Message from President Koffler

The General Catalog provides illuminating insights into the character of the University. As such it is of value not only to current students but also to individuals who contemplate enrolling.

You will find that these pages demonstrate the impressive depth and breadth of the University of Arizona's endeavors. They extend through the entire spectrum of the arts and sciences and embrace a wide range of professional fields. In all areas you will find both introductory courses, which outline the intellectual challenge of a field, and sequences of more advanced courses designed to develop a solid grasp of the issues involved.

Impressive as it is in length, variety and depth, this catalog still cannot tell the full story of our intellectual endeavors. It does not fully describe our graduate programs, for they are left largely to a separate volume. Nor does it cover the myriad specialized research activities of our faculty members, activities that underpin and invigorate their classroom teaching. Nor, again, does this catalog indicate our program of innumerable lectures, discussions, exhibitions and artistic performances. All of these, together with recreational and athletic activities, and the beauty of our setting, add to the vitality of campus life. All of these elements are valuable portions of the educational process and all of them contribute to our academic worth.

As you use this catalog I hope that you find not only the specific information that you seek but also additional information opening doors into exciting new worlds as yet unsampled, but intriguing.

Henry Koffler
President

Koffler
<table>
<thead>
<tr>
<th>Event</th>
<th>1987-88</th>
<th>1988-89</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last day for receipt of applications for undergraduate admission</td>
<td>Dec. 14 M</td>
<td>Dec. 12 M</td>
</tr>
<tr>
<td>and all supporting transcripts</td>
<td>Jan. 11-13 M-W</td>
<td>Jan. 9-11 M-W</td>
</tr>
<tr>
<td>Registration</td>
<td>Jan. 14 Th</td>
<td>Jan. 12 Th</td>
</tr>
<tr>
<td>Classes begin</td>
<td>Jan. 21 Th</td>
<td>Jan. 19 Th</td>
</tr>
<tr>
<td>Last day of registration for credit</td>
<td>Feb. 10 W</td>
<td>Feb. 8 W</td>
</tr>
<tr>
<td>Last day for dropping courses resulting in deletion of course</td>
<td>Feb. 15 M</td>
<td>Feb. 20 M</td>
</tr>
<tr>
<td>enrollment from record</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presidents' Day—no classes</td>
<td>Mar. 1 Tu</td>
<td>Mar. 1 W</td>
</tr>
<tr>
<td>Midsemester scholarship records due in Office of the Registrar</td>
<td>Mar. 2 W</td>
<td>Mar. 1 W</td>
</tr>
<tr>
<td>Founder's Day</td>
<td>Mar. 12 Sa</td>
<td>Mar. 12 Su</td>
</tr>
<tr>
<td>Spring recess</td>
<td>Mar. 12-20 Sa-Su</td>
<td>Mar. 11-19 Sa-Su</td>
</tr>
<tr>
<td>Last day for dropping courses</td>
<td>Mar. 30 W</td>
<td>Mar. 29 W</td>
</tr>
<tr>
<td>Applications for bachelor's degree candidacy must be filed for</td>
<td>May 2 M</td>
<td>May 1 M</td>
</tr>
<tr>
<td>degrees to be awarded at close of the following fall semester</td>
<td>May 4 W</td>
<td>May 3 W</td>
</tr>
<tr>
<td>Class and laboratory sessions end</td>
<td>May 5 F</td>
<td>May 5 F</td>
</tr>
<tr>
<td>Semester examinations begin</td>
<td>May 13 F</td>
<td>May 12 F</td>
</tr>
<tr>
<td>Semester examinations end</td>
<td>May 14 Sa</td>
<td>May 13 Sa</td>
</tr>
<tr>
<td>Spring Commencement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precession</td>
<td>1988</td>
<td>1989</td>
</tr>
<tr>
<td></td>
<td>May 16-June 4</td>
<td>May 15-June 3</td>
</tr>
<tr>
<td>Summer Session</td>
<td>1988</td>
<td>1989</td>
</tr>
<tr>
<td>Registration for first term</td>
<td>June 3 F</td>
<td>June 2 F</td>
</tr>
<tr>
<td>First term</td>
<td>June 6-July 7</td>
<td>June 5-July 6</td>
</tr>
<tr>
<td>Registration for second term</td>
<td>July 8 F</td>
<td>July 7 F</td>
</tr>
<tr>
<td>Second term</td>
<td>July 11-Aug. 10</td>
<td>July 10-Aug. 9</td>
</tr>
</tbody>
</table>
All colleges and departments establish certain academic requirements which must be met before a degree is granted. These requirements concern such things as curricula and courses, majors and minors, and campus residence. Advisors, directors, department heads, and deans are available to help the student understand and arrange to meet these requirements, but the student is responsible for fulfilling them. At the end of the student's course of study, if requirements for graduation have not been satisfied, the degree will not be granted. For this reason it is important for each student to be acquainted and remain currently informed about all regulations, and to be responsible for completing requirements. Courses, programs, and requirements described in the catalog may be suspended, deleted, restricted, supplemented, or changed in any other manner at any time at the sole discretion of the University of Arizona and the Arizona Board of Regents. The catalog does not establish a contractual relationship, but it summarizes the total requirements which the student must presently meet before qualifying for a faculty recommendation to the Arizona Board of Regents to award a degree.

The determination of acceptability of credit for course work completed at another institution of higher learning, whether the other institution is accredited or not, is made solely at the discretion of this institution as guided by its academic policy bodies. Students are advised to check with Office of Admissions to determine the acceptability of credit from other institutions and its applicability toward a program of study at the University of Arizona.

The University of Arizona does not discriminate on the basis of sex, age, race, religion, color, national origin, Vietnam Era Veteran's status, or disability in its admissions, employment and educational programs or activities, and is required by Title IX of the Education Amendments of 1972, Title VII of the Civil Rights Act of 1964, Sections 503 and 504 of the Rehabilitation Act of 1973, the Age Discrimination in Employment Act of 1967, and the Vietnam Era Veteran's Readjustment Assistance Act of 1972 not to discriminate in such manner. Inquiries concerning the application of said regulations to the University of Arizona may be referred to Dr. Doris J. Ford, Affirmative Action Officer, Administration 501, phone (602) 621-3081. In compliance with the Family Education Rights and Privacy Act of 1974, the University of Arizona guarantees that the parents of dependent children will have a right to information about their offspring without having to gain the student's consent.

Announcements in this catalog concerning regulations, fees, curricula, or other matters are subject to change without notice. Inquiries regarding admission to the University should be addressed to:

Director of Admissions
The University of Arizona
Tucson, Arizona 85721
(602) 621-3237

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</tr>
</thead>
<tbody>
<tr>
<td>Last day for receipt of applications for undergraduate admission and all supporting transcripts</td>
<td>July 27 M</td>
<td>July 22 F</td>
</tr>
<tr>
<td>Degrees awarded as of this date for students completing requirements at close of summer session</td>
<td>Aug. 13 Th</td>
<td>Aug. 11 Th</td>
</tr>
<tr>
<td>Residence halls open</td>
<td>Aug. 23 Su</td>
<td>Aug. 21 Su</td>
</tr>
<tr>
<td>New-student orientation program (Last session)</td>
<td>Aug. 22-24 Sa-M</td>
<td>Aug. 20-22 Sa-M</td>
</tr>
<tr>
<td>Registration</td>
<td>Aug. 24-26 M-W</td>
<td>Aug. 22-24 M-W</td>
</tr>
<tr>
<td>Classes begin</td>
<td>Aug. 27 Th</td>
<td>Aug. 25 Th</td>
</tr>
<tr>
<td>Last day of registration for credit</td>
<td>Sept. 3 Th</td>
<td>Sept. 1 Th</td>
</tr>
<tr>
<td>Labor Day—no classes</td>
<td>Sept. 7 M</td>
<td>Sept. 5 M</td>
</tr>
<tr>
<td>Last day for dropping courses resulting in deletion of course enrollment from record</td>
<td>Sept. 23 W</td>
<td>Sept. 21 W</td>
</tr>
<tr>
<td>Last day for dropping courses</td>
<td>Nov. 4 W</td>
<td>Nov. 2 W</td>
</tr>
<tr>
<td>Veterans’ Day—no classes</td>
<td>Nov. 11 W</td>
<td>Nov. 11 F</td>
</tr>
<tr>
<td>Honors Convocations—no classes</td>
<td>Nov. 19 Th</td>
<td>Nov. 15 Tu</td>
</tr>
<tr>
<td>9:00-11:00 a.m.</td>
<td>Nov. 26-29 Th-Su</td>
<td>Nov. 24-27 Th-Su</td>
</tr>
<tr>
<td>Thanksgiving recess</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applications for bachelor’s degree candidacy must be filed for degrees to be awarded at close of the following summer session</td>
<td>Dec. 1 Tu</td>
<td>Dec. 1 Th</td>
</tr>
<tr>
<td>Classes and laboratory sessions end</td>
<td>Dec. 11 F</td>
<td>Dec. 12 M</td>
</tr>
<tr>
<td>Semester examinations begin</td>
<td>Dec. 14 M</td>
<td>Dec. 14 W</td>
</tr>
<tr>
<td>Semester examinations end</td>
<td>Dec. 18 F</td>
<td>Dec. 21 W</td>
</tr>
<tr>
<td>Winter Commencement</td>
<td>Dec. 19 Sa</td>
<td>Dec. 22 Th</td>
</tr>
</tbody>
</table>
University Policies and Services
University Policies and Services

Admission to the University

The University of Arizona welcomes applications for admission from all individuals who qualify. Students with a record of success or high motivation to succeed will find the rich blend of academic and social opportunities for learning available at the University particularly well suited to their needs.

