra, abstract statics of a system of bound vectors, equilibrium of rigid bodies, dynamics of a particle. Prer., sophomore standing.

Aero. 204-3. Mechanics II. (M.E. 282.) Kinematics of rigid bodies, principle of virtual work, kinetics of a system of particles. Prer., Aero. 203.

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. 236.

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. Materials Science. (M.E. 301.) Study of the relationships between atomic properties and internal structure of solids and their physical and engineering properties and study of the physical factors and engineering processes for the control of the mechanical properties of engineering materials. Prer., Phys. 213 and one semester of general chemistry.

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. 341-3. Systems Analysis I. (M.E. 371.) Representation of mechanical and electrical lumped parameter elements and systems, steady-state sinusoidal analysis, integral transform theory. Prer., junior standing.

Aero. 342-3. Systems Analysis II. (M.E. 372.) Mathematical theory of control with applications to mechanical, electrical and hydraulic systems; modeling; feedback design; specifications; stability tests; root locus methods; and frequency response. Prer., Aero. 341 or M.E. 371.

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; A.Math. 236.

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. 430-3. Nuclear Energy Systems. (M.E. 450.) Foundations of nuclear energy systems; review of reactor theory; design and operation; nuclear electric power plants; systems for nuclear auxiliary power; analysis of nuclear energy systems for various applications. Prer., senior standing.

Aero. 447-3. Computational Fluid Mechanics. *Fall.* Numerical solution of fluid mechanics problems involving ordinary and partial differential equations of various types. Prer., C.S. 210/E.E. 210 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 Entry. Atmospheric effects on satellites; atmospheric entry from orbit using several classical theories; the entry corridor; orbit contraction due to atmospheric drag; flight path control during and after entry. Prer., Aero. 403 and 406 or 505 or consent of instructor.

Aero. 505-3. Space Flight Dynamics. Celestial mechanics, space navigation, orbit determination; trajectory design and mission analysis trajectory requirements; orbital transfer and rendezvous. Prer., Aero. 406 or consent of instructor.

Aero. 511-3. Ideal Fluids. Applicability of ideal flow theory, equations of motion, potential flow, circulation and vorticity, axially symmetric flow, review of complex variables and potential theory, conformal mappings, airfoil theory, stratified fluids, and gravity wave mechanics. Prer., Aero. 312.

Aero. 512-3. Viscous Flow. (M.E. 534.) Low Reynolds number flows, incompressible and compressible laminar boundary layer theory; similarity theory; separation, transition, and turbulent boundary layers. Prer., Aero. 517 or equivalent, or consent of instructor.

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.) 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 equivalent.

Aero. 518-3. Microscopic Physics of Fluids. 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. Effect of air pollution on materials, plants, animals, humans, and ecological changes. Sources of air pollution. Chemistry, diffusion, and dispersal of pollutants. Prer., graduate standing or consent of instructor.

Aero. 527-3. Noise Pollution and Abatement. 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. 535-3. Advanced Propulsion. 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. 541-3. Linear Control Design—Systems Analysis III. A continuation of Aero. 342. The design of linear systems, using frequency methods, other methods of design, and introduction to sampled data systems. Prer., Aero. 342.

Aero. 542-3. Nonlinear Control Design—Systems Analysis IV. A continuation of Aero. 541. Introduction to nonlinear systems; generalized Lagrangian mechanics; Liapunov methods, calculus of variations; Pontryagin methods, and general optimal control; Hamilton-Jacobi optimization; Kalman equation. Prer., Aero. 541.

Aero. 547-3. Computational Fluid Mechanics. (Similar to Aero. 447 but involves term project.) Numerical solution of fluid mechanics problems involving ordinary and partial differential equations of

various types. Prer. C.S. 210/E.E. 210 and Aero. 312 or consent of instructor.

Aero. 548-3. Advanced Computational Fluid Mechanics. Continuation of Aero. 447/547. Advanced computational methods are introduced for solving fluid mechanics problems on the computer, with emphasis on nonlinear flow phenomena. Prer., Aero. 447/547 or consent of instructor.

Aero. 556-3. Spacecraft Design. A systems approach to the design of an unmanned spacecraft, including guest lectures from specialists in each of the disciplines which make up a spacecraft design team. Topics include mission design, payload, launch systems, tracking and data systems, communications, structures, guidance and control. 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, and 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. 572-3. 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 wave-length), magnetic fields, velocity fields, and flare phenomena and interpretation. Prer., graduate standing or consent of instructor.

Aero. 573-3. Introduction to Magnetospheres. (A.G. 530.) Introduction to solar and stellar winds, planetary and stellar magnetospheres. Guiding center theory for particle motion, magnetospheric topology, convection, radiation belts, magnetic storms and substorms, auroras. Prer., graduate standing or consent of instructor.

Aero. 578-3. Oceanography. 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.* 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.* 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.) Covers the structure of the mammalian CNS with respect to functional organization and emphasis on synaptology. Includes description of neuroanatomical and neurohistological techniques and an introduction to CNS ultrastructure with demonstration of electron micrographs. Prer., Psych. 405 or Aero. 583, or consent of instructor.

Aero. 591-1. Seminar. *Fall.* Required of all aerospace engineering sciences graduate students. Provides reports on research activities and special current topics. Prer., graduate standing.

Aero. 592-1. Seminar. *Spring.* Required of all aerospace engineering sciences graduate students. Provides reports on research activities and special current topics. Prer., graduate standing.

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. Continuation of Aero. 505. Topics include perturbations of orbital motion due to asphericity of gravitational field, third bodies, solar radiation pressures, and atmospheric drag; classical orbit determination from angles-only observation; modern orbit determination using range and range-rate data; orbit transfer using impulses or continuous thrust; others to be chosen. Prer., Aero. 505 or consent of instructor.

Aero. 609-3. Mathematical Theory of Hydrodynamic Stability. Mathematical and physical study of laminar flow instability. Topics include derivation of general disturbance equations for curved and parallel viscid and inviscid flows, and nonlinear theory. Prer., Math. 431 and Aero. 512 or consent of instructor.

Aero. 613-3. Advanced Compressible Flow. Advanced topics in dynamics and thermodynamics of compressible fluid flow. Prer., Aero. 513.

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. 521 (Aeroelasticity), Aero. 523 (Advanced Aerospace Materials), Aero. 544 (Optimal Control), Aero. 545 (Linear Control Systems), Aero. 546 (Theory of Automata), Aero. 549 (Numerical and Simulation Techniques Applicable to Guidance and Control System Design), Aero. 563 (Stochastic Processes), Aero. 576 (Atmospheric Turbulence), Aero. 584 (Selected Topics in Macromolecular Biophysics); Aero. 608 (Optimal Trajectories in Space Flight), Aero. 611 (Plasma Spectroscopy), Aero. 614 (Hypersonic Aerodynamics), Aero. 616 (Quantum Fluid Dynamics), Aero. 617/M.E. 514 (Statistical Thermodynamics), Aero. 618 (Dynamics of Real Gases), Aero. 621/622 (Structural Thermomechanics I, II), Aero. 632 (Aeronautical Heat Transfer), Aero. 641 (Guidance Systems), Aero. 644 (Advanced Nonlinear Stability Theory), and Aero. 674 (Cosmic Gasdynamics).

Special topics which have been offered in the past include Aero. 295-299 (Engineering Science as Natural Philosophy, Implications of Rapid Transportation and Communication, 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. 102-2. Descriptive Geometry. Two lect., two 3 hr. labs per wk. Orthographic projection: point, line, and plane problems; angle problems, intersection, developments, perspective, shades and shadows and graphic statics. Prer. Engr. 101 or equivalent.

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. 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.

¹Arch.E. 403 and 404, are for nonengineering students and are not acceptable for credit toward a degree in engineering.

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. (C.E. 523.) 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 subcontracts; 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 I. Three lect. rec. 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. 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 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; coreq. Chem. 331 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 Math. 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 Math. 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 Ch.E. 351 or EDEE 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 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, Schrodinger 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.** Review of the fundamentals of thermodynamics. Application to pure fluids and mixtures. Physical equilibrium and changes of state. The equation of state and computation of fluid properties for pure fluids, mixtures, and solutions. Relations between thermodynamics and statistical mechanics. Prer., undergraduate thermodynamics (Ch.E. 432 or equivalent).
- 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. 542-3. The Physical Chemistry and Fluid Mechanics of Interfaces.** The principal topics covered in this course are the thermotension measurement; adsorption at liquid-gas, liquid-liquid, and solid-gas interfaces; monolayers; conservation equations for a fluid interface; rheology of interfaces; monolayers; conservation equations for a fluid interface; rheology of interfaces; surface tension driven flows; contact angle and wettability; double layer phenomena. Prer., Ch.E. 321 or equivalent.
- 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. 457 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. 691-899-0 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. 235.

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. 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. Three lect. per wk. The many aspects of water, air, and land pollution including the special topics of noise, radiation, pesticides, thermal, and mercury pollution. Prer., Chem. 103 or Ch.E. 210.

C.E. 311-3. 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, coreq., A.Math. 236.

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, coreq., A.Math. 236.

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. 314-2. Engineering Materials Laboratory. One lect.-rec. and one 3-hr. lab. per wk. The lecture 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. 315-2. Engineering Materials Laboratory—Water Quality. One lect. and one 3-hr. lab. per wk. Discussing techniques and making measurements of water quality and pollution parameters. Prer., or coreq., C.E. 241 or permission of instructor.

C.E. 318-2. Engineering Materials Laboratory—Geotechnical Engineering. Physical characterization of unconsolidated geologic materials. Evaluation of constants and parameters used in the design and construction of earth structures. Sampling and testing of soils. Coreq., C.E. 380 or consent of instructor.

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. 311.

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. 342-2. Water Treatment. Two lect. per wk. An intensive study of the processes used in treating water for potable supply purposes. Prer., C.E. 241.

C.E. 343-2. Wastewater Treatment. Two lect. per wk. 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., 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. 434-3. Open Channel Hydraulics. Three lect. per wk. Study of flow in open channels both natural and man-made. Topics include application of energy equation and momentum relationships, tractive force on erodible boundaries, water surface profiles theory and calculations, design of transitions. Prer., C.E. 331.

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. Three lect., per wk. General studies in water and sewage analysis: their application to design practices and public health standards. Prer., C.E. 341.

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. 458-2. 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. Three lect. per wk. 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. 480-3. Intermediate Soil Engineering. Continuation of C.E. 380 into selected topics in geotechnical engineering. Earth pressure theories and design and analysis of retaining and foundation structures. Stress distribution and settlement analyses. Application of consolidation theories. Prer., C.E. 380.

C.E. 494-3. Senior Projects. Entire semester is devoted to work on a project of the student's choice and the preparation of a report. Projects may include laboratory, analysis, or design efforts and may be done by individual students or by groups. The idea for the project can be generated by the student or suggested by a faculty member. A list of projects will be available in the departmental office at preregistration. The student is not permitted to register for this course during the last semester in residence and the student must obtain registration approval for a particular project from the faculty director. Prer., senior standing.

C.E. 495-1 to 8. 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. (C.E. 524.) 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. Mechanics of Materials II. 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. 314.

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. 523-3. Construction Planning and Scheduling. A comprehensive study of construction management including the contractor's role in preconstruction activities; the construction contract; bonds and insurance; purchasing and subcontracts; 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. Students will be required to apply the techniques of the course to a term project. Prer., Arch.E. 441.

C.E. 524-3. Engineering Contracts. Applications 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. Students will be required to complete a comprehensive term paper on a course topic of their choice and present the paper.

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. Introduction to the economics, utilization, and limitations of large-scale horizontal construction methods. The advanced study of planning, analysis, and methods improvement techniques as applied to public works and energy facilities construction. Emphasis is placed on computer simulation of construction operations and time lapse analysis. Prer., graduate standing with EDEE 497 or Arch.E. 441, 446, or consent of instructor.

C.E. 529-3. Construction Engineering II. Three lect. per wk. Continuation of C.E. 528. Advanced study of the application and analysis of construction equipment and methods. Topics include drilling, blasting, tunneling, dewatering foundations, formwork design, and construction aspects of Portland Cement concrete. The course is applicable to both building and public works construction. Prer., graduate standing; Arch.E. 441, 446, 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., graduate standing and 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. Prer., graduate standing.

C.E. 540-4. Advanced Environmental Engineering. Three lect. and one three hr. lab. per wk. 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 industrial wastewater. 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.

¹Courses usually offered at Boulder Campus only.

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. 241 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. Three lect. per wk. 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.² 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.² Three lect. 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 type of error (β), 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.² 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. Three lect. per wk. 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.² 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.² 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. Three lect. per wk. 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.² 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.² 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.

¹Courses usually offered at Boulder Campus only.

²Courses usually offered at Denver Campus only.

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: excavation, 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. 589-3. Dynamics of Soils and Foundations. Principles of vibrations and wave propagation in elastic, homogeneous, isotropic media; in-situ and laboratory determinations of dynamic engineering properties of soils; applications of these principles and properties in design of foundations subjected to dynamic loads generated by machinery, earthquake, or blast. Prer., C.E. 380 or either C.E. 581 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-dependent 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. 614-3. 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 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.

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. 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. 290-3. Honors Fundamentals of Computing. Honors version of C.S. 210 for students with strong aptitude or prior experience in computer science. Consists of an accelerated version of C.S. 210 with more challenging programming assignments (2/3 semester) followed by a selection of important topics from C.S. 310 including Fortran programming, use of the operating system, and non-numerical and numerical algorithms. Students who perform sufficiently well in C.S. 290 may be exempted from taking C.S. 310. Prer., same as C.S. 210 plus consent of the department.

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, and non-numerical and numerical algorithms. Prer., C.S. 210.

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. 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., introductory programming, two semesters of calculus, linear algebra (e.g., 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. 514-3. Advanced Finite Mathematics II. 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. Context-free languages and grammars. Theoretic properties-pumping lemma, ambiguity, representations (e.g., Dyck sets), decidable questions. Parsing algorithms for general and special (e.g., LR) grammars. Prer., C.S. 546 or consent of instructor.

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. (Math. 546.) 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. Proving correctness of programs.

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. 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 of instructor.

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. Algorithms—simplex and modifications. Theory-duality, complementary slackness. Network flow algorithms. Introduction to integer programming. Prer., 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. 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 generalized data management systems. Tree, network, and relational approaches. 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. 584-3. Software Development Workshop. In this software engineering practicum, student development teams perform specification, design, implementation and/or maintenance activities for some relatively complex software system. Prer., C.S. 582.

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, metacompilers, 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, analysis of algorithms, and computational complexity. Prer., consent of instructor.

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. Prer. for C.S. 665, C.S. 566; for C.S. 666, C.S. 665.

C.S. 700-4 to 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 oral 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 10. Doctoral Research. An investigation in some specialized field of computer science. Approved and supervised by faculty members.

C.S. 920-1 to 3. Lower Division Undergraduate Level Independent Study. Selected topics at the elementary level for students who have had little or no previous computing experience.

C.S. 940-1 to 6. Upper Division Undergraduate Level Independent Study. 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. 950-1 to 6. Graduate Level Independent Study in Computer Science. This course provides opportunities for independent study, work on a small research problem, or tutoring of lower division computer science students.

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. 214-3. 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 and E.E. 257.

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.Phys. 114; E.E. 313, 321, and 381.

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, applications, filters, transistors. 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; prer. or coreq., E.E. 214.

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., C.S. 310, E.E. 351, 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. Lyapunov 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. 437-3. (M) 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, implantation, 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 transforms 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., C.S. 310, E.E. 351 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 and 362.

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 must petition and have the 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 quality. 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. Optoelectronic 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. 511-3. (F) Waveguides and Transmission Lines. An intermediate-level fields course dealing with guided-wave systems at HF, microwave and optical frequencies. Modern waveguiding structures, including circular metallic waveguides, microstrip transmission lines, and optical waveguides are treated. Additional material may include waveguide losses, excitation of waveguides, microwave network theory, coupled-mode theory, resonators, Gaussian beams, pulse propagation in waveguides. Prer., E.E. 314 or equivalent.

E.E. 513-3. (F) Electromagnetic Radiation. Incoherent radiation, including the black body radiation law, is studied first, concluding with derivation of some of the fundamental antenna laws. Radiation from electrical charge in motion is considered next. Then these concepts are specialized to broadly applicable formulations for radiation from coherent current sources. Concludes with a study of the radiation and impedance characteristics of several types of antennas and antenna systems. Prer., E.E. 314 or equivalent.

E.E. 514-3. (F) Electromagnetic Boundary Problems. Mathematical theories and physical concepts related to Maxwell's equations. Potential representations, scalar and vector Green's functions, eigenfunction expansions, Green's theorem, reciprocity, equivalence principle and image theorem, etc., will be treated. The second part of the course involves applications such as radiation from apertures in cylindrical surfaces, scattering by cylinders and wedges, dipole radiation over a half-space, general mode theory of metallic and surface-wave waveguides, excitations, discontinuities and bends in waveguides. Prer., E.E. 511 or 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. 539-variable credit. Telecommunication Project. Supervised study project.

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. 543-3. (S) Nonlinear Control Systems I. Analysis and synthesis of nonlinear feedback control systems. Linearization and stability in the small equivalent linearization and the describing function. The dual input describing function. Stability in the large and the second method of Lyapunov. Stability of time-varying systems. Popov's method and extensions. Prer., E.E. 413.

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.* Procedures of mathematical engineering analysis and design. The 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. 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 of Programming Languages. (C.S. 553.) In-depth study of semantics and pragmatics of programming languages: primitives, composition, states and lifetimes. Examples are drawn from FORTRAN, PASCAL, ALGOL, COBOL, LISP, SNOBOL, and PL/I. Relationship of language to hardware. Prer., E.E. 401 and 453 or consent of instructor.

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. 553 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. (Also available via ACE TV.)

E.E. 565-3. (C) Detection and Extraction of Signals From Noise.* (C.S. 565.) 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, standby 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 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 421, or equivalent. (Also available via ACE TV.)

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. (Also available via ACE TV.)

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. (Also available via ACE TV.)

E.E. 573-3. (P) Tensor Analysis of Electric Energy Systems.* 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.* 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. (P) Power Distribution 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. (Also available via ACE TV.)

E.E. 577-3. (P) 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. (Also available via ACE TV.)

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. 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. 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. (Also available via ACE TV.)

E.E. 586-3. (S) Loudspeaker Synthesis. 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; crossover 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. 597-1. Speakers' Seminar. Lecture and discussion with invited speaker.

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 superconductivity. 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. 621-3. Mathematical Functions for Engineering. Derivation and exposition of important functional properties as required in engineering applications. Emphasis on those properties that have been found important in engineering. Functions examined include gamma, Bessel, Legendre, elliptic, hypergeometric, and others. Prer., E.E. 521 or M.E. 522.

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 WKB 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 in-

homogeneous 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.* 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 II.* 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 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 DESIGN AND ECONOMIC EVALUATION

EDEE 351-3. Engineering Statistics I. (Ch.E. 351.) 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. 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, project administration, audit and evaluation for optimum use of resources. Prer., senior standing.

EDEE 453-3. Computer Techniques in Engineering. 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. 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. Continuation of work begun in EDEE 461.

EDEE 465-3. 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. 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.) 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 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. 401 or equivalent; M.E. 414 or equivalent; or consent of instructor.

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 581-3. Optimal Design. 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. 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. 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 497.

EDEE 592-3. Engineering-Economic Simulation. 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 — NONDEPARTMENTAL TECHNOLOGY 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. 112 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 PHYSICS

E.Phys. 111-4. General Physics. Two lect., two rec. per wk., plus four evening exams during the semester. 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., plus four evening exams during the semester. 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. 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 Schroedinger 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. 446-3. Solid-State Physics. (E.E. 434.) Primarily for senior physics majors. Crystal structure, lattice dynamics, band theory, semiconductors, ferromagnetics, etc.

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. 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.

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. 131-2. Manufacturing Processes. Survey of industrial processes, quality control, materials of manufacturing, and numerical control.

M.E. 195-1 to 3. Special Topics in Mechanical Engineering. Subject matter to be selected from topics of current technological interest. Credit to be arranged. Prer., consent of instructor.

M.E. 203-3. Introduction to Computer-Aided Design. Review of computer languages, programming and special requirements. Linear and nonlinear programming; matrix methods and numerical techniques including constraints; simulation and graphical displays; optimization methods. Applications to mechanical and thermal systems. Prer., C.S. 210.

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. (Aero. 203.) 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. (Aero. 204.) 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. 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. (Aero. 326.) 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* square 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. (Aero. 341.) 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. (Aero. 342.) 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. 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. Mechanical Behavior of Materials. A study of the response of materials to applied stresses. Emphasis is on the understanding of the relationships between structure and properties. 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 362.

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. (Aero. 430.) 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. Application of multicomponent fluid equations of motion and chemical thermodynamics to a variety of combustion problems. Examples 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 and 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., M.E. 313 or equivalent.

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., M.E. 313 or equivalent.

M.E. 521-3. Methods 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 and 575, or equivalent.

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.) 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 bounded 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-dimensional 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; theory of plates, theory of shells, theory of hydrodynamic stability, advanced continuum mechanics. Outlines of these courses are available 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. 100-6. Environmental Design Studio: Individual Scale. Students, working individually and in small teams, develop designs for the needs of individuals. Design problems concentrate on sense of place, anthropometrics, pattern languages, increasing environmental awareness, and realms of privacy.

Env.D. 101-6. Environmental Design Studio for Small Groups. Students, working individually and in small teams, develop designs for the needs of small groups. Design problems concentrate on sense of social interaction, diagramming social forces, multifunctional design, and privacy in a social context. Prer., Env.D. 100.

Env.D. 104-2. Environmental Design Perspectives. A survey of major contemporary environmental issues which are representative of

faculty teaching and research interests in the College of Environmental Design. This introductory course for *nonenvironmental design students* will provide an overview of the environmental design philosophy and problem-solving approach to selected environmental problems.

Env.D. 110-3. Introduction to the Social Sciences and Environmental Design. An introduction to the theories, methods, and research findings of psychology and sociology as they apply to environmental design. Topics covered include human expression through the man-made environment, understanding and reacting to that environment, social science methods in environmental design research, and the relation of small group processes to environmental design practice.

Env.D. 111-3. Programming and Evaluation. A study of current methodologies that enable designers to evaluate existing features of the man-made environment from a social perspective. The course then teaches application of the evaluations to the planning of the design or redesign of this made environment.

Env.D. 120-3. Beginning Graphic Systems. Deals with introducing the tools and techniques used to communicate graphically. It includes freehand drawing, model making, an introduction to orthographic and isometric projection, and an introduction to one- and two-point perspective.

Env.D. 121-3. Intermediate Graphic Systems. A continuation of Env.D. 120, dealing with the fundamentals of graphic communication, perspective, freehand model making, color, etc. Prer., Env.D. 120.

Env.D. 130-3. Introduction to Natural Science/Technology and Environmental Design. An introduction to the use of natural science and technology in such environmental design career areas as human-scale design, architecture, and land-use planning. The course will study the influence of natural science and technology on these major design fields through the use of lectures and a survey of recent literature.

Env.D. 131-3. Design Implications of Resource Management. A survey of current and future impacts of human settlement on natural resources including water, air, wildlife, minerals, and land from a regional, national, and global perspective.

Env.D. 134-3. Applications of Mathematics and Physics to Problems in Environmental Design. Physics and mathematics methods are applied to physical concepts in solving basic environmental design problems at the human-scale, architectural, and land-use planning levels. Prer., high school algebra.

Env.D. 200-5. Environmental Design Studio for Complex Organizations. Continuation of environmental design studio sequence to the organizational needs of the human-made physical environment. Faculty-defined problems, research, scale, tools, etc., leading to physical form design. Prer., Env.D. 101.

Env.D. 210-3. The Socio-Political Context of Environmental Design. Looks at the social, cultural, political, and economic dynamics of land use at the community and regional levels. Also teaches techniques of primary research used to determine community-level user needs. Prer., Env.D. 111.

Env.D. 211-3. Issues in Urban Design. Explores a number of topics of current interest at the community and regional levels. Looks at the development and social consequences of the neighborhood movement, forms of municipal and regional governments, regional settlement patterns, and new communities. Discusses the methods and use of social impact assessment. Prer., Env.D. 210.

Env.D. 220-3. Advanced Graphic Systems. Lecture and studio to include orthographic drawing, working drawings, isometric drawings, and mechanical perspective. Prer., Env.D. 121.

Env.D. 221-3. Advanced Modeling. Structured to introduce the student to the more detailed aspects of structured space through model building. Each student will be required to build a scale model of an historic landmark building.

Env.D. 230-3. Materials and Technology for Environmental Design. A survey of materials and the properties which dictate limits to their use in design fields. Studies major categories of materials, such as thermoplastic and thermoset plastics, and investigates recent developments in the introduction of new materials and new uses for old materials. Prer., Env.D. 131.

Env.D. 231-3. Morphological Systems. Investigates form, natural and man-made, from the point of view of the environmental forces that shape it. Student projects focus on the analysis of interdependence of form and environment.

Env.D. 300-6. Environmental Design Studio for Community Problems. Continuation of environmental design studio sequence to neighborhood-, community- or metropolitan-scale problems in the human physical environment. Faculty-defined problems, research, scale, tools, etc., leading to physical form design. Prer., Env.D. 200.

Env.D. 310-3. Planning and Design Law. Deals with what society imposes upon the designer and planner as legal requirements to be met, how to find out about these requirements, how to understand them, and how to initiate and carry through changes to these laws.

Env.D. 312-3. Community Growth. Examines community growth and growth controls in terms of social causes and consequences, legal and ethical issues, and planning techniques.

Env.D. 313-3. Citizen Participation in Planning. Along with some of the history and philosophy concerning citizen participation in planning, this course covers various methods by which the public can become involved in planning decisions and specific examples of situations where these methods have been used.

Env.D. 320-3. Computer Applications for Environmental Design. Introduces students to computer techniques that can be used for analysis of problems and graphic display of solutions in the environmental planning and design professions. Techniques that will be useful for the architect, landscape architect, city and regional planner, geographer, and other design professionals will be covered.

Env.D. 321-3. Photography for Visual Communicators. Using the camera as a communications tool; looking at photography for presentation, portfolio, and seeing. Black-and-white and color.

Env.D. 323-3. Mathematical Models for Environmental Design. The use of mathematical models to describe and predict the performance of environmental design systems. Computer-aided design techniques and advanced computer graphics as design tools will also be covered. Prer., Env.D. 320.

Env.D. 333-1 or 2. Practicum in Solar Technology. Individuals or small teams will develop a solar project from conception through construction. Projects will be related to current needs of the college's House of Essentials Project (1826 Marine). Prer., Env.D. 332.

Env.D. 332-3. Solar Technology. Introduces students to the expanding potential of solar technology relevant to the environmental design profession, through readings and lectures to the nature of the energy crisis and the potential role of solar energy in the future. Prer., physics.

Env.D. 334-3. Appropriate Technology. Students, working individually or in small teams, develop designs for and actually construct simple tools and devices and small experimental dwellings. Emphasis on development of low-cost building technologies, such as passive solar energy systems and energy recycling systems. Prer., Env.D. 332.

Env.D. 335-1 or 2. Practicum in Appropriate Technology. Students apply skills from Env.D. 332 and 333 in actual contexts. Field work sites range from the college's House of Essentials Project in Boulder to sites in Colorado and the Third World. Credit arranged with instructor. May be taken twice with instructor's consent.

Env.D. 337-3. Systems of Structure and Fabrication. Deals with the current state-of-the-art of structure and fabrication of buildings, both locally and in many foreign countries. Coverage will include systems building (prefabrication in varying degrees) and conventional on-site fabrication. Also, fundamentals of prestressed concrete, lift-slab construction, and polyurethane structures. Prer., second, third, or fourth year students or instructor's consent.

Env.D. 400-6, 401-6. Planning Studio I, II. A preprofessional studio course in urban and regional planning. Prer., for Env.D. 400, Env.D. 300; for Env.D. 401, Env.D. 400.