The Office of Admissions offers numerous opportunities for visiting the University which include campus tours, personal interviews, and meetings with faculty members. Prospective students should call the Office of Admissions at (602) 621-3641 for information about campus visitation programs, and to arrange for personal appointments and for student-conducted campus tours.

GENERAL INFORMATION

EQUAL OPPORTUNITY—The University of Arizona is committed to providing equal educational opportunity for all without regard to sex, race, religion, color, national origin, age, Vietnam Era veterans’ status, or handicapping condition. Inquiries may be referred to the Affirmative Action Officer, Administration Building, Room 501, (602) 621-3081.

APPLICATION FOR ADMISSION—Applications for admission may be obtained by writing or calling:

Office of Admissions
University of Arizona
Tucson, AZ 85721
(602) 621-3237

Inquiries regarding admission policies and procedures for undergraduate programs should be directed to the Office of Admissions. Information about admission to the Graduate College, the College of Law, and the College of Medicine may be obtained from the admissions office of the respective college.

DEADLINE FOR APPLICATION—Applications and supporting transcripts must be received in the Office of Admissions by July 1 for the fall semester and December 1 for the spring semester. However, to be eligible for the Priority Service Program (financial aid, scholarships, residence hall accommodations, and summer orientation and pre-registration), applicants should submit complete applications and supporting transcripts by April 1 for the fall semester. Earlier applications are recommended. High school seniors may submit their applications any time during the first semester of their senior year. A description of the Priority Service Program is below.

PRIORITY SERVICE PROGRAM—The University of Arizona has received unprecedented national recognition over the last several years for its academic excellence in teaching and research, its athletic programs, and its outstanding quality of life. This has led to a growth in applications and a demand for student services which has placed it among the nation’s most popular universities. It is now essential that students interested in attending the University of Arizona apply for admission and services for new students (financial aid, scholarships, residence hall space, and summer orientation) as early as possible. To encourage early application, the University of Arizona has established the Priority Service Program.

Under the Priority Service Program, students applying for admission and services for new students by April 1 (for fall semester) will receive priority service from participating offices. While April 1 is the priority service date, students may apply much earlier, and they are encouraged to do so. A brochure which details each priority service function can be obtained through the Office of Admissions.

ACT OR SAT REQUIREMENTS—All entering freshman students must take the American College Test (ACT) or the Scholastic Aptitude Test (SAT) of the College Board, and have their
scores sent to the Office of Admissions. Information regarding these tests may be obtained from high school counselors. Transfer applicants who have earned less than 36 semester hours of credit must also submit results from either the ACT or SAT examinations.

DOMICILE AFFIDAVIT—A student enrolling in the University of Arizona for the first time, or a student returning after an absence of one or more semesters, must file a Domicile Affidavit. This form is furnished to students with the admission or readmission application. Foreign students (nonimmigrants) are classified nonresidents of the State of Arizona for the duration of their enrollment, and a Domicile Affidavit is, therefore, not required.

HEALTH REGULATIONS—All new students and students absent from the University more than two semesters must submit a completed Student Health Questionnaire to the Student Health Service. This form will be mailed to all admitted students. Additionally, it is recommended that the results of a tuberculin skin test taken within six months prior to registration be submitted. If the skin test is found to be positive, a chest x-ray is recommended. Medical or nursing students should defer the chest x-ray until arrival at the University.

READEMISSION—Students absent from the University for a regular semester or longer are required to apply for readmission. Readmission applications are available at the Office of Admissions. Applicants for readmission must meet the application deadline specified for the term in which they wish to enroll. Students who withdraw for medical reasons and who are medically encumbered must have their readmittance approved by the Student Health Service. Medical withdrawal procedures should be initiated through the Student Health Service.

ADMISSION AS A NONDEGREE STUDENT—Applicants who have graduated from high school and who do not wish to work toward a degree may enroll for on-campus courses as a nondegree student. Applicants for admission to this program may enroll for as many credits as their chosen college allows during the first semester, but may not enroll for more than six credits or two courses in subsequent semesters. A maximum of 15 credits completed as a nondegree student may be used to fulfill degree requirements. A Domicile Affidavit is required if registration is for more than 6 credits. A disqualified student may not attend the University as a nondegree student.

SUMMER SESSIONS—The University of Arizona offers numerous summer learning opportunities. Students wishing to attend summer sessions may apply for summer sessions only or for continuing enrollment beginning with the summer terms. Please contact the Office of Admissions for application materials.

CANCELLATION OF ADMISSION OR REGISTRATION—The University reserves the right to cancel the admission or registration of an individual whose attendance at the University, in the opinion of the appropriate administrative officer and the President, would not be mutually beneficial to the student and to the institution.

ACCOMMODATION OF RELIGIOUS OBSERVANCE AND PRACTICE —In accord with Board of Regents' policy, no employee, agent or policy of the University of Arizona shall discriminate against any student, employee, or other individual because of that individual's religious belief or practice or any absence thereof. Administrators and faculty members are responsible for reasonable accommodation of individual religious practices. A refusal to accommodate is justified only when undue hardship would result from each available alternative of reasonable accommodation. Further, no administrator or faculty member shall retaliate or otherwise discriminate against any student, employee or prospective employee because that individual has sought a religious accommodation pursuant to this policy.

Persons wishing clarification of the nature or proper application of this policy should consult the Office of the Dean of Students or the Office of the Director of Personnel, as appropriate.
GENERAL APTITUDE—Applicants must demonstrate general aptitude through meeting one of the following requirements:

a. Ranks in the upper 50 percent of the applicant's high school graduating class or has a cumulative high school grade-point average of at least 2.50 on a 4.0 scale; or

b. Is a legal resident of Arizona for tuition purposes and obtains a composite score of at least 21 on the American College Test or at least 930 on the Scholastic Aptitude Test; or

c. Is not a legal resident of Arizona for tuition purposes but obtains a score of at least 23 on the American College Test or at least 1010 on the Scholastic Aptitude Test; or

d. Has earned a grade-point average of at least 2.0 on a 4.0 scale in at least 12 semester credit hours in transferable academic courses in English; mathematics; social, physical or biological sciences; foreign languages; or the humanities in a community college, in a summer session of the University, or in another regionally accredited college or university.

BASIC COMPETENCIES—Applicants must demonstrate academic competency in each of the subjects listed below. Students who choose to demonstrate their competency in a subject by completing appropriate high school or college courses must attain an overall grade-point average for courses in that subject of a least 2.0 on a 4.0 scale. A high school unit is defined as one year of study.

English: 4 units
High school English courses taken to satisfy this competency requirement must include literature and substantial emphasis on grammar and composition. Courses such as journalism, business communications, speech, and others that often include some emphasis on grammar or composition may improve a student's ability in English. However, they are not devoted exclusively to the study of English and may not be substituted for a regular English course.

Mathematics: 3 units
Algebra I; Plane Geometry; Algebra II or any math course which requires Algebra I as a prerequisite.

Social Studies: 2 units
One unit in American history and an additional unit in another social science field such as: world history, economics, sociology, geography, government, psychology, or anthropology.

Laboratory Science: 2 units
One unit from any two of the following: biology, chemistry, physics, and earth science.
A laboratory science course is defined as a course in which at least one class period each week is devoted to providing an opportunity for students to manipulate equipment, materials, or specimens, to develop skills in observation and analysis, and to discover, demonstrate, illustrate, or test scientific principles or concepts.

ADDITIONAL SUBJECT UNITS RECOMMENDED—In addition to the above required course work, applicants are strongly recommended to take two years of a single foreign language; a third year of laboratory science and social studies; and other electives in music, art, drama, speech, or any other college preparatory subjects commonly offered for credit by secondary schools. A minimum of 5 credits of recommended additional course work is desirable.

Applicants who meet the above aptitude and competency requirements will be admitted to the University of Arizona without conditions.

ADMISSION WITH DEFICIENCIES
Applicants who meet the general aptitude requirements, but who have not completed all of the competency requirements may be admitted with deficiencies. Applicants who lack no more than two credits of the required competency course work may be admitted in this manner. There may be no more than one credit of deficiency in any competency area. A grade-point average lower than 2.00 on a 4.0 scale in any of the academic competency areas will be considered as one deficiency in that area.

The deficiencies must be made up within one calendar year of the date of first enrollment, either by additional high school courses or by college courses. When the deficiencies have not
been removed by the time the student first registers at the University, the first course taken in the subject matter area will be used to remove that deficiency. Students who fail to remove deficiencies within one calendar year of the date of their first enrollment will not be permitted to register for future terms. Academic competency requirements may also be met by obtaining a specified score on the American College Test (ACT); the Scholastic Aptitude Test (SAT) and the ATP Achievement Tests. Methods to meet the academic competency requirements are indicated in the following chart.

### MEETING ACADEMIC COMPETENCY REQUIREMENTS

You may meet the Academic Competency Requirements in English, mathematics, laboratory science, and social studies by using any combination of the methods shown below.

<table>
<thead>
<tr>
<th>SUBJECT AREAS</th>
<th>HIGH SCHOOL COURSEWORK</th>
<th>SAT &amp; ACHIEVEMENT SCORES</th>
<th>COLLEGE COURSEWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH</td>
<td>“C” average required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 UNITS</td>
<td>English I</td>
<td>English subscore of 19 or above</td>
<td></td>
</tr>
<tr>
<td>(Composition &amp; Literary Analysis only)</td>
<td>English II</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>English III</td>
<td>Verbal subscore of 450 or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>English IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATHEMATICS</td>
<td>Algebra I</td>
<td>Mathematics subscore of 18 or above</td>
<td></td>
</tr>
<tr>
<td>3 UNITS</td>
<td>Plane Geometry</td>
<td>Mathematics subscore of 500 or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Algebra II or one other math with Algebra I as prerequisite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORATORY SCIENCE</td>
<td>One unit from any two of the following: Biology Chemistry Physics Earth Science</td>
<td>ATP Achievement Test Scores: Chemistry: 575 or above Biology: 550 or above Physics: 590 or above</td>
<td>Two 4-credit transferable laboratory science courses</td>
</tr>
<tr>
<td>2 UNITS</td>
<td>Natural Science subscore of 20 or above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCIAL STUDIES</td>
<td>American History</td>
<td>ATP Achievement Test Scores: American History/Social Studies: 510 or above European Hist/World Culture: 545 or above</td>
<td>One 3-credit transferable American History course and one additional 3-credit transferable social science course</td>
</tr>
<tr>
<td>2 UNITS</td>
<td>One additional unit from: European/World History Economics Sociology Geography Government Psychology Anthropology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social Studies subscore of 18 or above. Meets any social studies requirements with the exception of American History</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEST SCORES MAY BE USED TO SATISFY ONLY ONE LABORATORY SCIENCE UNIT
ADMISSION TO THE UNIVERSITY

ADMISSION EXCEPTIONS

Applicants who are age 22 or older and who demonstrate readiness for college-level study may be admitted under alternative requirements. Applications for admission will be reviewed individually.

Applicants who do not meet the general aptitude and basic competency requirements may appeal in writing to be admitted on the basis of at least one of the criteria listed below. Appeals may be approved or denied by an admissions committee based upon the space available in the college selected and evidence of potential for success.

- Has a high school grade-point average of at least 2.0 on a 4.0 scale and either an upward grade trend during high school or an upward grade trend during the senior year in academic courses such as mathematics, English, social science, science, and foreign languages;
- Has attained an average score on the General Education Development Test of at least 50;
- Has positive written recommendations from professional individuals who are personally familiar with the applicant's academic potential as demonstrated by work experience, leadership ability, or extracurricular activities;
- Does not meet the general aptitude requirement but has completed high school courses in English, mathematics, laboratory science, or social science in excess of the minimum basic competency requirements and/or provides evidence of above average grades for the average of all courses taken in those subjects and has no deficiencies in the basic competencies.

ADMISSION TO COLLEGES AND SCHOOLS

ARCHITECTURE—Applicants are expected to present credit in mathematics and laboratory science as follows: one unit of algebra I, one unit of algebra II, one unit of plane geometry, and one unit of physics with a lab. Students are strongly advised to include among their electives additional courses in mathematics such as trigonometry, advanced algebra, or solid geometry.

ARTS AND SCIENCES—Applicants are expected to complete patterns of study which offer reasonable preparation for university study with better than average grades. Included are college preparatory courses, as follows: English courses in the 11th and 12th grades which include writing instruction and evaluation, and which require substantial amounts of writing of extensive structured papers, expressive and analytical, and which demand a high level of thinking skills and are integrated with extensive reading of significant literature; mathematical courses which include algebra, geometry, trigonometry, calculus, and mathematical analysis; study of foreign languages, natural and physical sciences, social sciences, and the humanities.

BUSINESS AND PUBLIC ADMINISTRATION—Applicants are strongly advised to offer entrance credit in mathematics as follows: one unit of algebra I and one unit of algebra II. Upper-division courses in the college are open only to students who meet the requirements for advanced standing, as specified in the College of Business and Public Administration section of this catalog.

EDUCATION—Applicants for admission to the College of Education must have completed 56 semester units of credit applicable to a baccalaureate degree with a cumulative grade-point average of 2.5000 or better. Students who wish to enroll in professional education ("methods") courses for the purpose of obtaining a teaching certificate must meet the above requirements plus have passing scores on all three portions of the Pre-Professional Skills Test (PPST).

ENGINEERING AND MINES—Applicants are required to present credit in mathematics as follows: one unit of algebra I, one unit of algebra II, one unit of plane geometry, and 1/2 unit trigonometry. It is strongly recommended that one unit of physics and one unit of chemistry be presented. Students transferring into the college must have a cumulative grade-point average of 2.5000 in all previous university studies. In-state high school applicants must have a class standing in the top 25 percent; or a grade-point average of 2.75 on a 4.0 scale; or a composite ACT score of 23 or above; or a combined SAT score of 1010 or above. Out-of-state applicants...
6 UNIVERSITY POLICIES AND SERVICES

will be admitted according to the same high school requirements; or an ACT score of 24 or above; or an SAT of 1050 or above.

HEALTH-RELATED PROFESSIONS—Admission to the school is solely through acceptance into a specific program. Applicants are required to have completed 58-63 semester hours of college credit and to have maintained a 2.2500 grade-point average on all collegiate work attempted. Applicants must meet the school's general prerequisites as well as those prerequisites established for the particular program of study for which the student is applying.

NURSING—Two years in the College of Arts and Sciences are prerequisite to entrance into the College of Nursing. For further information, see the College of Nursing section of this catalog.

PHARMACY—Two years of study in the liberal arts and sciences are prerequisite to entrance into the College of Pharmacy. For further information see the College of Pharmacy section of this catalog.

CHANGES IN ADMISSION REQUIREMENTS

The University of Arizona reserves the right to depart from or supplement its published policies and to adopt additional admission requirements or change present ones, subject to the approval of the Board of Regents.

ADVANCED FRESHMAN PLACEMENT

ADVANCED PLACEMENT—Students who have completed college-level courses in secondary schools and have taken the Advanced Placement Examinations of the College Entrance Examination Board will be considered for advanced placement and for the granting of college credit to count toward degree requirements.

The Advanced Placement Program recognizes that many students can complete college-level courses while they are still in secondary school. Participating colleges encourage and recognize this achievement. The program provides course descriptions and professional consultants to help schools establish college-level courses for their stronger students. It sets, administers, and grades examinations in these courses. It sends the examination grades, together with supporting materials, to the students' colleges, enabling the college to grant appropriate placement and credit. See section on Advanced Placement from High School under "Proficiency and Exemption Examinations, Credit by Examination" in chapter entitled Academic Guidelines.