Env.D. 402-6, 403-6. Architecture Studio I, II. A preprofessional studio course in architectural design. Prer., for Env.D. 402, Env.D. 300; for Env.D. 403, Env.D. 402.

Env.D. 404-6, 407-6. Historic Preservation Studio I, II. A preprofessional studio in historic preservation design. Prer., for Env.D. 404, Env.D. 300; for Env.D. 407, Env.D. 404.

Env.D. 405-6. Urban Design Studio. A preprofessional studio in urban design. Prer., Env.D. 300.

Env.D. 406-6. Landscape Architecture Studio. A preprofessional studio in landscape architecture. Prer., Env.D. 300.

Env.D. 409-6. Interior Design Studio. A preprofessional course in interior architecture and space planning. Prer., Env.D. 300.

Env.D. 412-3. Human Nature and Environment. (Phil. 446.) An in-depth examination of actual and contemplated ideal communities

and their relation to conceptions of human nature and its plasticity. The design of communities which have as their intent the evolution of human nature in a positive direction is the focus of the course.

Env.D. 420-3, 421-3. Architectural Graphics I, II. Techniques of graphic communication and presentation for architectural design.

Env.D. 431-4. Comparative European Environments. A summer field seminar in Europe offered in alternate years to inspect new towns, satellite cities, and other forms of human settlement and cities of antiquity. Preference given to students with a planning emphasis. Prer., consent of instructor.

Env.D. 432-3. Environmental Impact Assessment. Field-oriented seminar in current environmental impact controversies. Attention is given to the history, theory, and application of impact analysis at the state level for designers, land-use planners and others involved in resource decisions. Prer., consent of instructor.

Env.D. 450-3, 451-3. Environmental Systems for Architecture I, II. Fundamental systems considerations of water supply (management and treatment), waste water (treatment and reuse), power supply and consumption, transportation, land use planning.

Env.D. 452-3, 453-3. Architectural Structures I, II. Statics and strength of materials applied to basic structural systems in architecture.

Env.D. 513. Imagination and Creativity. A seminar on imagination and creativity in environmental design. Students research some aspect of the topic of interest to them and acceptable to the instructor and prepare a class presentation and research paper on that topic. Open to advanced undergraduates and graduate students, irrespective of major.

ARCHITECTURE, BOULDER CAMPUS

Arch. 320, 321-3. Architectural Appreciation and Design. Open only to architectural engineering students. Basic problems and principles of architectural design to provide the student with a basis for understanding and evaluating architecture.

Arch. 470, 471-3. History/Philosophy I and II. A survey of architectural and related design responses to changing attitudes, technologies, and natural settings from primitive through contemporary cultures.

ARCHITECTURE, DENVER CAMPUS

Architectural Communication

Arch. 510-3, 511-3. Graphic Communication. Two lect.-studio periods per wk. Techniques of graphic communication and architectural presentation for design.

Architectural Design

Arch. 500-5. Architectural Design. Three studio-seminar periods per wk. Basic design theory and application; exploration of design fundamentals and vocabulary. Basic understanding of the tools of the designer and their application to the design of man-made environments. Simple, abstract, and real design problems are used to make the student environmentally aware and to introduce the student to the design process.

Arch. 501-5. Architectural Design. Three studio-seminar periods per wk. Continuing exploration of design fundamentals. Scope of study expands in scale from a small social unit to a subcommunity. Design parameters investigated are human needs and activities, climate, pedestrian and vehicular circulation, site planning and development, zoning ordinances and building codes, structure, materials and utilities.

Arch. 600-5. Architectural Design. Three studio-seminar periods per wk. The investigation and design of large building complexes within the context of nearby buildings, site, climate, codes and ordinances, utilities, and circulation. Emphasis is given to the integration of architectural form and space with structure and environmental controls.

Arch. 601-5. Architectural Design. Three studio-seminar periods per wk. Four independent studios are offered for student selection with an attempt at diversity of project skill, building type, theoretical emphasis, and design process. This selection is intended to allow some degree of student initiative in exploration of personal interest. The studio option procedure is based on the educational theory that

design is learned through repetitive exercise and challenge, and that beyond introduction from earlier semesters to the variable and processes of design, the project base can be quite varied.

Arch. 700-5. Architectural Design. Three studio-seminar periods per wk. Four studio selections organized as in Arch. 601 above. In Arch. 601 and 700, attempt is made to include four selection projects emphasizing urban design urban context problems, major building complex problems, and building type problems (e.g., performing arts, high rise commercial, institutional, housing).

Arch. 701-7. Architectural Design Thesis. Three studio-seminar periods per wk. The thesis is the final design product of the program. It serves to integrate all prior architectural learning in a single project to demonstrate the student's capacity for self-discipline and self-direction in the execution of a complete process of problem definition and solution, and to contribute to the solution of particular architectural and urban problems. Though projects of a major design challenge are expected, emphasis may be given to any of the several areas of architectural interest such as type problems (e.g., housing, health care facilities, recreational facilities), urban infrastructures, historic preservation and contexts, and architectural technology.

Arch. 702-2. Thesis Preparation. One seminar period per wk. Independent study leading to the development of a finished project program with site selection and analysis ready for the final design thesis semester. Though topic selection and problem definition are an individual responsibility of the student, the thesis preparation will be pursued as an adjunct to the Arch. 700 studio to enable broad-based criticism for the work. Projects may be developed for thesis work with the Community Center for Development and Design.

Arch. 710-7, 711-7. Research/Design. Advanced study and research in an area of major professional interest to the student.

Technologies

Arch. 550-3. Environmental Systems. Two lect. and one lab. per wk. Systems considerations of management and treatment of water supply, waste water-treatment and reuse, power supply and consumption, transportation, land use and measurement.

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. 552-3, 553-3. Basic Structures I and II. Two lect. per wk. Analysis of basic structures. Applications of structural systems.

Arch. 557-3. Elements of Structure. Two lect. per wk plus three Saturdays. The course is organized to provide students in areas of specialization other than architecture with an understanding of the effects of natural and man-made loads imposed on the structures of buildings. Analysis of elements range from building systems through the final foundation structure. Prer., lab course in physics, mathematics, to and including an introduction to integral calculus and Arch. 551.

Arch. 650-3. Heating, Air Conditioning, Ventilating, and Utilities. Two lect. per wk. Energy conscious design. Principles and application of HVAC systems. Water supply and sanitation systems. Electrical distribution systems.

Arch. 651-3. Lighting and Acoustics. Two lect. per wk. Illumination quantity and quality, daylighting and electric/lighting, lighting design and application, principles of sound transmission and absorption, room acoustics, architectural acoustics problems.

Arch. 652-3, 653-3. Structures III and IV. Two lect. per wk. Structural design of buildings and building elements. Design with steel, timber, concrete, and other building materials. Advantages and disadvantages in application of various materials and building systems.

Arch. 655-2. Acoustics. One lect. per wk. Advanced problems in noise control and room acoustics.

Arch. 656-2. Masonry Structures. One lect. per wk. Design of masonry elements for buildings.

Arch. 657-1. Elevators and Escalators. Introduction to vertical transportation.

Arch. 658-2. Alternative Energy Technologies. One lect. per wk. Available and proposed energy resources, distribution applications, and technologies with emphasis on solar energy utilization. Studies of new energy solutions include commercially available hardware for the design of domestic scale active and passive energy systems.

Arch. 664-2. Life Safety Systems. Two lect. per wk. An architect's guide to the disaster movies. The course is designed to acquaint the student with building and fire codes, loads from seismic, wind blast and fire forces, flood protection, and building safety features.

Arch. 750-3. Systems Synthesis. A synthesis of the preceding environmental systems and structures courses. The student will perform the structural frame design and select and detail the mechanical and electrical systems of a specific building carried forward from Arch. 600 design studio.

Professional Practice

Arch. 660-4. Professional Practice and Construction Documents. Two lect. and two labs per wk. Ethics, management, documents, organization, and production procedures of a professional practice. Preparation of working drawings and specifications for a small building.

Arch. 760-3, 761-3. 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. Student must have completed Professional Practice and Construction Documents and be in the last year of the program.

Theory

Arch. 570-3, 571-3. History/Philosophy I and II. Two 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. 640-3. Environmental Impact Statements. One seminar workshop per wk. Procedures determining site environmental resources. Inventory and analysis of spatial, physical, biological, and sociocultural assets and liabilities for particular urban and regional locations and activities.

Arch. 670-2. Seminar: Designer Philosophy. An examination of the philosophies of a selected group of designers and the contributions generated by those philosophies.

Arch. 672-2. Architectural Preservation. One lect. per wk. Materials rehabilitation technology. Sources for project dating and history. Adaptive uses. Recording.

Arch. 673-2. The Politics of Architectural Preservation. One lect. per wk. Tax law for designated historic properties. Preservation organizations. Landmark status processes.

Arch. 680-3. Theory and Practice in Architecture. Two lect. per wk. Contemporary design theory and approaches to the practice of architecture. Reading, papers, and presentations by ten of the best in Denver architecture.

Arch. 682-3. Studies in Architecture and Urban Design Theory. One seminar workshop per wk. Case studies of Denver and other urban developments. Origins, forces, and precedents, with student papers on the ideas that have shaped our man-built environment.

Arch. 683-3. Teaching Methods in Architecture. Teaching assistants. By invitation.

Arch. 695-2. Experiments in Form. Two studios per wk. Visual design and its application to architectural design.

Arch. 699-variable credit. 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, DENVER CAMPUS

U.D. 600-3. Urban Design and Graphics Workshop I. Combines studios, lectures, and field trips to introduce basic urban design principles and graphic communication skills. Analyses of materials, infrastructures, scales, ways and places are used in the studio to develop written, oral, and visual techniques. Workshops focus on drawing, mapping, and multi-media presentation means.

U.D. 601-5. Design II. Broad scale studio design course that focuses on problems of new and rehabilitation project developments in rural and urban locations. Particular emphasis is given to environmental circulation, land use, regulations, and urban quality concepts used in the design process.

U.D. 640-3. Basic Environmental Impact Analysis. A lecture, case-study course with field work that adheres to the EPA requirements for certain proposed developments to have a draft impact inventory,

analysis, and resolution. Students select a problem of their choice to determine the assets and liabilities of the spatial, physical, biological, cultural (social, political, economic) aspects of the project and related alternative environments. The sites include locations in the city core, edge of core, general city, edge of city, suburbs, and rural areas.

U.D. 684-3. Urban Design Development Systems and Management. A lecture, casework course that analyzes critical urban development factors. Study covers land activity modules, circulation elements, construction methods, zoning and real estate, business office and construction management, marketing development, and financing.

U.D. 700-5. Design III. A studio course to synthesize the studies of advanced architectural, urban design, landscape, and planning design problems that consider large-scale organization and communication concepts of society. The program includes design studio and/or community action center study options. Studies cover particular aspects of urban design, with emphasis on economic, social and political factors and design process determinants. Topics include the design, implementation and evaluation of urban residential districts, urban cores, institutional centers and circulation systems.

U.D. 701-6. Design IV. Studio and field trips. Focuses all of the student's graduate professional studies on completing a compound, complex thesis. The problem centers on an urban design project, but the work includes architecture and planning aspects with significant attention given to either one. The areas of concentration are in recreation, transportation, health, community action and development, preservation and renewal design.

U.D. 784-3. Urban Design Seminar. A case study course with classroom and field presentations. Emphasis is on particular human needs and responses to provide places for housing (individual and mass) industries, commerce, education, culture, recreation, health, defense, religion, transportation, politics, business, and necropolis, as well as combined activities. Consideration is given to the effect of each function on physical characteristics of domestic and foreign architecture, landscape, urban design, and planning complexes.

U.D. 795-3. Experiencing the Cityscape. Seeing the scope of the city form as well as exploring individual examples to interpret urban architecture in its context.

INTERIOR DESIGN, DENVER CAMPUS

I.D. 500-5. Design Research/Problem-Solving Methods. A general project-oriented introduction to interior architecture and space planning. An explication of methodologies involved in the organization of physical settings correlated with specific human social, psychological, and biological functioning.

I.D. 501-5. Residential Design. Dynamics of near-environment systems studied with emphasis on the analysis and optimization of these systems via design as they support habitational activities. Major projects include designing for adaptive uses of existing structures and designing the interior spaces of a structure utilizing solar energy systems.

I.D. 557-3. Elements of Structure. Organized to provide students in areas of specialization other than architecture with an understanding of the effects of natural and man-made loads imposed on the structures of buildings. Analysis of elements range from building systems through the final foundation structure. Prer., lab. course in physics, mathematics to and including an introduction to integral calculus, and Arch. 551.

I.D. 600-5. Transportation Design. Design of interiors for air, sea, and ground transportation systems and related facilities. Of fundamental concern is an investigation of the physiological, psychological, and technological factors in designing for transportation experiences.

I.D. 601-5. Commercial Design. Development of comprehensive solutions to facility space planning and design problems. Special emphasis is given to feasibility studies, identification of sources of dissonance within the social-physical environment interface, programming, space modulation and organization, definition of behavior systems, integration of interior space components and space enclosure systems with environmental control systems, preparation of construction documents, and cost estimating.

I.D. 624-3. Environmental Signage and Graphic Design. Programming and design development of sign systems and graphics as integral parts of total environments, with respect to information

transfer, and symbolic communication. (To be taken concurrently with I.D. 700.)

I.D. 660-3. Furniture Design. An exploration of materials and manufacturing processes with efforts directed toward their applications in the design of furnishings. Delineation of performance criteria and the preparation of specifications and working drawings are stressed.

I.D. 662-3. Professional Practice. An examination of the key characteristics of the professional market milieu, the construction industry, current and projected professional practice, the legal environment, and code of ethics.

I.D. 680-3. Physical Environmental Factors. An analytical inquiry into the effects of various aspects of the designed environment on human development and well-being at the individual, group, and institutional scale. Seminar materials are drawn from related recent literature and case studies and are used as backgrounds for discussions.

I.D. 681-3. Human Environmental Factors. A seminar programmed to focus on social processes and patterns as parameters for the physical arrangement of the environment. Concepts considered in the contexts of various classes of micro and macro space include personal space, privacy, territoriality, and crowding. Variables affecting spatial behavior are also explored.