Students should contact the Office of Admissions, consult their high school counselors, or write to the College Entrance Examination Board, Princeton, New Jersey, 08540 for more details.

PROGRAMS FOR SUPERIOR STUDENTS

Outstanding students may wish to consider participating in the Honors Program. For a description of this program and of Academic Honors and Awards conferred to outstanding students at the University, please refer to the section in this catalog titled Provisions for Superior Students.

TRANSFER STUDENTS

APPLICATION FOR ADMISSION—Applications for admission may be obtained by writing or calling:

Office of Admissions
University of Arizona
Tucson, AZ 85721
(602) 621-3237

Students transferring from other colleges and universities are required to file with the Office of Admissions official transcripts sent directly from all previously attended schools. Students may
not disregard their records in other colleges and universities in order to apply for admission solely on the basis of their high school records. Any student who does so is subject to suspension from the university and, should requirements for a degree otherwise be met, subject to the withholding of the degree.

ADMISSION REQUIREMENTS FOR TRANSFER STUDENTS—Transfer applicants for admission are required to present a minimum overall grade-point average on their previous college work of 2.0000 (C) on a 4.0000 scale. Students transferring with less than 36 transferable semester units will be subject to the same curricular requirements as regular admittees from high schools and must show evidence of having fulfilled the required secondary school subject units. Such units must be completed in high school or by equal or higher work at the college level in the same manner as designated for entering freshmen.

NOTE: The above statements do not necessarily apply to students seeking admission to divisions of the university which have higher entrance requirements. See the sections stating requirements for admission to the College of Architecture, the College of Business and Public Administration, the College of Education, the College of Engineering and Mines, and the College of Pharmacy.

STUDENTS' COPIES OF TRANSCRIPTS—Transfer students are urged to bring with them to registration unofficial transcripts of their records at colleges and universities previously attended. These will be helpful for advising when the official transfer evaluation has not yet been completed by the Office of Admissions.

COLLEGE-LEVEL EXAMINATION PROGRAM—The University of Arizona grants credit for both the General Examinations and the Subject Examinations of the College-Level Examination Program of the College Entrance Examination Board.

TRANSFER OF CREDITS—The University of Arizona evaluates without prejudice applicants for admission from regionally accredited postsecondary institutions or postsecondary institutions which are candidates for accreditation on the individual merits of their academic achievements. Credit in courses in which the grade received was lower than C is not transferable. Grades earned in courses taken at other institutions are not included in calculation of the University of Arizona grade-point average.

Inquiries concerning the acceptance of transfer credit from foreign institutions should be directed to the Office of Admissions, which is responsible for the evaluation of foreign credit transfer.

CREDITS FROM COMMUNITY COLLEGES—A maximum of 72 credits may be transferred from accredited community colleges, provided these credits are in courses acceptable for transfer credit. While all courses offered for transfer will be accepted by the university subject to the above rule, the specific lower-division requirements of various curricula vary widely. In order to complete the baccalaureate program in the normal time span, the student should therefore consult the Colleges section of this catalog that is appropriate for the student's curriculum, as well as the head of the appropriate university department to determine specific requirements of the program into which the student plans to transfer.

Normally a course completed in a community college whose content is offered at the University of Arizona in the upper division (carrying a course number of 300 or higher) will not be accepted in transfer as the equivalent of the University of Arizona upper-division course.

NONRESIDENT APPLICATIONS

ADMISSION APPLICATION FEE—Applicants for admission from states other than Arizona must pay an application fee of $25 (this fee does not apply to applicants for admission to the Graduate College). The application fee is also required of undergraduate foreign students. This should be paid in check or money order made payable to the University of Arizona and must be submitted with the application for admission. Applications are not considered unless accompanied by this nonrefundable fee.
ADMISSION OF FOREIGN STUDENTS (Students who hold nonimmigrant visas)—Inquiries about undergraduate admission should be directed to the Office of Admissions, Administration Building, Room 316. Foreign students are expected to have above average grades, must demonstrate proficiency in the English language, and must satisfy the financial guarantee requirements for each year of attendance.

All foreign applicants whose native language is other than English are required to take the Test of English as a Foreign Language (TOEFL), which is given at test centers worldwide under the direction of the Educational Testing Service. For test registration information, write: Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08541.

Results of the TOEFL are valid for two years. Applicants should request that TOEFL (Box 899-TR, Princeton, New Jersey 08541, USA) send their scores to the University of Arizona. The scores must be received before the application for admission can be considered.

Newly admitted foreign students may also be required to take a locally administered English placement test upon arrival and must take such further study in English as the test results indicate is necessary. Transfer students from U.S. colleges or universities must check with their academic advisor and/or the University Composition Board to determine their upper-division writing proficiency requirements.

For those lacking college-level English proficiency, the Center for English as a Second Language (CESL) on this campus offers full-time English language training. The full semester sessions carry no college credit, but satisfactory completion of CESL study will meet the English proficiency requirement for admission. Request further information by writing to CESL, Room 104, CESL Building. It is recommended that a statement of academic admissibility be requested from the Office of Admissions before application is made for CESL study. Admission to CESL study does not guarantee admission to any academic program at the University of Arizona.

Foreign students on nonimmigrant visas must submit proof of adequate financial resources to support themselves while in residence at the University of Arizona. If sponsorship is through an organization or government agency, the Office of Admissions should be notified directly by the sponsor of the terms of scholarship support, which must include instructions if the University of Arizona is to bill for tuition and fees. The address for billing must be through an embassy or other agent in the United States; otherwise, the students must pay their own fees at registration.

Foreign students on nonimmigrant visas are required by the University to have University of Arizona Student Accident and Sickness Insurance coverage. Information and costs of this coverage are sent to those foreign students who are accepted for admission. The cost of the insurance is included in the amount of the financial guarantee. Insurance coverage is required for each term of enrollment. Students are exempted from the University of Arizona insurance plan only when their government or sponsoring agency has submitted accident and sickness insurance plans acceptable to the University of Arizona, or when the student can show proof of having health insurance comparable with that available through the University (coverage for dependents is very strongly recommended).

Inquiries concerning the acceptance of transfer credit from foreign institutions completed by U.S. and non-U.S. citizens should be directed to the Office of Admissions, which is responsible for the evaluation of foreign credit in transfer.

Application deadlines: May 15 for fall; September 15 for spring; April 1 for summer. To meet the deadlines, the application and other required official credentials and statements must be received in the Office of Admissions by the above dates.

UNDERGRADUATE ADMISSION OF IMMIGRANT AND REFUGEE-STATUS STUDENTS

Application inquiries should be directed to the Office of Admissions, Administration Building, Room 322.

Applicants whose native language is not English are required to take the Test of English as a Foreign Language (TOEFL), which is given at test centers worldwide under the direction of the Educational Testing Service. For test registration information, write: Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08541.

In Tucson, arrangements may be made to take the Institutional TOEFL at the University of Arizona by contacting the Center for English as a Second Language, Room 104 CESL Building. To take the International TOEFL, contact the Testing Office of the Student Counseling Service located in Old Main, Room 223.
ADMISSION TO THE UNIVERSITY

ADMISSION OF DISABLED STUDENTS

The requirements for admission to the University of Arizona are the same for all students. The individual with a disability utilizes the same process as the nondisabled individual.

Prospective students who are disabled are encouraged to write or call the Disabled Student Services Program, University of Arizona, Tucson, AZ 85721, (602) 621-3268, in conjunction with the application process. A comprehensive program of academic support, rehabilitation health, and athletics/recreational services is available.

ADMISSION OF VETERANS AND CHILDREN OF DECEASED VETERANS

The University of Arizona is fully approved for the training of students under several government educational programs for veterans and eligible dependents of deceased or disabled veterans. Eligible students as well as those who wish to determine their eligibility should apply at the University of Arizona Office of Veterans' Services, Bear Down Gym, Room 1A, Tucson, AZ 85721 or call (602) 621-6454.

Veterans who are making an initial application for their G.I. Bill benefits must provide the original or a certified copy of military record (DD-214). Eligible dependents who are making an initial application under Chapter 35 must provide a copy of their birth certificate and if possible, the parent's V.A. claim number.

Students attending under the Veterans' Administration Vocational Rehabilitation Program must contact their vocational rehabilitation specialists prior to registration. This contact can be made through the Office of Veterans' Services.

Additional services offered by the Office of Veterans' Services include application for all V.A. educational benefits, professional educational counseling, tutorial assistance, and referral assistance.

EXEMPTION OF CERTAIN VETERANS FROM EFFECTS OF FAILING GRADES—By Arizona statute, in determining the admissibility to the University of a veteran, honorably discharged, who has served in the armed forces of the United States for a minimum of two years and who was previously enrolled at a university or community college in Arizona, no failing grades received by such veteran at any Arizona university or community college prior to military service may be considered. This policy applies to the admission decision only. Failing grades awarded at the University of Arizona remain on the record, and the graduation average is based upon the grades received in all course work attempted in residence. The student admitted or readmitted to the University under this statute is subject to progression, retention, graduation, and other academic regulations and standards in this catalog.

CREDIT FOR MILITARY SERVICE—A Guide to the Evaluation of Educational Experiences in the Armed Services, published by the American Council on Education, has been adopted by the University of Arizona as a basis for evaluating training in the armed forces.

Credit for military service experiences may be acquired through standardized examinations (see credit by examination policy). Cases which fall outside of the regular policies of the University will be reviewed by the Registrar. The evaluation of military credit is completed only after a student has been admitted to the University and all required documentation has been submitted (normally, the form DD-214).

For active service terminated under honorable conditions in the Army, Navy, Marine Corps, Air Force, or Coast Guard credit is given as follows: for a period of at least six months and less than a year, the University allows 4 units of military science; for one year or more of active service, 8 units of military science; for the rank of warrant officer earned in the service, 6 upper-division units of military science, naval science, or aerospace studies; and for a commission earned in the service at the rank of second lieutenant or higher (in the Army, Air Force, or Marine Corps), 12 upper-division units in military science, naval science, or aerospace studies. Information concerning the evaluation of military training and experience may be obtained in the Office of Admissions.

PROGRAMS OF STUDY—All veterans must choose a program of study and may take only those courses that fulfill the degree requirements. Proper counseling and course planning is highly encouraged. Veterans and veterans' dependents are not allowed to enroll in course repeats, course audits, or independent study courses without the approval of the Office of Veterans' Services.
ATTENDANCE—Veterans and veterans' dependents are paid to attend and complete course work. If at any time the Office of Veterans' Services is notified that either is not occurring, benefits will be reduced accordingly.

CHANGE IN STATUS—Any time academic progress or other status of a veteran is changed, a notice will be sent to the Veterans Administration Regional Office, within 30 days following the date of occurrence, or last day of class attendance. It is the veterans' responsibility to notify the Veterans' Services Office of any changes occurring in their status.

VETERANS' DEFERMENT OF TUITION PAYMENTS—Veterans' tuition deferments are available to many veterans and eligible dependent students. All deferments must be approved by the Veterans' Coordinator.

THE TRAVELING SCHOLARS PROGRAM

The Traveling Scholars Program is designed so that students may take advantage of programs or special resources available at one of the three state universities not available at their own institution. Any undergraduate student with a 2.5000 grade-point average or any graduate student with a 3.0000 grade-point average enrolled at Arizona State University, Northern Arizona University, or the University of Arizona may be designated a Traveling Scholar by prior mutual agreement of the appropriate academic authorities at both the sponsoring and the hosting institution. Additional information and the application form may be obtained from the Office of Admissions.
Registration

Any student who makes use of classroom or laboratory facilities or of faculty time is required to register formally. Graduate students who have previously registered for all of the credit required for their degrees may enroll for supplementary registration in order to meet this requirement.

CLASSIFICATION OF STUDENTS

Students of the University of Arizona are classified as regular, nondegree, or noncredit.

REGULAR—A regular student follows a prescribed curriculum leading to a degree. All student programs must be approved by the college dean or the dean's representative.

NONDEGREE—A nondegree seeking student is not a candidate for a degree.

NONCREDIT—Noncredit students do not take courses for credit. Such students are not required to meet admission standards but must obtain permission from the instructor before enrolling in a course. Noncredit students pay the same fees as credit students.

PROCEDURES

NEW STUDENT ORIENTATION—Orientation for new students is held during the summer and again in the fall and spring. New students receive information about these programs after the students have been admitted to the University. Students are encouraged to attend the Summer Orientation and Preregistration Program if possible. Orientation activities include counseling, academic advising, and an introduction to campus facilities and service.

REGISTRATION—Students must register for each class in which they will participate. Pre-registration is conducted during the fall and spring for the following semester. Students who do not preregister are required to register in alphabetical groups on designated days at the beginning of each semester.

REGISTRATION DEADLINE—Students must be registered by the 7th day and no late registrations will be accepted after the 21st calendar day following the first day of class. Registration is not complete until registration fees, and tuition if appropriate, are paid. Failure to pay by the 21st day will result in the student not being allowed to enroll, even if the student has been attending classes. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be present), legal problems, or some other academic commitment which precluded enrolling prior to the 21st day (study abroad, co-op, in absentia registration). See the calendar for the academic year in the front of this catalog.

PENALTY FOR LATE REGISTRATION—Students who fail to pay all fees during the designated walk-through registration period are charged a late registration fee.

IDENTIFICATION CARDS—As part of the registration process, each new student at the University of Arizona will be issued a photo identification card. This card, along with the current fee receipt, establishes the student's identity as a University of Arizona student and authorizes access to certain university facilities. This card must be obtained during the prescribed time at the beginning of each semester during the student's first term of enrollment or a late processing fee of $10 will be charged.
CLEARANCE OF ACCOUNTS—No student whose record indicates indebtedness to the University shall be permitted to register.

SPECIAL TESTING—Students may be required to take special tests as recommended by their college dean or the Dean of Students.

REGISTRATION ADJUSTMENTS

CHANGE OF SCHEDULE—Changes in a registration by adding or dropping courses must be initiated by the student by filing a change-of-schedule form with the University Cashier. A fee of $2.00 is charged unless the change is made for the convenience of the department.

After the last day of registration for credit, as stated in the Academic Calendar, a student may not add a course without special permission from the instructor of the course and the student's college dean.

Course withdrawals filed by the end of the fourth week of classes result in cancellation of registration in the course. Course withdrawals filed from the end of the fourth week of classes until the end of the tenth week of classes are subject to rules set forth in the section "Withdrawal Grade" under Academic Guidelines in this catalog.

The last day on which a student may drop a course is the last day of the tenth week during which classes are held, except for an extraordinary reason approved by the student's college dean (in the case of undergraduate students) or by the Graduate Council (in the case of graduate students) or by the Dean of Students (in the case of students withdrawing completely from the University). For students in the colleges of Law and Medicine, withdrawals are governed by regulations established by the respective college faculty.

Each semester students are mailed written confirmation from the Office of Student Information, Registration and Records of the courses in which they are officially enrolled. If this official registration record does not agree with the student's own records, it is the responsibility of the student to go to the Office of Student Information, Registration and Records and correct his or her registration. An instructor has no alternative but to assign a failing grade ("E") to a student who has not participated in the course but whose name appears on the final grade report list.

TRANSFER TO LESS ADVANCED COURSE—Students unable to meet satisfactorily the requirements of courses in which they are registered may be transferred to less advanced courses in the same department if the head of the department and the instructor of the less advanced course approve. In all such cases, the transfer shall be made within five weeks after the beginning of classes using the change-of-schedule form. In certain departments this privilege extends only through the 14th day of classes.

CHANGE OF REGISTRATION FROM CREDIT TO AUDIT—After the fourth week of classes, a change in registration in a course from credit to audit will be permitted only if the student is doing passing work in that course and receives the approval of the course instructor and the student's college dean. No change from credit to audit will be permitted after the end of the tenth week of classes except with special permission from the student's college dean.

CHANGE OF COLLEGE—Students wishing to change colleges must consult the dean's office of the college to which they wish to transfer. Change from one college to another may be made by filing a change-of-college form with that college at least 30 days prior to the next registration. The change of college will be effective for the current term if filed within the first four weeks of classes during a regular semester. If filed after that date, the change of college will be effective the following semester.

CHANGE OF MAJOR—A student may change his or her major by contacting his or her college dean and completing the appropriate forms.