I.D. 700-7. Institutional Design. Development of design and planning strategies based on static models organized around decision theory, and dynamic models with mechanistic characteristics. Design and planning problem-solving activities within this framework focus on collection and analysis of data, implementation of social change, the consonance between the organizational structure of the function to be accommodated and the physical fabric of the environment, cost control and the relating of cost to performance, semantic aspects of environmental form, communication patterns, and projected change and growth in the physical and social environment.

I.D. 663-3. Internship I. Supervised field applications of theoretical learning in approved professional offices. Eight hrs. per wk.

I.D. 664-3. Internship II. A continuation of professional activities specified in Internship I, with emphasis on developing the students' maturity in their motivations and in their understanding and managing assigned area of project responsibilities. Monetary compensation for work performed to be negotiated by students and sponsoring offices.

I.D. 701-7. Thesis. Approved professional research or design project undertaken by students as concentrations in one or several areas of interior architecture and space planning. Each candidate for the graduate degree is required to submit and defend a thesis project to demonstrate a high level of competence in solving complex social-environmental problems through research, design, and planning.

LANDSCAPE ARCHITECTURE, DENVER CAMPUS

L.A. 500-5. Landscape Architecture Design I. This initial studio in design focuses on the application of aesthetic principles which form the basis for landscape architectural design. Space, form, color, and texture are explored in their application to design. Problem solving is introduced as a fundamental design tool.

L.A. 501-5. Landscape Architecture Design II. The second design studio attempts to apply the principles and experiences explored in the previous design studio to the site planning process. In a studio/lecture situation several problems are analyzed from site analysis through site design. The intent is to build design competence through application of design principles to solve site problems in an increasing level of complexity.

L.A. 510-3. Graphic Communication I. Two studio lect. periods per wk. Introductory graphics, including orthographic and isometric projections, one- and two-point perspective, lettering, sheet layout, freehand sketching, useful equipment and materials, and reproduction techniques.

L.A. 511-3. Graphic Communication II. Two studio lect. periods per wk. Detailed studies in freehand sketching; rendering of all types of plans, sections, and elevations; and photographic reproduction processes.

L.A. 550-3. Environmental Systems—Engineering I. Two lect. and one studio per wk. Systems considerations of management and treatment of water supply, waste water treatment and re-use, power sup-

ply and consumption, transportation, land use and measurement, and grading and storm drainage.

L.A. 560-3. Elements of Structures—Construction I. Two lect. and one studio per wk. Introduction to the structural elements of construction, wood, steel, and concrete and the nature of construction materials.

L.A. 561-1. Synthecology Field Research I. A three-day intensive short course exploring on field location various aspects of the Rocky Mountain region ecological tolerances to development.

L.A. 580-3. Rocky Mountain Plant Materials. Two lect. per wk. Deciduous trees and shrubs of the Rocky Mountain region. Identification, horticultural concerns, and design potential are stressed.

L.A. 581-3. Rocky Mountain Planting Design Principles. Two studio/lect. periods per wk. Principles of aesthetic and functional uses of both native and exotic plant species, plus maintenance considerations.

L.A. 600-5. Landscape Architecture Design III. The third design studio expands design process even further by expanding the complexity and diversity of the type of site design explored. There is an attempt at the second-year level to select real problems for studio projects. This introduces the constraints of clients, politics, and economics to the site design problem solving method of design.

L.A. 601-5. Landscape Architecture Design IV. The fourth design studio is also an expansion of the "increasing complexity" concept of exploring case studies in the studio environment. Team projects are part of this process and real projects in the Colorado environment are used as case studies. The results are packaged in brochure form in an attempt to explore this form of graphic communication.

L.A. 630-3. Survey of Landscape Architecture. Two lect. and one studio period per wk. Plant materials and basic principles of landscape design related to city planning and development.

L.A. 650-3. Landscape Architecture Engineering II. Two studio/lect. periods per wk. Topics include topography and grading design, earthwork, and drainage design.

L.A. 651-3. Landscape Architecture Engineering III. Two studio/lect. per wk. A continuation of L.A. 650 with emphasis upon adaptive systems on the land. The automobile in space; parking, horizontal and vertical road alignment, path systems and structures.

L.A. 660-2. Landscape Architecture Seminar. One seminar period per wk.

L.A. 661-1. Synthecology Field Research II. A three-day intensive short course on field location exploring various aspects of Rocky Mountain region ecological tolerances to development.

L.A. 670-3. Landscape Architecture History and Theory Seminar II. Two lect. per wk. Landscape architecture history is explored from the cradles of civilization to the present. Emphasis is placed upon contemporary landscape architecture theory and design expression in seminar form.

L.A. 680-3. Rocky Mountain Planting Design Principles. Two studio/lect. periods per wk. Principles of aesthetic and functional uses of both native and exotic plant species, plus maintenance considerations.

L.A. 700-5. Landscape Architecture Design IV. The case study projects used at this level are complex and require the integration of aesthetic, political, and economic principles. Cost analysis and construction principles are also important elements of this level of design synthesis.

L.A. 701-5. Independent Design Practicum. The final semester in design is spent in the development of an independent design project of the student's choice. This is an opportunity for the student to bring together in one comprehensive project all of the relevant design tools learned by expanding the research base of a particular landscape architecture subject area, demonstrating his/her hypothesis through a case study of a real problem, and packaging the results.

L.A. 760-2. Landscape Architecture Construction II. Two studio/lect. per wk. A continuation of L.A. 560. Concentrates on methods of landscape architecture construction and the professional documents of construction-working drawings.

L.A. 761-1. Synthecology Field Research III. A continuation of L.A. 561 and 661.

L.A. 790-2. Independent Design Practicum Research and Research Methods. One lect./research studio per wk. Concentrates on research methods and technical writing. The student is expected to select his/her independent design practicum project and document the research during this course.

L.A. 792-1. Landscape Architecture Issues Seminar. Meets one period a week and provides an opportunity to explore relevant issues of all descriptions which effect the practice of landscape architecture.

L.A. 791-3. Natural Resource Issues Seminar. Two lect. periods per wk. Renewable and nonrenewable natural resources. The focus of real issues will be on the Rocky Mountain frontier.

URBAN AND REGIONAL PLANNING — COMMUNITY DEVELOPMENT, DENVER CAMPUS

U.P.C.D. 500-3. Fundamentals of Planning/Community Development. A basic course in the principles of urban and regional planning and community development. Theories of planning, community organization, basic techniques, changing philosophies in modern society, and the process of shaping community form.

U.P.C.D. 510-3. Planning Communication Skills. Fundamentals of communication of the planning process in graphic, written, and spoken form. In addition to basic graphics, students are exposed to media representatives for instruction in preparing reports, press releases, television material, and public presentation in general.

U.P.C.D. 518-1. Statistics for Planners. A short course to provide an understanding of statistical theory as used in planning analysis. Students who have taken an acceptable college-level course in statistics may have this course waived.

U.P.C.D. 520-3. Planning/Community Development Methodology and Techniques I. *Fall only.* Teaches the basic analyses that are used in the comprehensive planning process and community development. General theoretical understandings, specific analytical methods and techniques, and available data sources are discussed in regard to economics, demography, urban activities, community and neighborhood organization, physical structures, land form, and natural features.

U.P.C.D. 521-3. Planning/Community Development Methodology and Techniques II. *Spring only.* Advanced analysis of methods and techniques. Includes physical, social, and economic systems, urban development models, cost-benefit analysis, decision-making techniques, linear programming, and advanced statistical methods. Prer., U.P.C.D. 520.

U.P.C.D. 530-3. Planning/Community Development Theory. *Spring only.* Describes and critically evaluates contemporary theories and ideologies of the planning process and planned change. Aids the student in developing individual powers of critical theoretical analysis and positions on what planning and community development is and should be.

U.P.C.D. 540-3. Basic Environmental Impact Analysis. A lect., case-study course with field work that adheres to the EPA requirements for certain proposed developments to have a draft impact inventory, analysis, and resolution. Students select a problem of their choice to determine the assets and liabilities of the spatial, physical, biological, cultural (social, political, economic) aspects of the project and related alternative environments. The sites include locations in the city core, edge of core, general city, edge of city, suburbs, and rural areas.

U.P.C.D. 552-3. Urban and Regional Transportation for Planners. *Spring only.* A study of transportation problems and systems as they relate to urban and regional planning activities. Includes an investigation of trends, techniques, financing, and interrelationship with land use and community organization.

U.P.C.D. 580-3. Housing and the Social System. *Fall only.* Designed to explore and define housing problems, to identify the actors and institutions that have an impact on the supply and availability of housing, to review the past and present role of the federal government in housing programs, and to acquaint the student with housing design, residential development requirements, and the role of housing in urban development.

U.P.C.D. 570-3. 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. 580-3. Ethnicity and the City. *Fall only.* The purpose is to examine where minorities are spatially, culturally, socially,

economically, and politically in American cities and to determine the effect these factors have on the minorities as well as on the future of society and cities.

U.P.C.D. 590-3. The Modern Metropolis. *Spring only.* Provides a basic background in the structure and dynamics of the modern metropolis. Includes a review of the historical background of the metropolis; analysis of its economic, social, and political components; and consideration of various interpretations of its role in modern society.

U.P.C.D. 592-3. Environmental Science. A special course devoted to reading and research in problems of the environment and the development of environmental science. Offered to students with specific interests in the environment, after arrangement with the instructor.

U.P.C.D. 600-3. Social Policy Analysis and Application. *Spring only.* 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. 610-3. Neighborhood Planning. *Fall only.* An introduction to small area planning. Survey of neighborhood and community theory. Examines and critiques research and analytical techniques involved in neighborhood planning. Examines and analyzes existing plans of local neighborhoods.

U.P.C.D. 620-3. Rural and Small Town Planning. *Spring only.* Provides knowledge and perspective on global changes in rural areas, with particular reference to the United States. Evaluates the issues of agricultural, rural, and small town development and interrelationships with the industrialization and urbanization processes. Develops knowledge and skills in program planning for rural and small town development.

U.P.C.D. 630-3. Regional Analysis and Planning. 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. 640-3. State and Regional Planning. *Summer only.* A seminar devoted to discussion of planning activity at the state and regional level. Focuses on the interrelationship, the effect upon local planning activity, the systems for coordination of activity, and the funneling of aid monies.

U.P.C.D. 650-3. Comparative World Planning. *Fall only.* Designed to expand the student's knowledge and perspective of urban and regional planning and community development situations beyond those in this country. The purpose is to provide a sense of different planning situations throughout the world, including an analysis of cultures, social and political organizations, types of urbanization, physical settings, and resource availabilities.

U.P.C.D. 660-3. Social Factors in Urban Design. *Spring only.* 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. 670-3. Humanistic Environmental Planning. *Spring only.* Intended to review recent literature in planning with a humane scale including socioeconomic, land use, building, landscape, transport, and utility systems, and to design prototype low energy-high community habitats for the 21st century. Consists of research, analysis, and the design of a community congruent with the conclusions of the research. Prer., U.P.C.D. 570.

U.P.C.D. 672-3. Environmental Policies Planning. *Fall only.* A review of the basic principles of air, water, and energy systems and their politics with the purpose of applying knowledge gained to the problems of future development of states and regions. Included is the design of an integrated policy for a major problem area in present environmental management.

U.P.C.D. 690-6. Planning Problem Solving Studio I. *Spring only.* 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, planmaking, and plan evaluation.

U.P.C.D. 700-6. Planning Problem Solving Studio II. *Fall only.* A continuation and expansion of Studio I, dealing with more complex problems in a team format. Projects are selected to provide options to

relate to individual student interest and are usually practical in that they deal with an actual community or citizen organization.

U.P.C.D. 710-3. Legal Aspects of Planning. *Fall only.* 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. 720-3. Practical Growth Management. *Spring only.* An examination of zoning, subdivision, growth management systems, and environmental regulations in the context of the society in which they function and the needs of that society. Students learn to read and to challenge intelligently statutes and ordinances and to help design better regulatory systems.

U.P.C.D. 730-3. Planning and Politics. *Summer only.* A seminar designed to expose students to the realistic political facts ever present in the planning process and to prepare individuals to deal effectively with governmental operation at all levels of their professional careers.

U.P.C.D. 732-3. Planning and Public Finance. *Spring only.* Seminar which covers the theory of municipal and state financing. Includes study of budget preparation, establishment and maintenance of tax base, financing of capital improvements, and the general importance of overall governmental finance to planning effectuation.

U.P.C.D. 740-3. Communities and the Federal System. *Spring only.* 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 process for dealing with the federal bureaucracy.

School of Journalism

Jour. 100-3. Contemporary Mass Media. 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. 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. The camera as a reporting tool; training in the use of cameras; composition; darkroom procedures. Prer., Jour. 250.

Jour. 340-3. Principles of Advertising. 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. 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. 346-3. Advertising Media. Study of media, markets, and audiences and their relationships to advertising messages. Prer., Jour. 340.

Jour. 350-4. Reporting of Public Affairs. 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. Principles and practice in copy editing and writing headlines for local and wire stories. Practice in page makeup, picture editing, and electronic editing. Prer., Jour. 250.

Jour. 360-3. Radio and Television News. Principles and techniques involved in the preparation of news for broadcasting. Prer., Jour. 250.

Jour. 364-4. Principles of Broadcast Production. Introduction to the use of radio and television equipment. Emphasis is on applying the basic principles to professional program production. Prer., Jour. 250.

Jour. 367-3. Television Production II. Production of material for biweekly segments on CU Today. Students produce material in various formats—16mm, super 8mm, remote and studio videotape, live studio, etc.—with and without editing. Prer., Jour. 364 or Comm. 362.

Jour. 377-3. History of Journalism. 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.

U.P.C.D. 750-3. Planners and the Real World. In seminar format, the opportunity is provided for the student to come in contact with persons from the business world who are affected by planning requirements and restrictions. These include bankers, real estate brokers, developers, land subdividers, and local officials who must interpret land control provisions.

U.P.C.D. 760-3. 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. 770-3. Planning Practicum. This course is specifically designed to give experience to students interested in planning and community development. The emphasis is on actual work experience in community settings with client groups depending upon the students to assist them in determining solutions to their problems. Director's consent required.