PETITIONS—Students may petition the University Petitions Committee for relief if they believe they deserve redress or exception to university rules, regulations, or policies regarding academic affairs, such as extension of incomplete grade, choice of catalog and degree requirements. Petition forms may be obtained in the Office of Student Information, Registration and Records or from the college dean. The completed form with all relevant facts and supporting evidence is submitted to the college dean for recommendation and forwarding to the Office of
Student Information, Registration and Records, after which it is forwarded to the University Petitions Committee for action. The decision of the University Petitions Committee is final.

Students may also petition for redress or exception to college policies or requirements. Petitions may address a change of program, approval for an overload, substitution of course work, transfer credit, modification in degree program, or in certain instances, eligibility for registration or enrollment in the college. The necessary forms, instructions and assistance may be obtained in the office of the college dean. The decision of the dean is final.

LIMITATION OF REGISTRATION—Whenever lack of facilities in courses makes it necessary to limit the number of students admitted, preference will be given to students for whom these courses are required. Among these, priority is given to graduating seniors and to students having superior records in prerequisite courses, respectively.

CANCELLATION OF COURSES—The University reserves the right to cancel any course not elected by an adequate number of students.

STUDENT RETENTION

An average of 75 percent of entering freshmen return to register the first semester of the following year. After four or five years and in the subsequent semesters to follow, approximately 60 percent of the entering class has either graduated or are still enrolled.

RELEASE OF INFORMATION

The University complies with all provisions of the Family Educational Rights and Privacy Act of 1974 dealing with the release of education records. A copy of the full text of this act is on file in the Office of Student Information, Registration and Records, the Office of the Dean of Students, and the Special Collections division of the University Library, along with the University of Arizona's policy for implementation of the act.
Academic Guidelines

SCHOLARSHIP REQUIREMENTS

MINIMUM GRADE-POINT AVERAGE REQUIRED—One of the requirements for students to be eligible to continue in the institution is that they earn minimum cumulative averages as follows:

<table>
<thead>
<tr>
<th>Minimum grade-point average</th>
<th>Total units completed in residence and accepted in transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.750</td>
<td>Fewer than 14 units</td>
</tr>
<tr>
<td>1.840</td>
<td>From 14 through 26 units</td>
</tr>
<tr>
<td>2.000</td>
<td>27 or more units</td>
</tr>
<tr>
<td>3.000</td>
<td>Graduate students (any student registered in the Graduate College), work carried for graduate credit only</td>
</tr>
</tbody>
</table>

For scholarship requirements in the College of Law, see the Colleges section of this catalog.

GOOD STANDING—Good standing status denotes that a student is eligible to continue in or to return to the University.

UNIVERSITY CREDIT—University credit is the term used to identify all credit offered by the University of Arizona with the exception of correspondence credit and credit by examination (whether or not for a grade). Only the grades of courses taken for university credit and by Special Examination for Grade are used in calculating the grade-point average.

DEFINITION OF UNIT OF CREDIT—Utilizing the definition that an hour of work is the equivalent of 50 minutes of class time (often called a contact hour) or 60 minutes of independent-study work, university policy requires at least 45 hours of work for each unit of credit. Contact hours required for specific types of courses are as follows:

1. At least 15 contact hours of recitation, lecture, discussion, seminar, or colloquium, as well as a minimum of 30 hours of student homework are required for each unit of student credit.
2. Workshops require at least 15 through 45 contact hours and the appropriate number of homework hours to comprise a total of at least 45 hours of work for each unit of credit.
3. Studios require at least 30 contact hours and at least 15 hours of homework for each unit of credit.
4. Laboratory courses must maintain a minimum of 45 contact hours per unit of credit.
5. Field trips are to be counted hour-for-hour as laboratory meetings.
6. Each unit of internship or practicum must require a minimum of 45 hours of work.

Since it would be virtually impossible for a student to satisfactorily complete 45 hours of work in less than one week, the policy regarding the duration of courses maintains that a course must cover at least a one-week period for every unit of credit given. During the summer session, however, 6 units of credit might be given over a five-week period.

It is understood that, when the official university calendar deviates from these guidelines, that calendar shall prevail.

It is also understood that the hour requirements specified above represent minimums for average students and that considerable deviation in excess of these requirements may occur, particularly at the graduate level.

MIDSEMESTER SCHOLARSHIP REPORT—A report of students (except in the College of Law) doing failing or below-average work is issued during the eighth week of classes each semester. Students listed on this scholarship report are warned that their work in the courses reported is...
deficient and their extracurricular activities may be restricted by their deans until the end of the semester.

**ACADEMIC PROGRESS, PROBATION AND DISQUALIFICATION**

**ACADEMIC PROGRESS**—Undergraduate students will be considered to be making normal progress toward a degree if their cumulative grade-point average for all work attempted at the University of Arizona is not less than 2.000.

**ACADEMIC WARNING STATUS**—Freshman students who have completed fewer than 14 units at the University with a University of Arizona cumulative grade-point average between 1.750 and 2.000, or who have completed from 14 through 26 units at the University with a University of Arizona cumulative grade-point average of between 1.840 and 2.000 will be on academic warning status. Academic warning status invokes no academic penalties and will not be indicated on the student's permanent record, but will be indicated on the student's grade report. This status serves as a warning to students beginning their college careers that their performance is below the level required for successful completion of an academic program. Students in this status are strongly urged to seek academic counseling.

**PROBATION**—Students not meeting the standards of normal progress or academic warning status will be on probation. Students on probation are subject to such restrictions with respect to courses and extracurricular activities as may be imposed by the academic dean of the college in which the student is enrolled. Students are removed from probation upon earning the minimum cumulative grade-point average required by the table listed under “Minimum Grade-point Average Required” above. Probation status will be indicated on the student's permanent record.

**DISQUALIFICATION**—Disqualification is of two types: from a particular college in the University, or from the University, the type to be established by the Deans' Council on the recommendation of the dean of the college in which the student was enrolled.

The student recommended for disqualification from a particular college may seek immediate admission to another college in the University. Permission for admission to another college must be obtained in writing from the dean of the college into which the student plans to transfer. The letter of permission should be presented to the Office of Student Information, Registration and Records. Ordinarily permission will be granted only if the student plans to pursue a modified program in a curriculum of the new college and has demonstrated ability warranting such action. Those who have been given college disqualification are strongly urged to seek thorough academic and vocational counseling and guidance. Failure to secure approval to transfer to another college in the University is tantamount to university disqualification and the rules governing this type of disqualification then will apply. A disqualified student may not attend the University as a nondegree student.

A student disqualified from a particular college who may have secured subsequent permission to register in another college is automatically on scholastic probation in the new college. A student may be granted college disqualification only once in his or her academic career. Any later disqualification will be considered permanent disqualification.

**FIRST UNIVERSITY DISQUALIFICATION**—A student may be academically disqualified only after having been on probation for one semester or two summer terms, or by special action of the Deans' Council, as described below under “Probation or Disqualification by Special Action.”

A student disqualified from the University is ineligible to register the following semester. A student disqualified at the close of the first semester may register in the summer session, but a student disqualified at the close of the second semester cannot register in the summer session or the first semester of the following academic year. Students under First University Disqualification are discouraged from taking credit course work elsewhere and should treat their period of disqualification as a time to reassess their goals while in a nonacademic environment.

**SECOND UNIVERSITY DISQUALIFICATION**—A student with two disqualifications may return to the University only on the basis of evidence that underlying conditions have materially improved and that he or she is now capable of serious intellectual effort. The student must furnish the Registrar with a letter from the dean of the college from which he or she was last disqualified stating that the dean approves the re-registration. If the student wishes to enroll in a college of the University other than the one from which he or she was last disqualified, approval must be
obtained from both the dean of the college from which the student was disqualified, and the dean of the college he or she wishes to enter.

PROBATION OR DISQUALIFICATION BY SPECIAL ACTION—Upon recommendation of the dean of the college and the approval of the Deans' Council, a student may be placed on scholastic probation or may be disqualified at any time for neglect of academic work. Such disqualification may be either temporary or permanent.

CREDIT RESTRICTIONS FOR STUDENTS UNDER UNIVERSITY DISQUALIFICATION—Students who are under disqualification from the University may not take University of Arizona courses for credit or establish credit by examination during their periods of disqualification, although they may remove incomplete grades. With the permission of the college dean concerned, students who have been disqualified from the University may register for audit enrollment and correspondence enrollment.

ACADEMIC RENEWAL

Under certain circumstances an undergraduate student may petition the Registrar for academic renewal. Academic renewal allows students to have grades for a particular period of time excluded from the grade-point average. If the qualifications are met, the student may have a maximum of four consecutive semesters of course work disregarded in all calculations regarding academic standing, grade-point average, and eligibility for graduation. If summer work is to be included in the work to be disregarded, a five-week summer term shall count as one-half semester.