U.P.C.D. 790-6. Planning Problem Solving Studio III. The studio is used for the final individual project of the student for presentation to the faculty for the awarding of the degree. This project should reflect the culmination of the knowledge gained through the program and be designed to reflect the primary interest of the student.

U.P.C.D. 970-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.

Jour. 410/510-3. Advanced Photography. 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. 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. Survey of public relations in America. Case studies and individual projects.

Jour. 428/528-3. Public Relations Programs. 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. Seminar for students intending to enter the public relations field. Examines specific tools and activities of the field.

Jour. 440/540-3. Advertising Campaigns. Advanced copy and layout. Emphasis on planning integrated advertising campaigns for national and regional audiences. Prer., Jour. 345.

Jour. 443/543-3. Retail Advertising Campaigns. 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. Covering writing news and features about actual events for publications under deadline pressure. Prer., Jour. 350.

Jour. 460/560-3. Editorial and Opinion Writing. The editorial page and its readers; analysis and writing of editorials and columns.

Jour. 461-1 to 3. Advanced Radio Practices. 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., Jour. 364 or 462 or Comm. 361, and consent of the instructor.

Jour. 462/562-3. Advanced Radio-TV News. 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. Interpretation, preparation, and reporting of public affairs for broadcast media; preparation of radio and film documentaries. Prer., Jour. 360 and consent of instructor.

Jour. 464/564-3. Radio-TV Station Organization and Operation. Analysis of station operations, public relations, personnel, financing,

labor relations, and laws and regulations as well as the manager's ethical and social responsibilities. Prer., Jour. 100 or Comm. 260.

Jour. 465-3. Journalism and the Law. Legal rights and responsibilities of news media. Study of cases and case briefs.

Jour. 467-1 to 4. Television Production III. In-depth experience in one facet of a complex television production, e.g., directing, producing, writing, sports, commercials, etc. Prer., Jour. 364, 367 or instructor consent.

Jour. 470/570-3. Critical Writing for the Journalist. 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. Practice in writing freelance articles; consideration of types, sources, methods, titles, illustrations, and marketing. Prer., Jour. 260 or consent of instructor.

Jour. 485/585-3. Magazine Editing and Production. 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 or consent of instructor.

Jour. 490/590-3. Journalism and Public Opinion. 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. 496/596-1 to 3. Newspaper Practicum. News work on *Campus Press*.

Jour. 497/597-1 to 3. Advertising Practicum. Advertising work on *Campus Press*.

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. 535-3. Television in Education. (Same as 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., Jour. 100 or consent of instructor.

Jour. 551-3. Investigative Reporting. Investigative techniques and problems, including opportunity, under supervision, to put the training into practice.

Jour. 565-3. Press and the Constitution. Graduate seminar in communications law. Study of changing law and applied legal research techniques.

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.

Jour. 930-1 to 3. Undergraduate Independent Study.

Jour. 950-1 to 3. Graduate Independent Study.

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 610-3. 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 632-2. 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 633-2. Mining Law. Federal law regulating mining of hard minerals, oil, gas, and coal on public lands; mining law with respect to privately owned lands, including study of typical coal and uranium lease provisions.

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 662-3. 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 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 669-3. 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 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 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 712-3. Public Land Law. Deals with the legal status and management of federal lands. Federal law, policy, and agency practice affecting the use of mineral, timber, range, water, wildlife, and wilderness resources on public lands are explored.

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 718-3. 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 724-3. Corporate Finance. Covers a number of important topics relating to corporate finance which are necessarily omitted or given only cursory treatment in the basic corporation law course. Includes valuation theory, characteristics and uses of senior securities, dividend policy, and statutory and contractual constraints on dividends and other corporate distributions. Prer., Corporations.

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 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 737-3. American Indian Law. Investigation of the federal and state laws which bear upon problems of American Indians and on Indian reservations.

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 745-3. 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 748-2. Negotiation. A skills course analogous to Moot Court and Trial Practice. It explores the lawyer's role as a negotiator in a variety of contexts, e.g., divorce, personal injury claims, labor relations, and commercial transactions. Assigned reading introduces students to game theory and behavioral approaches to negotiation.

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 prejudgment and postjudgment 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 757-3. International Business Transactions. A problem-oriented study of the legal and quasi-legal questions concerning international trade and investment, with particular attention to the problems of trade with, and investment in, developing nations.

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 intergovernmental relations and legislative control of local governmental units; and the powers, duties, and liabilities of local governmental units.

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 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 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 788-2. Natural Resource Litigation Clinic: The clinic will work on cases concerning natural resource protection in the Rocky Mountain region. Current cases: Denver air pollution, molybdenum development (Colorado); Black Hills uranium development (Wyoming and South Dakota); transmountain water diversion projects (Colorado, Wyoming, Utah), and timber management in Wyoming national forest.

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 704-2. Economic Analysis of Law: Selected Issues. The seminar will study intensively a fairly small number of issues, using basic economic concepts. Likely issues include unequal bargaining power and unconscionability; contribution and indemnity among multiple tortfeasors; penalties and liquidated damages; and nuisance. There will also be readings on the utility of economic analysis of law. A prior background in economics is not required.

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 719-2. Products Liability Seminar. The first part of the semester will be devoted to a review of theories of liability and to an introduction to recent developments in the law. In addition, each student will review the record in a products case and dissect it from the perspective of the plaintiff and defendant as well as from that of the trial and appellate courts. A seminar paper and class presentation are required of each student.

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 721-2. Legal History Seminar. This seminar will focus on the development of legal institutions and on understanding and interpreting certain events in legal history. Each student will select a topic which interests him or her and write a paper analyzing and evaluating the available sources and the competing interpretations to be drawn therefrom. A list of suggested topics will be provided at the commencement of the seminar, but students will be free to propose their own topics as well.

Law 725-2. Federal Common Law of Corporations. Study of federal regulation of relations among the constituents of a corporation.

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 732-2. 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 738-2. Advanced Problems in Water Law Seminar. This seminar will explore several problems involved in the use and administration of water resources, beyond those which are covered in the basic Water Resources Course. (Having taken the basic course is consequently recommended for the seminar.) In addition to considering several state law problems, problems associated with the federal government's roles as an owner of land, a provider of services, and as a regulator will also be considered.

Law 739-2. Exclusionary Practices in Land Use Regulation. This seminar will consider some of the legal, social and economic impacts of various land use regulations which have the effect of reducing people's range of choices of places to live, work, shop, etc. Illustrative regulations include large lot zoning, restrictions on mobile home housing, building code restrictions, subdivision regulations; control over utility service extensions; etc.

Law 746-2. Selected Issues in Jurisprudence. Selected streams in legal philosophy and their contemporary political meaning. Emphasis on the application of legal theories to criminal law. Prer., Law 722.

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 753-2. Social Science Research and the Law. This seminar will explore the impact of empirical research on a variety of legal topics. Early classes will use guest lecturers to explain the basics of

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.

statistical methodology and will also consider the relationship between law and the social sciences from a broad, jurisprudential perspective. Later class will critique student papers, each of which would probably treat a specific law-related issue that had been the subject of empirical research. Examples might include the effects of school integration efforts upon student academic achievements, racial attitudes, and the abandonment of urban public schools by middle-class whites; the deterrent impact of capital punishment; the effect of the economic impact of housing codes or of other law reforms; the relationship between obscene literature and undesirable behavior; and the success of various programs designed to reform criminals. A typical paper would probably summarize the relevant social science literature, assess the impact of this research on the attitudes and actions of legal decision-makers, and consider the extent to which empirical findings should in fact guide the formulation of policy in the area under consideration.

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 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 779-2. Problems in Education Law Seminar. The emphasis in this seminar will be on (a) student rights and (b) equal educational opportunity. Student rights areas will include due process—suspensions and expulsions; free speech and student press; the *in loco parentis* concept; judicial intervention and review; corporal punishment; substantive due process—excessive punishment, etc.; hair and dress regulations; school regulation of off-campus activities; and Fourth Amendment issues—searches of lockers, dormitory rooms. Equal educational opportunity areas will include; discrimination against minorities; sex discrimination; inequality in school financing; and providing educational opportunities for handicapped children. The basic text for the seminar will be A. Morris, *The Constitution and American Education* (2d ed., 1980).

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 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 786-2. Natural Resources/Litigation. Focus on current environmental issues, particularly in the Rocky Mountain region, which illustrate the frequent conflict between resource protection and resource development. The subject matter falls into five major categories: land use, water resource development, timber and national forest management, mineral development, and fish and wildlife.

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. Hayes.

Mus. 576-3. History of Choral Literature. Fall. 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. 181-3. 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. Introduction to Music. Fall, Spring. Basic knowledge of music literature and development of discriminating listening in depth. For nonmusic majors only. Galm, Ellsworth.

Mus. 183-3. 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. Ellsworth, Kearns, Luhring.

Mus. 275-3. History of America's Popular and Folk Music. Spring. American music: folk, popular, art music. Prer., Mus. 180, 182, or 183. Kearns.

Mus. 276-3. 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. Ellsworth, Hayes.

Mus. 277-3. World Music. Spring. Musics outside western art tradition, using current ethnomusicological materials. Prer., Mus. 180, 182, or 183. Hayes.

Mus. 364-3. History of Jazz. Fall. Study of origins, development, and current trends. Open to all University students. Scott.

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, 275, 276, 277, or 379. Ellsworth, Luhring.

Mus. 382-3, 383-3. Music Literature I and II. Fall, Spring. Study of music masterpieces from choral, orchestral, chamber music, and operatic repertoire. For nonmusic majors only. Prer., Mus. 182, 382, or consent of instructor. Staff.

Mus. 466/566-2. Chamber Music Literature: Winds and Percussion. Spring. Stylistic-historical survey in various genres from Baroque era to present. Prer., Mus. 381. Aaholm.

Mus. 471-2, 3/573-2, 4. Renaissance Music. 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. Luhring.

Mus. 474-3/574-3. Performance Practice of Early Music. *Spring.* A seminar-type examination of performance-practices involving 16th, 17th, and 18th century music. Luhring.

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. *Fall.* Literature of the lyric theatre in its most salient currents and works from early Baroque to contemporary productions. Prer., Mus. 381. Ellsworth.

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. 480/580-3. History of Art Music. *Spring.* Intensified work in American art music. Prer., Mus. 381.

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, 3/582-3, 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. A History of Vernacular Music. *Spring.* Intensifies folk and popular music of America. Prer., Mus. 381. Kearns.

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. 17th- and Early 18th-Century Music. *Spring.* Music from 1580 to 1750 examined in terms of vocal and instrumental styles and national influence. Prer., Mus. 380. 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 the 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. 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. Staff.

MUSIC EDUCATION

Mus. 210-3. The Public School Music Curriculum. *Fall, Spring.* Music education within aesthetic education is principal focus of study. Patterns of music curricula in schools will be explored through class study, school observation, and participation. Special consideration given to methods and materials in general music. Prer., Mus. 100, 101, 102, 103, 180, 181. Beall.

Mus. 217-1. Laboratory Chorus. *Spring.* The study of special music literature available and suitable for young voices (ages 10-17). Opportunities to examine, sing, and conduct this literature are provided with little outside work. Prer., Mus. 100, 101, 102, 103, 180, 181, class or private voice. McCarthy.

Mus. 310-3. Teaching General Music. In-depth study of general music teaching at all levels through development of philosophy of music within aesthetic education; musical structure as content; child and adolescent development objectives; methods and approaches: Orff, Kodaly, Dalcroze, MMCP, eclectic approaches; evaluation. Prer., Mus. 210. Beall.

Mus. 311-3. Introduction to the Arts. *Spring.* Survey of the arts in Western culture, including architecture, painting, sculpture, poetry, prose, music, dance, comedy, tragedy, and film, along with a presentation of various approaches to relating the arts. Prer., basic course in one art. McCarthy.

Mus. 312-3. Teaching Choral Music. *Spring.* Music materials, pedagogical techniques, and administrative procedures used in choral music programs for junior and senior high school-age students. Prer., 200, 202, 210. McCarthy.

Mus. 314-3. Teaching Instrumental Music. *Spring.* Basic courses covering broad principles for administering, teaching, organizing instrumental music programs in the public schools. Staff.

Mus. 315-3. Teaching Woodwind Instruments. *Spring.* Instruction in playing and teaching all woodwind instruments. Playing experiences will be in heterogeneous and homogeneous groupings. Staff.

Mus. 316-2. Teaching Stringed Instruments. *Fall.* Instruction in playing and teaching all stringed instruments. Playing experiences will be in heterogeneous and homogeneous groupings. Staff.

Mus. 317-2/318-2. Conducting I; Conducting II. *Fall, Spring.* Introduction to conducting and rehearsal techniques. Sect. 1-Choral; Sect. 2-Instrumental. Prer., Mus. 200, 180, 181. Whitten, Bernstein, McMurray.

Mus. 319-1. Woodwind and Percussion Design and Repair. *Fall, Spring.* May be repeated for additional credit. Naylor.

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. Beall.

Mus. 321-3. Teaching Brass Instruments. *Spring.* Instruction in playing and teaching all brass instruments. Playing experiences will be in heterogeneous and homogeneous groupings. Staff.

Mus. 412-2. Teaching the Learning-Disabled Child in the Music Class. *Fall.*

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, General, Instrumental). *Fall, Spring.* Required of all students in student teaching programs. Beall, Hilligoss, McKinley.

Mus. 513-1. Advanced Conducting—Instrumental. *Spring.* Advanced work in orchestral conducting. Prer., a 1-sem. conducting class or equivalent. Bernstein, McMurray.

Mus. 515-2. Seminar in the Literature and Performance of Choral Music. *Fall, Spring.* See Choral Music section.

Mus. 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.). Staff.

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. 611-3. Foundations of Music Education I. *Fall.* Survey of historical, philosophical, psychological, and aesthetic bases of contemporary music education. Reeves.

Mus. 613-4. Comprehensive Musicianship for Teachers. *Spring.* Application of structural and analytical principles of music to teaching, conducting and performing music for musician-teachers in the schools. Beall.

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. Beall.

Mus. 616-2. Psychology of Learning in Music. *Spring.* Reeves.

Mus. 617-2. Directions of Contemporary Aesthetic Education. *Fall.* Beall.

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. *Fall.* 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. 236 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.* Hilligoss.

THEORY / COMPOSITION

Mus. 100-3, 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. 121, 221, 321, 421, 521-1. Composition Seminar. *Fall, Spring.* Weekly assembly of all graduate and undergraduate composition students for presentations and discussions on various aspects of theory and composition. Theory/composition division staff.

PMus. 153, 253, 353, 453, 553-1, 2. Composition. *Fall, Spring.* Individual or small-group instruction. Theory/composition division staff.

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. 307-3. Jazz Improvisation. *Spring.* Offers assistance and guidance to the student toward acquiring the necessary skills and gaining insights for achieving creative musical results. Prer., Mus. 100, 101, and basic skills on an instrument. 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.

Composition 1 or 2. *Fall, Spring.* May be repeated for additional credit.

Aero. 395/599. Music Acoustics. *Fall.* See Aerospace Engineering Sciences.

VOICE

Mus. 144-2. Italian Diction and Repertoire. *Fall.* Phonetic elements of liturgical Latin and of Italian for singers. Paton.

Mus. 145-2. English Diction and Repertoire. *Spring.* Clear and expressive use of standard American English in singing.

Mus. 344-2. German Lyric Diction and Repertoire. *Fall.* Orientation to the phonetics of High German by means of International Phonetic Alphabet. Paton.

Mus. 345-2. French Lyric Diction and Repertoire. *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.*

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. 801-0 to 8. Precandidacy for D.Mus. A. *Fall, Spring, Summer.*

Mus. 802-0 to 8. Candidacy for D.Mus. A. *Fall, Spring, Summer.*

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

Concert Band, Marching Band. *Fall, Spring.* One hr. credit each sem. Open to all qualified University students. Hill.

Symphonic Band, Wind Ensemble. *Fall, Spring.* One hr. credit each semester. Prer., consent of instructor. McMurray.

Bell Ensemble. *Fall, Spring.* One hr. credit each sem. A performing organization using the University's set of 49 Whitechapel bells.

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.

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.

Symphony Orchestra, Repertory Orchestra, Chamber 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 Ensembles. *Fall, Spring.* One hr. credit each sem. Prer., consent of instructor.

New Music Ensemble. *Fall, Spring.* One hr. credit each semester. Prer., consent of instructor. Eakin.

SPECIAL STUDIES

Mus. 940-1 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. 950-1 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. 980-1 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.

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.

Musiology Colloquium. *Fall, Spring.* Required for all graduate students in musicology. Kearns.

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; 2 hours credit for B.A. in music students). 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	Piano
Bassoon	Saxophone
Clarinet	String bass
Cornet	Trombone
Flute	Trumpet
French horn	Tuba
Classical guitar	Viola
Harp	Violin
Organ	Violoncello
Percussion	Voice

School of Pharmacy

BIOPHARMACY

Bi.Ph. 308-4. Drug Action. *Spring.* Introduction to biopharmaceutics, pharmacokinetics, drug absorption, metabolism, and excretion. Mathematics of drug receptor interaction. Prer., third-year status.

Bi.Ph. 450-3. Infectious Disease. *Fall.* Survey of diseases resulting from microbial and viral infections. Principles of immunological and drug therapy. Prer., fourth-year status.

Bi.Ph. 490-4. Pathology. *Spring.* Lect. and lab. General pathologic processes—cell injury, inflammation, thrombosis, neoplasia, as well as genetic and immunologic mechanisms of disease are described. A presentation of diseases affecting specific organ systems follows. The cellular aspects of disease and clinical implications are emphasized. Prer., fourth-year status and EPOB 343.

Bi.Ph. 554-2. Cancer: Experimental and Medical Aspects. Lect. Course is divided into two parts. First is a biochemical and morphological description of tumors, tumor behavior such as metastasis and angiogenesis, and tumor development. The second part concerns carcinogenesis: mechanisms, modulation, testing, and epidemiology. Chemotherapy is covered at the end. Prer., Chem. 471 or 481-482, or MCDB 105-106.

Bi.Ph. 949-1 to 3. Independent Study in Biopharmacy. *Fall, Spring.* Study involving library, laboratory, and a report. Prer., undergraduate standing and consent of instructor.

Bi.Ph. 959-1 to 3. Special Problems in Biopharmacy. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

CLINICAL PHARMACY

Cn.Ph. 420-3. Clinical Pharmacy and Therapeutics I. *Fall.* Lect. A didactic course providing information on the appropriate use of pharmacotherapeutic principles in the treatment of selected disease states with particular attention to adverse drug reactions, drug-drug interactions, drug-disease interactions, and rationale pharmacotherapeutics. Prer., fifth-year status.

Cn.Ph. 421-3. Clinical Pharmacy and Therapeutics II. *Spring.* Lect. Continuation of Cn.Ph. 420. Prer., Cn.Ph. 420.

Cn.Ph. 422-3. Therapeutic Aspects of Nonprescription Products. *Spring.* Lect. A didactic course providing information on the use of nonprescription products in selected disease states with particular attention to the areas of product selection, symptomatology, and patient consultation. Prer., Cn.Ph. 420.

Cn.Ph. 423-2. Institutional Pharmacy Practice. *Fall.* Lect. A didactic course providing an introduction to the principles of institutional pharmacy practice with consideration given to purchasing, basic management skills, and protocols to be observed in a hospital pharmacy practice. Prer., fifth-year status.

Cn.Ph. 424-2. Communicative and Psychosocial Aspects of Pharmacy Practice. Lect. and discussion. Designed to acquaint the student with aspects of both interpersonal communication relative to patient care and social issues in pharmacy practice. Prer., Ph.Ad. 486.

Cn.Ph. 426-2. Community Pharmacy Practice Externship I. *Fall, Spring.* Designed to familiarize the student with the practice of community pharmacy. Prer., fifth-year status.

Cn.Ph. 427-2. Community Pharmacy Practice Externship II. *Fall, Spring.* An experiential course to familiarize the student with clinical approaches in the area of community pharmacy practice with particular emphasis on patient consultation. Prer., fifth-year status.

Cn.Ph. 428-2. Institutional Pharmacy Practice Externship I. *Fall, Spring.* An experiential course designed to acquaint the student with basic procedures in hospital pharmacy practice. Prer., fifth-year status.

Cn.Ph. 429-2. Institutional Pharmacy Practice Externship II. *Fall, Spring.* An experiential course designed to acquaint the student with experience in clinical aspects of hospital pharmacy practice. Prer., fifth-year status.

Cn.Ph. 430-2. Outpatient Pharmacy Clerkship. *Fall, Spring.* An experiential course providing an opportunity for the student to gain clinical pharmacy experience in the area of ambulatory care. Prer., fifth-year status.

Cn.Ph. 431-2. Inpatient Pharmacy Practice Clerkship. *Fall, Spring.* An experiential course designed to give the student an opportunity for clinical pharmacy practice in the area of inpatient therapeutics. Prer., fifth-year status.

Cn.Ph. 432-2. Drug Information Clerkship. *Fall, Spring.* A discussion-experiential course in which the student gains experience in the use of both computerized and non-computerized systems utilized in the process of drug information retrieval. Prer., fifth-year status.

Cn.Ph. 433-2. Rural Pharmacy Practice Externship I. *Fall, Spring.* An experiential course designed to provide the student with an opportunity for experience in pharmacy practice in rural areas of Colorado. Prer., fifth-year status.

Cn.Ph. 434-2. Rural Pharmacy Practice Externship II. *Spring.* An extension of Cn.Ph. 433, in which the student is allowed an opportunity to practice clinical pharmacy in a second rural pharmacy practice site in Colorado. Prer., Cn.Ph. 433.

Cn.Ph. 435-2. Geriatric Pharmacy Practice Externship. *Fall, Spring.* An experiential course designed to provide the student with information on the unique aspects of clinical pharmacy practice in the nursing home setting. Prer., fifth-year status.

Cn.Ph. 436-2. Industrial Pharmacy Practice Externship. *Fall, Spring.* An experiential course designed to acquaint the student with principles of pharmacy practice in the area of pharmacy manufacturing. Prer., Phar. 417 or permission.

Cn.Ph. 437-2. Radiopharmacy Clerkship. *Fall, Spring.* An experiential course involving practical application of principles of nuclear pharmacy practice. Prer., fifth-year status.

Cn.Ph. 438-2. Pediatric Pharmacy Practice Externship. *Fall, Spring.* An experiential course involving principles of pharmacotherapeutics as applied to patient care interactions in pediatric patients. Prer., fifth-year status.

Cn.Ph. 439-2. Psychiatric Pharmacy Externship. *Fall, Spring.* An experiential course stressing the care of the mentally ill patient, utilization of drug therapy in mental illness, social aspects of mental

illness, and the role which the pharmacist plays in the care of the mentally ill patient. Prer., fifth-year status.

Cn.Ph. 440-2. Administrative Pharmacy Practice Externship. *Fall, Spring.* An experiential course designed to provide the student with insight into the social-governmental aspects of pharmacy practice. Prer., fifth-year status.

Cn.Ph. 441-2. Special Projects in Clinical Pharmacy. *Fall, Spring.* Advanced opportunities for students to participate in a selected area of clinical pharmacy practice such as pharmaceutical product distribution, pharmaceutical sales representation or clinical research. Prer., fifth-year status.

Cn.Ph. 449-3. Clinical Pharmacokinetics. *Fall.* Lect. and rec. Application of pharmacokinetic principles to therapeutic management of patients. Prer., fifth-year status.

PHARMACEUTICAL CHEMISTRY

Ph.Ch. 370-2. 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. 371-2. Pharmaceutical Chemistry II. *Spring.* Lect. and lab. Continuation of Ph.Ch. 370. Prer., Ph.Ch. 370.

Ph.Ch. 375-3. Physiological and Clinical Chemistry. *Spring.* lect. Concerns regulation of metabolism with emphasis on hormonal mechanisms, changes in biochemistry, due to intrinsic factors such as age and extrinsic factors such as diet, and current diagnostic tests for biochemical abnormalities. Prer., Chem. 471 or 481.

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. 565-2. Advanced Topics in Medicinal Chemistry. *Fall.* Lect. and discussion. A review of topics of current interest in medicinal chemistry. Prer., consent of instructor.

Ph.Ch. 566-2. Advanced topics in Medicinal Chemistry II. *Spring.* Lect. and discussion. Continuation of Ph.Ch. 565. Prer., consent of instructor.

Ph.Ch. 566-1. 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. 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. 700-4 to 6. Master's Thesis.

Ph.Ch. 800-1 to 10. Doctor's Thesis.

Ph.Ch. 949-1 to 3. Independent Study in Pharmaceutical Chemistry. *Fall, Spring.* Study involving library, laboratory and a report. Prer., undergraduate standing and consent of instructor.

Ph.Ch. 959-1 to 3. Special Problems in Pharmaceutical Chemistry. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

PHARMACOLOGY

Ph.Cl. 452-5. Pharmacology I. *Fall.* Lect. and lab. Effects produced by drugs on living systems. Prer., EPOB 343 and Chem. 471.

Ph.Cl. 453-5. Pharmacology II. *Spring.* Lect. and lab. Continuation of Ph.Cl. 452. Prer., Ph.Cl. 452.

Ph.Cl. 474-2. Toxicology. *Spring.* Lect. Current concepts of clinical, environmental, and forensic toxicology. Factors which influence toxicity as well as therapy. Prer., fourth-year status.

Ph.Cl. 550-3. Advanced Pharmacology. *Fall.* Lect. A study of the more advanced aspects of pharmacology. Prer., Ph.Cl. 453 or consent of instructor.

Ph.Cl. 551-3. Psychopharmacology. *Spring.* Lect. Psychedelic agents and drugs used in the treatment of mental illness. Prer., Ph.Cl. 453 or consent of instructor.

Ph.Cl. 552-2. 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. 557-3. 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. 558-1. 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. 653-3. Drug Mechanisms. *Spring.* Lect. and lab. Current concepts relative to mechanisms involved in the response of cells to drugs. Prer., Ph.Cl. 550 or consent of instructor.

Ph.Cl. 654-1 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. 800-1 to 10. Doctor's Thesis.

Ph.Cl. 949-1 to 3. Independent Study in Pharmacology. *Fall, Spring.* Study involving library, laboratory and a report. Prer., undergraduate standing and consent of instructor.

Ph.Cl. 959-1 to 3. Special Problems in Pharmacology. *Fall, Spring.* Research techniques, methods and reporting. Prer., graduate standing and consent of instructor.

PHARMACY-PHARMACEUTICS

Phar. 103-3. Drugs in Society. *Fall.* Lect. and discussion. An overview of cultural and biological aspects of drug use-abuse in contemporary society. Open to all students except pharmacy majors.

Phar. 305-2. Pharmacy Orientation. *Spring.* 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. *Fall.* Conference. Introduction to the elements of modern prescription procedures. Prer., third-year status.

Phar. 308-3. Drug Action. *Spring.* Lect. Introduction to biopharmaceutics and pharmacokinetics, drug absorption, metabolism, and excretion. Mathematics of drug receptor interaction. Prer., third-year status.

Phar. 410-4. Pharmaceutics I. *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 II. *Spring.* Lect. and lab. Theoretical and practical techniques related to the formulation, preparation and dispensing of modern pharmaceuticals. Prer., Phar. 410.

Phar. 416-2. Intercultural Drug Use. *Spring.* Conference. Cultural variations in health practices and attitudes with emphasis on pharmacist-patient communication. Prer., fourth-year status and consent of instructor.

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. 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. 700-4 to 6. Master's Thesis.

Phar. 800-1 to 10. Doctor's Thesis.

Phar. 949-1 to 3. Independent Study in Pharmaceutics. *Fall, Spring.* Study involving library, laboratory and a report. Prer., undergraduate standing and consent of instructor.

Phar. 959-1 to 3. Special Problems in Pharmaceutics. *Fall, Spring.* Research problems involving dosage form design, biopharmaceutics and pharmacokinetics. Prer., graduate standing and consent of instructor.