Eligibility for academic renewal shall be subject to the following conditions:

1. At the time the petition is filed, a minimum of five years shall have elapsed since the most recent course work to be disregarded was completed.
2. In the interval between the completion of the most recent course work to be disregarded and the filing of the petition, the student shall have completed a minimum of 30 units of regularly graded course work at the University with a minimum grade-point average of 2.500 on all work completed at the University in that interval.

The petition shall specify the semester(s) or term(s) to be disregarded. If more than one semester or term is to be disregarded, these shall be consecutive, completed within a maximum of two calendar years, with no intervening enrollments at the University. The maximum of two calendar years may be extended by one semester if the time period includes a semester of involuntary absence by reason of disqualification.

If the petition qualifies under this policy, the student's permanent academic record shall be suitably annotated to indicate that no work taken during the disregarded semester(s) or term(s), even if satisfactory, may apply toward graduation requirements. However, all work will remain on the record, ensuring a true and accurate academic history.

Academic renewal may be effected only once during a student's academic career.

ENROLLMENT POLICIES

MAXIMUM UNITS ALLOWED PER SEMESTER—Approval of the college dean is required for any student to exceed the maximum number of units allowed per semester as indicated below. The semester load includes all work carried in residence as well as concurrent registration in correspondence, extension, high school courses or approved courses at other institutions.

<table>
<thead>
<tr>
<th>College or School</th>
<th>Units</th>
<th>College or School</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>18</td>
<td>Engineering/Mines</td>
<td>19</td>
</tr>
<tr>
<td>Architecture</td>
<td>18</td>
<td>Graduate</td>
<td>16</td>
</tr>
<tr>
<td>Arts &amp; Sciences</td>
<td>18</td>
<td>Health-Related Professions</td>
<td>18</td>
</tr>
<tr>
<td>Engineering, Geosciences</td>
<td>19</td>
<td>Law</td>
<td>17</td>
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<tr>
<td>Business &amp; Public Admin.</td>
<td>18</td>
<td>Nursing</td>
<td>18</td>
</tr>
<tr>
<td>Education</td>
<td>19</td>
<td>Pharmacy</td>
<td>18</td>
</tr>
</tbody>
</table>
CLASS STANDING—Class standing in the various colleges and schools, based upon the number of units completed, is given in the table below. A student’s class standing does not necessarily relate to the number of semesters or units required to complete degree requirements. Class standing is determined by the college in Medicine and Pharmacy.

<table>
<thead>
<tr>
<th>College or School</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
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<tr>
<td>Agriculture</td>
<td>1-25</td>
<td>26-57</td>
<td>58-90</td>
<td>91+</td>
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<tr>
<td>Architecture</td>
<td>1-29</td>
<td>30-60</td>
<td>61-94</td>
<td>95+</td>
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<tr>
<td>Arts &amp; Sciences</td>
<td>1-24</td>
<td>25-55</td>
<td>56-86</td>
<td>87+</td>
</tr>
<tr>
<td>B.S. in Geosciences</td>
<td>1-27</td>
<td>28-62</td>
<td>63-97</td>
<td>98+</td>
</tr>
<tr>
<td>Education</td>
<td>—</td>
<td>—</td>
<td>56-86</td>
<td>87+</td>
</tr>
<tr>
<td>Engineering &amp; Mines</td>
<td>1-27</td>
<td>28-62</td>
<td>63-97</td>
<td>98+</td>
</tr>
<tr>
<td>Health-Related Professions</td>
<td>—</td>
<td>—</td>
<td>58-97</td>
<td>98+</td>
</tr>
<tr>
<td>Nursing</td>
<td>—</td>
<td>—</td>
<td>65-100</td>
<td>101+</td>
</tr>
<tr>
<td>1st year</td>
<td></td>
<td></td>
<td>1-21</td>
<td>50+</td>
</tr>
<tr>
<td>2nd year</td>
<td></td>
<td></td>
<td>22-49</td>
<td></td>
</tr>
<tr>
<td>3rd year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FULL-TIME STUDENT STATUS—Full-time status for an undergraduate student varies with the college and study program, but ordinarily requires a load of at least 12 units per semester. Full-time status for graduate students is more widely variable, depending upon assistantship or associateship duties and the composition of the individual student’s program. Students in doubt about their standing should check with the dean of the college.

GRADING SYSTEM

The grading system used by the University of Arizona follows:

- A — Excellent
- B — Good
- C — Fair
- D — Poor
- E — Failure
- P — Passing (see section on “Pass-Fail Option”)
- F — Failure (see section on “Pass-Fail Option”)
- S — Superior (see paragraph on “Special Grades”)
- I — Incomplete
- K — Course in progress
- W — Approved withdrawal
- O — Audit
- CR — Credit

All medical students are graded on a pass-fail basis for courses taken in the College of Medicine.

INCOMPLETE GRADE—The grade of I may be awarded only at the end of a semester, when all but a minor portion of the course work has been satisfactorily completed. The grade of I is not to be awarded when the student is expected to repeat the course; in such a case, the grade of E must be assigned. Incomplete grades do not enter into the calculation of the grade-point average for one year from the date of award. If the incomplete is not removed by the instructor within one year, the I grade will revert to a failing grade. For undergraduate courses, the one-year limit may be extended for cause approved by the instructor with the concurrence of the dean of the college in which the student is registered. For courses taken for graduate credit, such approval may be granted only by the Graduate Council.

COURSE IN PROGRESS—The grade of K may be awarded by the instructor for 900-level courses when the course continues for longer than one semester. Time-limit for completion of such work for full credit for the master’s degree is six years; for the doctoral degree, ten years. K grades remain on the student’s permanent record until removed with a final grade but do not enter into the calculation of the grade-point average.
The grade of K is awarded by the Office of Student Information, Registration and Records, at the end of the semester, for courses which require more than one semester for completion. It is also awarded by the Office of Student Information, Registration and Records for all supplementary registrations (930). Following the completion of the final semester or supplementary registration, the grade of CR will be awarded for the terminal semester only.

WITHDRAWAL GRADE—Prior to the end of the fourth week of classes, official withdrawal (drop) of a course cancels the registration for the course; dean's signature not required. Weeks five through ten, the grade of W is awarded to students who are passing at the time of withdrawal; the grade of E is awarded to students not passing at the time of withdrawal. Also during weeks five through ten, a dean's signature is required and the withdrawal grade shows on the student's permanent record. After the tenth week of classes, the grade of W can be awarded only with the approval of the student's academic dean, and only under exceptional circumstances. For other regulations concerning withdrawal, see the section on "Change of Schedule." The W may also be awarded in the case of complete withdrawal from the University. (See the section on "Formal Withdrawal."

SPECIAL GRADES—Grades for university-wide "house-numbered" courses, including individual studies, vary from the regular university grading system. For explanation of these grades, see the Department and Courses of Instruction section elsewhere in this catalog.

For the grading systems available in honors individual studies courses (199H, 299H, 399H, 498H, and 499H), see the "Honors Program" in the Department and Courses of Instruction section of this catalog.

AUDIT GRADE—The grade of O is awarded for courses taken for audit. This grade is not awarded unless the student is registered for audit.

AVERAGING OF GRADES—For the purpose of computing grade-point averages, grade points are assigned to each grade as follows: A, 4 points for each semester unit; B, 3 points; C, 2 points; D, 1 point; and E, 0 points. To calculate the grade-point average, the unit value for each course in which a student receives one of the above grades is multiplied by the number of grade points for that grade. The sum of these products is then divided by the sum of the units of A, B, C, D, and E. The grade-point average is based only on work attempted in residence at the University and upon the results of Special Examinations for Grade. (See provision for "Graduation Average" in Graduation Requirements section.)

CHANGE OF GRADE—Final grades may be changed by the instructor on a grade-change form only if there has been an error in computation. The grade change must be approved by the head of the instructor's department and the Registrar, or by the Deans' Council if the Registrar deems it necessary. Requests for changes of grade for reasons other than errors in computation must be submitted by the student on a general petition.

APPEAL OF GRADE—A student who feels that a grade has been unfairly awarded may appeal. To initiate the appeal procedure, the student must contact the course instructor no later than the end of the fifth week of classes of the first regular semester after the semester or summer term in which the grade was awarded. The entire procedure to be followed is described in detail in the Student Handbook and in the Faculty Manual.