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. *Fall.* Lect., rec. The application of accounting principles and financial analysis to the management of a pharmacy. Prer., third-year status.

Ph.Ad. 486-3. Pharmacy Management. *Fall.* Lect. and rec. Management, marketing and merchandising problems that must be con-

sidered in the successful operation of a pharmacy. Prer., Ph.Ad. 381 and 483.

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. 700-4 to 6. Master's Thesis.

Ph.Ad. 800-1 to 10. Doctor's Thesis.

Ph.Ad. 949-1 to 3. Independent Study in Pharmacy Administration. *Fall, Spring.* Study involving library, research, and a report. Prer., undergraduate standing and consent of instructor.

Ph.Ad. 959-1 to 3. Special Problems in Pharmacy Administration. *Fall, Spring.* Individual investigations in pharmacy marketing, retailing and management. Prer., graduate standing and consent of instructor.

Graduate School of Public Affairs

See the *University of Colorado at Denver Bulletin* for course descriptions and information.

Reserve Officers 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 I. 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, professionalism, U.S. defense strategy, and military foreign policy decision-making, with emphasis on the 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-making, international laws of warfare, and the Uniform Code of Military Justice.

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. Also examines the career opportunities available through military service. Leadership theories and the fundamentals of human relations will be addressed.

M.S. 102-1. Organizing for Defense. Analyzes the organization of the Department of Defense and Army with a view toward understanding the functions and purpose of these departments in today's world. Also examines organizational theories and the concept of professionalism.

M.S. 201-1. Military Leadership and Management I. Studies supervision, decision-making, planning, communication, interaction, and counseling. Problem and group process approach utilized to develop student's ability for application of effective leadership and management.

M.S. 201-2. Military Leadership and Management II. Continuation of M.S. 201. Organizational theory, organizational effectiveness, management by objectives, and personnel management are studied. Emphasis placed on management case study exercises. Management and leadership theories are developed and applied in a military organizational context.

M.S. 301-2. Advanced Leadership and Military Instruction. Develops the student's expertise in those academic areas and skills required of a military officer. Subject areas include map reading, principles of logistics, maintenance and tactical communications, and introduction to military weaponry and tactics.

M.S. 302-4. Control Aspects of Small Unit Operations. Provides the student with an exposure to Advanced Camp subject matter. Classroom and field training exercises are used to learn small unit tactics, operations techniques and military skills. This course is the successor of M.S. 301 and 303, taught in the spring semester.

M.S. 303-1. Leadership Practicum. Provides student experience in leadership via practical exercises which support the M.S. 301 curriculum. Students will develop their abilities to lead physical training, conduct drill and ceremony, navigate and conduct tactical operations in a field environment.

M.S. 401-1. Seminar in Officer Development and Leadership. This course contains subjects designed to develop and prepare the student for commissioning and initial duty with the active Army or Reserve Forces; organization and functions of the Army, officership and professionalism, customs and traditions, leadership techniques, and career development.

M.S. 402-1. Seminar in Officer Development and Leadership II. This course contains subjects designed to develop and prepare the student for commissioning and initial duty with the active Army or Reserve Forces; assignments, career development, military justice, and benefits of military service.

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 con-

straints 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 domestic and 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 correspondence and 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

ROBERT A. ALDRICH, Professor.* B.A., Amherst College; M.B., M.D., Northwestern University.

BOULOS AYAD, Professor.* B.A., M.A., Ph.D., Cairo University (Egypt); M.A., University of Einshams (Egypt).

DAVID A. BRETERNITZ, Professor.* B.A., University of Denver; M.A., Ph.D., University of Arizona.

GERALD LLOYD BROCE, Assistant Professor (Colorado Springs).* B.A., M.A., Wichita State University; Ph.D., University of Colorado.

ALICE BRUES, Professor.* A.B., Bryn Mawr College; Ph.D., Radcliffe College.

HELEN CANNON, Professor Emeritus.

JOHN G. H. CANT, Assistant Professor (Colorado Springs).* B.A., Yale University; M.A., Ph.D., University of California, Davis.

DENNIS J. DE SART, Assistant Professor (Denver).* B.A., University of Nevada; M.A., Ph.D., Cornell University.

FRANK W. EDDY, Associate Professor.* B.A., University of New Mexico; M.A., University of Arizona; Ph.D., University of Colorado.

DAVID LEE GREENE, Professor.* B.A., M.A., Ph.D., University of Colorado.

ROBERT ALLAN HACKENBERG, Professor.* B.A., M.A., University of Minnesota; Ph.D., Cornell University.

JAMES J. HESTER, Professor.* B.A., University of New Mexico; Ph.D., University of Arizona.

GORDON W. HEWES, Professor.* A.B., Ph.D., University of California, Berkeley.

DOROTHEA V. KASCHUBE, Professor.* A.B., M.A., Ph.D., Indiana University.

ALEC J. KELSO, Department Chairman, Professor.* B.S., Northern Illinois University; M.A., Ph.D., University of Michigan.

GOTTFRIED OTTO LANG, Professor.* A.B., Brown University; M.A., University of Chicago; Ph.D., Cornell University.

JAMES RUSSELL McGOODWIN, Associate Professor.* B.B.A., M.B.A., Ph.D., University of Texas at Austin.

JANET R. MOONE, Associate Professor (Denver).* B.A., University of Tucson; M.A., University of Colorado; Ph.D., University of Arizona.

LORNA B. MOORE, Associate Professor (Denver).* B.A., Smith College; M.A., Ph.D., University of Michigan.

DAVID F. POTTER, Assistant Professor (Attendant rank). B.A., Cornell University; Ph.D., Tutane University.

DUANE QUIATT, Associate Professor (Denver).* A.B., A.M., University of Michigan; Ph.D., University of Colorado.

PAUL SHANKMAN, Associate Professor.* B.A., University of California, Santa Barbara; Ph.D., Harvard University.

PAYSON D. SHEETS, Associate Professor.* B.A., M.A., University of Colorado; Ph.D., University of Pennsylvania.

JACK E. SMITH, Professor (Denver).* B.A., University of Colorado; Ph.D., University of California, Los Angeles.

OMER C. STEWART, Professor Emeritus.*

DENNIS P. VAN DERVEN, Associate Professor.* B.A., University of Utah; M.A., Ph.D., University of Massachusetts.

DEWARD E. WALKER, JR., Professor.* B.A., Ph.D., University of Oregon.

RICHARD WARNER, Associate Professor Adjunct.* M.B., B.S., London University; M.A., University of Colorado; D.P.M., Royal College of Physicians, London.

JOE BEN WHEAT, Professor.* B.A., University of California; M.A., Ph.D., University of Arizona.

THOMAS B. WYNN, Assistant Professor (Colorado Springs).* A.B., Occidental College; A.M., Ph.D., University of Illinois.

ASTRO-GEOPHYSICS

R. GRANT ATHAY, Professor Adjunct.* B.S., Utah State University; Ph.D., University of Utah.

CHARLES A. BARTH, Professor.* B.S., Lehigh University; M.A., Ph.D., University of California, Los Angeles.

EDWARD R. BENTON, Professor.* A.B., Harvard College; A.M., Ph.D., Harvard University.

DONALD E. BILLINGS, Professor Emeritus.*

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Index

- A**
- Academic calendar, 1
 - Academic advising: Arts and Sciences, 25; Education, 92; Engineering, 107
 - Academic ethics, Arts and Sciences, 25; Pharmacy, 214
 - Academic policies: Arts and Sciences 25-26; Business 79-81; Education, 95-96; Engineering, 109-111; Environmental Design, 132-134; Journalism, 185; Law, 190-191; Music, 194-195; Pharmacy, 213
 - Accounting: degree programs, 82; courses, 291
 - Accreditation, 2. *See also* specific colleges and schools
 - Adding and dropping courses, 11
 - Administrative officers, 23-24
 - Admission requirements: undergraduate students, 2-9; freshman students, 3-6; transfer students, 6-8; special students, 8-9; faculty members, auditors, 9; graduate students, 152-154; Business, 81; Education, 93-94; Engineering, 102-105; Environmental Design, 131; Graduate, 150-153; Journalism, 183; Law, 188; Music, 195; Pharmacy, 213-214
 - Advanced placement program, 10, 105
 - Advanced standing by examination, 10
 - Advertising sequence, Journalism, 184
 - Advising, academic. *See* academic advising
 - Aerospace engineering sciences: degree programs, 113-114; courses, 304-306
 - Affirmative action/equal opportunity, 2, 186
 - African and Middle Eastern studies, 31
 - Air Force aerospace studies, ROTC, 216; courses, 338
 - Alumni, 17
 - American studies, 31
 - Anatomy, 164
 - Anesthesiology, 164-165
 - Anthropology: degree programs, 31-32; courses, 218-221
 - Application procedures: freshman students, 4-5; transfer students, 5-6; graduate students, 152
 - Applied mathematics: degree programs, 115-116; courses, 306
 - Applied music, 336
 - Applied physics, 159
 - Architectural engineering: degree programs, 116-118; courses, 306-307
 - Architecture, Master of: degree program, 134-136; courses, 324
 - Arctic and Alpine Research, Institute of (INSTAAR), 142
 - Areas of emphasis in Business, 82-87
 - Art history, 245-247
 - Arts and Sciences, College of, 25-77; course descriptions, 218-290; faculty, 340-353
 - Asian studies, 32-33
 - Assistantships, 151. *See also* specific programs
 - Astro-Geophysics: degree programs, 33-34; courses, 221-223
 - Attendance regulations: Arts and Sciences, 26; Business, 79; Engineering, 112; Environmental Design, 134; Journalism, 185; Law, 191; Music, 194
 - Auditors, admission of, 9
 - Automobiles on campus, 15
 - Awards. *See* Scholarships, awards, and prizes
- B**
- Bachelor's degrees: Arts and Sciences, 26, 27; Business, 81-86; Education 94-96; Engineering, 105-109; Environmental Design, 131-132; Journalism, 184; Music 195-205; Pharmacy, 212-215. *See also* specific departmental sections
 - Basic Science, Master of, 160-161
 - Behavioral Genetics: Institute for (IBG), 142; graduate training program, 159
 - Behavioral Science, Institute of (IBS), 142-143
 - Bibliography, 36; courses, 223
 - Bicycles on campus, 15
 - Biochemistry, 165-167
 - Biological science, in integrated studies, 261
 - Biological sciences: degree programs, 34-36; courses 223-227. *See also* Environmental, population, and organismic biology, and Molecular, cellular, and developmental biology
 - Biometrics, 167-168
 - Biophysics and genetics, 165-167
 - Black studies, 36; courses, 227-228
 - Board and room, 15
 - Board of Regents, 23
 - Business Administration, Master of, 87; Doctor of, 89-91
 - Business and Administration, College of, 78-91; courses, 291-297; faculty, 353-354
 - Business education, 291
 - Business, environment and policy, 291
 - Business law, 291
 - Business Research Division, 144
- C**
- Calendar, academic, 1
 - Campuses of the University, 1
 - Career Counseling and Occupational Information Services, 17
 - Catalog, ordering of, 2
 - Center for Interdisciplinary studies, 36; courses, 228-230
 - Central and East European studies, 37
 - Chemical engineering: degree programs, 118-120; courses, 307-309
 - Chemical physics, 159-160
 - Chemistry: degree programs, 37-38; courses, 230-232
 - Chicano studies: degree program, 36; courses, 232-233
 - Child health associate, 168-169
 - Chinese: degree program, 62; courses, 263-264; *See also* Oriental Languages and Literatures
 - Civil, environmental, and architectural engineering: degree programs, 120-121; courses, 309-312
 - Classics: degree programs, 38-39; courses, 233
 - Classification of in-state, out-of-state students, 14-15
 - College Expository Writing Program (CEWP), 26, 32, 221
 - College-Level Examination Program (CLEP), 9, 26
 - Colleges and schools of the University, 1
 - Colorado Springs Campus, 20
 - Combined programs: in Business, 81, 86; in Engineering, 106; in Environmental Design, 129; in Pharmacy, 212
 - Communication: degree programs, 39-40; courses, 236-236
 - Communication disorders and speech science: degree programs, 40-41; courses, 236-237
 - Community Development and Design, Center for, 140
 - Comparative literature: degree programs, 41-42; courses, 237
 - Comprehensive-final examinations, 155
 - Computer science: degree programs, 121-122; courses, 312-314
 - Computing Center, 143
 - Concurrent enrollment, 9
 - Conferences and Management/Technical Programs, Center for, 21
 - Confirmation: freshman students, 5, 6; transfer students, 7; graduate students, 152;
 - Conflict and peace studies, 42
 - Continuing Education, Division of, 21
 - Cooperative Institute for Research in Environmental Sciences (CIRES), 143
 - Correspondence study: Arts and Sciences, 27; Business, 80
 - Counseling services, 16
 - Course descriptions, 223-343
 - Course load: definitions, 10; Arts and Sciences, 28; Business, 81; Engineering, 113; Graduate School, 152
 - Law, 190; Music, 194
 - Credit for military service and schooling, 9
- D**
- Dance: degree programs, 73-75; courses, 289. *See also* Theatre and dance
 - Day Care Center, 17
 - Deferred payment, tuition, 14
 - Degree requirements. *See* Bachelor's degrees, Master's degrees, Doctoral degrees, and specific departmental sections
 - Denver Campus, 21
 - Disabled Students, Office of, 19
 - Dissertation: credit, 156; requirements, 158
 - Distributed studies program, 42
 - Doctor of Philosophy, 156
 - Doctoral degrees: requirements for, 157-160; in Business Administration, 89-91; in Education, 98-99; in Engineering, 112-113; in Law, 190; in Music, 209-211. *See also* specific degree programs and departmental sections
 - Double majors and degrees, Arts and Sciences, 27; Business, 81; Journalism, 184
 - Drop/add procedure, 11
- E**
- Economic Research, Bureau of, 144-145
 - Economics: degree programs, 42-45; courses, 237-240
 - Economics Institute, 145
 - Education, School of, 92-99; courses, 297-304; faculty, 354-355
 - Educational facilities, 20-23
 - Educational Leadership Services, Center for, 145
 - Educational opportunity programs, 17-18
 - Electrical engineering: degree programs, 122-125; courses, 314-318
 - Elementary education, 94-95
 - Employment, student, 17

- Engineering and Applied Science, College of, 100-128; courses, 304-322; faculty, 355-358
- Engineering, in Arts and Sciences, 45
- Engineering, Master of, 112, 161
- Engineering, nondepartmental courses, 319
- Engineering design and economic evaluation: degree programs, 125; courses, 318-319
- Engineering physics: degree programs, 125-127; courses, 320
- Engineering Research Center, 143
- English: degree programs, 45-47; courses, 240-243; in Engineering, 108
- Enrollment confirmation deposit, 11-12
- Ensembles, Music, 342
- Entrance examinations, 4-5
- Environmental conservation, 47
- Environmental Design, College of, 129-140; courses, 322-328; faculty, 358-359
- Environmental, population, and organismic biology: degree programs, 34-35; courses, 223-226
- Equal opportunity/affirmative action, 2
- Estimate of expenses, 15
- Events/Conference Center, 21 preliminary, 156
- Examinations: entrance, 4-5; comprehensive-finals, 156, 158
- Expenses, 12-15
- Experimental studies, 47
- F**
- Facilities and services, 16-23
- Faculty, 340-365
- Family Educational Rights and Privacy Act, 10
- Farrand College, 29-30
- Fee regulations, 13-15
- Fees and tuition, 12-13
- Fellowships and scholarships, Graduate, 149. *See also* Financial Aid and Scholarships, awards, and prizes
- Film studies, 48, 243
- Finance: degree program, 82-83; courses, 293-294
- Financial aid, 16-17
- Fine arts: degree programs, 48-51; courses, 243-247; exhibitions, 22
- Fiske Planetarium, 21
- Foreign Language House, 27
- Foreign language requirement: Arts and Sciences, 28; Graduate, 157
- Foreign student adviser, 18
- Foreign students, 7
- Former students, 7-8, 104
- French and Italian: degree programs, 51-52; courses, 247-248
- Freshman students, admission of, 3-6. *See also* Admission requirements
- G**
- General information, 1-24
- Geography: degree programs, 52-53; courses, 248-250
- Geological sciences: degree programs, 53-54; courses, 251-253
- Geophysics, 160
- Germanic languages and literatures: degree programs, 54; courses, 253-254
- Governmental Research and Service, Bureau of, 144
- Grading and grade symbols, 10-11
- Grade-point average: Arts and Sciences, 28; Education, 95; Engineering, 112; Environmental Design, 132; Graduate, 154; Journalism, 185; Law, 190; Music 193; Pharmacy, 215; Public Affairs, 217
- Graduate degrees: list of, 141-142; requirements for, 154-160; *See also* Master's degrees, Doctoral degrees, and specific departmental sections
- Graduate Record Examinations, 151
- Graduate School, 141-182; faculty, 359-363
- Graduate study and research facilities, 142-148; Colorado Springs Campus, 146-147; Denver Campus, 147; Health Sciences Center, 147-148
- Greek: degree program, 38-39; courses, 234
- H**
- Health administration, 169-171
- Health Sciences Center, 20
- Health Service, 19
- High Altitude Observatory (HAO), 143
- History: degree programs, 55; courses, 254-258
- History and literature major, Music, 196
- History of the University, 2
- Honors: program, 55-56; Arts and Sciences, 28; Business, 79; Engineering, 102; Journalism, 182; Music, 196; Pharmacy, 212
- Housing, 15
- Humanities, 56; courses, 229
- I**
- Independent study, Arts and Sciences, 28
- Individually structured major, 56
- Information science, 83
- Information systems, 294
- Information, general, 1-24
- Installment payments, 13
- In-state students, classification of, 14-15
- Insurance, 294
- Intellectual Behavior, Institute for the Study of (ISIB), 143
- Intensive English Center, 21
- Interdepartmental programs, Graduate, 159-164, 171
- Interdisciplinary Studies, Center for, 36
- Interior Design, Master of, 138-139; courses, 325-326
- International affairs, 56-57
- International business, 83
- International Economics Studies Center, 145
- International Education, Office of, 18, 148
- Intrauniversity transfer, 8
- Italian: 51, 248. *See also* French and Italian
- J**
- Japanese: degree program, 62; courses, 264. *See also* Oriental languages and literatures
- Joint degrees: Business, 81; Engineering, 105
- Joint Institute for Laboratory Astrophysics (JILA), 144
- Journalism, School of, 182-185; courses, 328-329; faculty, 363
- L**
- Labor Education and Research, Center for (CLEAR), 144
- Laboratory breakage deposit, 12
- Laboratory for Atmospheric and Space Physics, (LASP), 143-144
- Laboratory of Educational Research, 145
- Laboratories and special equipment, graduate study, 145-146
- Landscape Architecture, Master of, 136-138; courses, 326-327
- Language requirements. *See* Foreign language requirements
- Late registration: graduate, 154 penalty, 13
- Latin: degree program, 38-39; courses, 234
- Latin American studies, 57-58
- Law, School of, 186-192; courses, 329-332; faculty, 363
- Lectures and professorships, Law, 187
- Legal Aid and Defender Program, 188
- Libraries, 22
- Lifelong Learning, Center for, 21
- Linguistics: degree programs, 58-60; courses, 258-259
- Loans. *See* Financial aid and Scholarships, awards, and prizes
- M**
- Macky Auditorium, 22
- Management science, 294
- Marketing: degree program, 83; courses, 294-295
- Master of Basic Science, 160-161
- Master of Engineering, 161-162
- Master's degrees: requirements for, 153-156; in Architecture, 135-140; in Business, 88-90; in Education, 97; in Engineering, 111-113; in Environmental Design, 133-140; in Journalism, 184-185; in Music, 205-209; *See also* specific departmental sections
- Master's thesis or report, 154
- Mathematical physics, 162-163
- Mathematics: degree programs, 60-61; courses, 259-263
- Matriculation fee, 12
- Mechanical engineering: degree programs, 127-128; courses, 320-322
- Medical care, 19
- Medical Center, *see* Health Sciences Center
- Medicine, 172
- Medieval studies, 61; courses, 267
- Microbiology and immunology, 172-173
- Military science ROTC, 217; courses, 338
- Military service and schooling, credit for, 9
- Minerals land management; degree program, 83-84; courses, 295
- Model degree program, Business, 83
- Molecular and cellular biology, 171
- Molecular and human genetics, 171
- Molecular, cellular, and developmental biology: degree programs, 35-36; courses, 226-227
- Museum, 22, 61-62; courses, 263
- Music, College of, 193-211; in Arts and Sciences, 62; courses, 332-336; faculty, 364
- Music education: degree programs, 200-202; courses, 333
- N**
- Natural science, 229
- Naval science, ROTC, 216; courses, 339
- News-editorial sequence, Journalism, 184
- Nonresident students, classification of, 14-15

- Norwegian, 254
 Notification and confirmation:
 freshman students, 5;
 transfer students, 6;
 graduate students, 154
 Nuclear Physics
 Laboratory, 144
 Nursing graduate
 program, 173-177
- O**
- Objectives and stature of the
 University, 2
 Office administration, 295
 Ombudsman Office, 18-19
 Organ and church music, 197;
 courses, 334
 Organization management:
 degree programs, 84;
 courses, 295-296
 Oriental and Slavic
 languages and
 literatures: degree
 programs, 62-63;
 courses, 263-265
 Originality of work, 12
 Out-of-state students,
 classification of, 14-15
- P**
- Parking and traffic
 regulations, 15-16
 Pass/fail: procedure, 11; option
 in Arts and Sciences, 29;
 Business, 81; Engineering,
 109; Environmental
 Design, 133; Music, 194
 Pathology, 177-178
 Payment of fees, 12-13
 Personnel human resources
 management: degree
 program, 84; courses, 296
 Pharmacology, 178-179
 Pharmacy, School of, 212-215;
 courses, 336-338;
 faculty, 364-365
 Pharmacy administration, 338
 Philosophy:
 degree programs, 63-64;
 courses, 265-267
 Physical education:
 degree programs, 64-66;
 courses, 267-269
 Physical medicine and
 rehabilitation, 179
 Physical science, in integrated
 studies, 262
 Physical therapy, 179
 Physics: degree
 programs, 66-68;
 courses, 269-271
 Physiology, 179-180
 Piano major, 197;
 courses, 334
 Placement, job, 17
 Planetarium, 21
 Policies, academic. *See*
 Academic policies
 Political science: degree
 programs, 68-70;
 courses, 271-276
 Portuguese: degree
 program, 72-73;
 courses, 287
 Prehealth sciences, 75-77
 Prelegal preparation, 187
 Preliminary examination,
 doctoral degree, 156
- Premedicine, option in
 engineering, 107-108
 Preventive medicine and
 comprehensive health
 care, 180
 Prizes. *See* Scholarships,
 awards, and prizes
 Probation: Arts and
 Sciences, 30
 Production and operations
 management: degree
 program, 84-85; courses,
 296
 Provisional degree
 students, graduate, 150
 Psychiatry, 180
 Psychology:
 degree programs, 70-71;
 courses, 276-280
 Public agency administration, 85
- Q**
- Quality of work, Graduate
 School, 153
 Quantitative methods, 296
- R**
- Radiology, 180-181
 Radio-television. *See*
 Communication
 Radio-television news
 sequence, Journalism, 184
 Readmission: of former
 undergraduate students, 7-8;
 of former and suspended
 students, Graduate
 School, 151-152
 Real estate:
 degree program, 86;
 courses, 305
 Recitals, theses, and required
 classes, Music, 335
 Recreation: program, 22;
 degree program, 65-66;
 courses, 269. *See also*
 Physical education and
 recreation
 Refunds and withdrawal
 charges, 14
 Regents, Board of, 23
 Registration, 10; graduate, 153.
 See also Academic calendar
 Religious studies:
 degree program, 71;
 courses, 280-281
 Repetition of courses:
 Engineering, 110;
 Graduate, 155
 Requirements for degrees. *See*
 Bachelor's degrees, Master's
 degrees, Doctoral degrees
 Research assistantships, 151
 Research and public service, 23
 Research facilities,
 Graduate, 142-148
 Reserve Officer Training
 Corps. *See* ROTC
 Residence facilities, 15
 Residence requirements:
 Education, 97;
 Environmental Design, 132;
 Graduate, 155, 158;
 Journalism, 184;
 Music, 195;
 Pharmacy, 213
 Resident students,
 classification of, 14-15
- Residential academic
 programs, 29-30
 Room and board, 15
 ROTC, 23; in Business, 80;
 in Engineering, 108; in
 Environmental Design, 133;
 programs, 221-222; faculty,
 365; courses, 338-339
 Russian:
 degree program, 62
 courses, 264-265
- S**
- Scandinavian, 254. *See also*
 Germanic languages and
 literatures
 Scholarships, awards, and
 prizes: Education, 92;
 Engineering, 102;
 Environmental Design, 130;
 Graduate, 149; Journalism,
 183; Law, 188; Music, 194;
 Pharmacy, 212. *See also*
 Financial aid
 Scholastic: dismissal, Arts and
 Sciences, 30; standards,
 Business, 79; standards,
 Education, 95;
 deficiency, Engineering,
 110; suspension,
 Environmental Design, 133;
 suspension, Journalism, 185;
 rules, Law, 191;
 requirements, Music, 195;
 requirements
 Pharmacy, 215
 Schools and colleges of the
 University, 1
 Secondary education 95;
 Senior auditor program, 8
 Services for Disabled Students,
 Office of, 18
 Sewall Hall, 29-30
 Slavic languages and
 literature, 263-265;
 See also Oriental and
 Slavic languages
 and literatures
 Small business management:
 degree program, 85;
 courses, 297
 Social science, in interdisciplinary
 studies, 230
 Sociology: degree programs,
 71-72; courses, 281-285
 Sommers-Bausch
 Observatory, 143
 Spanish and Portuguese:
 degree programs, 72-73;
 courses, 285-287
 Special students,
 admission of, 7-8
 Special studies, Music, 335
 Specialist in Education
 degree, 97-98
 Speech and Hearing Clinic, 23
 Speech pathology
 and audiology: *See*
 Communication disorders
 and speech science
 String instruments major, 198;
 courses, 334
 Student employment, 17
 Student Health Service, 19
 Student organizations:
 Business, 79; Education, 92;
 Engineering, 102;
 Journalism, 183;
 Law, 188; Music, 193
- Student services
 and facilities, 16-20
 Study abroad, 18
 Swedish, 254
- T**
- Teacher certification, 92-93
 Teacher education
 programs, 94-99;
 courses, 305-312
 Teaching assistantships, 149-150
 Telecommunications, 163-164
 Televised courses,
 Engineering, 111
 Testing services, 16
 Theatre and dance:
 degree programs, 73-75;
 courses, 287-290
 Theatre, University, 23
 Theory major, Music, 198
 Thesis requirements, 155, 157
 Time limit, graduate
 degrees, 159
 Traffic and parking
 regulations, 14
 Transcripts, 12
 Transfer of credit, 6-7;
 in Arts and Sciences, 30;
 in Business, 80; in
 Education, 93; in
 Engineering, 103-104;
 in Environmental Design,
 131; in Graduate School,
 154-155, 157;
 in Journalism, 184; in
 Law, 189; in Music, 195
 Transportation and traffic
 management:
 degree programs, 85-86;
 courses, 297
 Tuition and fees: Boulder
 Campus, 11-12; Colorado
 Springs Campus, Denver
 Campus, Health Sciences
 Center, School of Nursing,
 148-149
- U**
- Undergraduate admission
 requirements, 2-9. *See also*
 Admission requirements
 Undergraduate degree
 requirements. *See*
 Bachelor's degree
 requirements and specific
 departmental sections
 Uniform grading
 system, 10-11
 University Memorial
 Center, 20
 University Theatre, 22
 Urban design, 325
 Urban and Regional
 Planning — Community
 Development,
 Master of, 139-140;
 courses, 327
- V**
- Veterans affairs, Office of, 19
 Voice major, Music, 199;
 courses, 341-342
- W**
- Wind instruments major,
 Music, 200
 Withdrawal from the
 University, 11, 14
 Women studies, 75, 290
 Women's Center, 16