REPEATING A COURSE—Undergraduate students may repeat courses, with the exception of Engl. 100, in which they have not earned credit as many times as necessary to establish credit. They may repeat only once any courses in which they previously earned grades of C, D, or P, and may not repeat courses in which they have earned grades of A or B, except as specifically provided by departments on a course-by-course basis. All grades for repeated courses will be included in computing the grade average. Credit will be allowed only once, however, for successful completion of a course, unless the course is designated "repeatable for credit" by the department. For the policy regarding Engl. 100, see "University Requirements in Composition" elsewhere in this section.

PASS-FAIL OPTION—For certain courses, a qualified student may elect to register under the pass-fail option. Under such registration, the only final grades available to the student are P (pass) or F (fail).
Undergraduate students may elect to take courses under the pass-fail option only after they have attained sophomore standing and only if they have earned grade-point averages of 2.000 or better. They must also have the approval of their advisers to register for a course under the pass-fail option.

Students registering for a course under the pass-fail option must meet the prerequisites or otherwise satisfy the instructor of their ability to take the course.

Undergraduate students may register under the pass-fail option for not more than two courses per semester up to a maximum of 12 courses. Further, they must carry a minimum of 12 units of regular grades other than P/F during each semester in which they elect courses under the pass-fail option. Any exceptions to this policy must be approved by the student's academic dean.

Courses taken under the pass-fail option must be electives only, and may not be used to fulfill major, minor, or other specified curriculum requirements.

The pass-fail option is not generally available to graduate students. The only exceptions to this proscription are: (a) admission deficiencies which the student has prior specific, written approval to take on a P/F basis (only the department head or the departmental graduate adviser may give such approval, which must be on file in the Graduate College office before registration); (b) any undergraduate nondeficiency course available for P/F grading; and (c) any course offered by the College of Law.

Each department decides which of its courses will be available under the pass-fail option. Pass-fail courses in the 500, 600, or 700 series may be offered only in law and to candidates for the M.D. degree. Further, the instructor of the course must approve of its being offered pass-fail. The instructor shall be informed by the Registrar which students are enrolled under the pass-fail option.

Students may change from pass-fail enrollment to enrollment for a regular grade, or vice versa, only during the time period prior to the last day of the fourth calendar week during which classes are held, except with special permission of the student's college dean.

If a course is taken under the pass-fail option, the grade of P or F will be permanently recorded. However, neither grade will be included in the average. If the course is passed, the units of credit will be applied toward graduation.

NOTE: Pass/fail grades are the only grades available for T.T.E. 493a and 493b. Enrollment in these courses will not reduce the amount of work for which a student can otherwise enroll under the pass-fail option as described above.

All courses in the College of Medicine are graded on a pass-fail system for medical students.

GENERAL EDUCATION REQUIREMENTS

All colleges serving undergraduate students will begin to implement new general education requirements during 1987-88. The general education program provides breadth of knowledge as a balance and complement to the depth provided by the major. General education broadens the student's knowledge and awareness in each of the principal areas of human knowledge.

An overview of the general education requirements for each college is provided in the following table. This table is not intended to be exhaustive, but only to serve as a guide. Students should realize that the requirements vary across colleges and departments. For specific details on general education requirements as they pertain to specific courses, see the college and department sections of this catalog. Also, students are advised to check with college and department offices for current lists of courses that meet general education requirements.
## University of Arizona General Education Overview

### Category

#### I. Basic Skills and Proficiencies

<table>
<thead>
<tr>
<th></th>
<th>Arts &amp; Sciences</th>
<th>Agriculture†</th>
<th>Architecture</th>
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<tbody>
<tr>
<td>English</td>
<td>6-9</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Language*</td>
<td>0-16**</td>
<td>9</td>
<td>0-16**</td>
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<tr>
<td>Mathematics</td>
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#### II. Study Areas

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<th>Architecture</th>
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<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Arts/Lit.</td>
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<td>6</td>
<td>3-6</td>
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<tr>
<td>Inst. Soc. &amp; Individuals</td>
<td>9</td>
<td>6-9</td>
<td>9-15</td>
</tr>
<tr>
<td>Western Civ.</td>
<td>9</td>
<td>6-9</td>
<td>12-18</td>
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<tr>
<td>Non-West.</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<td>Other</td>
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<td>-3</td>
<td>-3</td>
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<td><strong>TOTALS</strong></td>
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### Category

#### I. Basic Skills and Proficiencies

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<th>Engineering &amp; Mines</th>
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<table>
<thead>
<tr>
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<th>Business &amp; Public</th>
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<td>6</td>
<td>0-11***</td>
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<tr>
<td>Inst. Soc. &amp; Individuals</td>
<td>12</td>
<td>9</td>
<td>0-11***</td>
</tr>
<tr>
<td>Western Civ.</td>
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<td>9</td>
<td>0-11***</td>
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<tr>
<td>Non-West.</td>
<td>3</td>
<td>3</td>
<td>0-11***</td>
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<td>-3</td>
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### Category

#### I. Basic Skills and Proficiencies

<table>
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<tr>
<th></th>
<th>Fine Arts (BFA &amp; BM)</th>
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<th>Pharmacy</th>
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<tbody>
<tr>
<td>English</td>
<td>6-9</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Language*</td>
<td>3</td>
<td>3-6</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics</td>
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<td>6</td>
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#### II. Study Areas

<table>
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<th>Fine Arts (BFA &amp; BM)</th>
<th>Nursing</th>
<th>Pharmacy</th>
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<td>Bio. &amp; Phys. Sciences</td>
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<td>32</td>
<td>12</td>
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<td>Arts/Lit.</td>
<td>3-12</td>
<td>3-6</td>
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<td>9-15</td>
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<tr>
<td>Western Civ.</td>
<td>6-9</td>
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<tr>
<td>Non-West.</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6-12</td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>36-54</td>
<td>65-71</td>
<td>42-48</td>
</tr>
</tbody>
</table>

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1. Under review at the time of catalog printing. Contact the College of Agriculture for current information.
2. Language includes foreign language, communication and the language of specific professional fields.
3. Students must demonstrate proficiency at the 4th semester level. This can be accomplished through courses (16 units) or by examination (0 units).
4. Students are required to take two courses (6 units) in at least two study areas.
UNIVERSITY REQUIREMENTS IN COMPOSITION

The University of Arizona has long regarded sound training in writing as indispensable to the academic development of an educated person; clear, intelligent writing is a skill required of all university graduates. Freshman Composition, the Upper-Division Writing-Proficiency Examination, and a writing-emphasis course are required of all students.

I. Freshman Composition

All students working toward degrees must meet the freshman composition requirement by completing one of the following sequences: Engl. 100-101-102, Engl. 101-102, Engl. 103H-104H, Engl. 106-107-108, Engl. 107-108. There is no exemption from the freshman composition requirement; any substitutes must be approved by the Director of Composition, Department of English. The freshman composition requirement may not be satisfied by correspondence work.

Placement in freshman composition takes into account the student's performance on two examinations: (1) a written placement essay administered at the time a student first registers for a course in freshman composition, (2) the English section of the American College Test or the Test of Standard Written English score on the Scholastic Aptitude Test. Both of these examinations require fees. Students with superior ratings based on the above examinations enroll initially in Engl. 103H; students whose scores indicate inadequate preparation initially enroll in Engl. 100 and pass this course before they enroll in Engl. 101. A student who fails Engl. 100 twice may not take the course again; instead the student must pass the essay placement examination with a score high enough to justify placement in Engl. 101.

II. The Upper-Division Writing-Proficiency Examination

Every student must take the Upper-Division Writing-Proficiency Examination, which is a prerequisite to enrolling in a writing-emphasis course (see below). Students may take the exam after they have satisfied the freshman composition requirement and accumulated at least 40 but less than 75 credit hours toward their degree. Students register for the exam with the University Composition Board; a fee is required.

The examination may be taken only once. Results are reported to students and to their major departments. Students who earn an evaluation of unsatisfactory on the exam usually are required by their department to complete further work in composition before registering for writing-emphasis courses. They should consult with their academic advisors for specific information about their department's requirements.

III. Writing-Emphasis Classes

Every undergraduate degree program includes at least one required writing-emphasis course. Writing-emphasis courses are regular junior or senior level courses in an academic discipline in which at least half the grade awarded is determined by written work appropriate to the academic discipline. Such courses are identified with the phrase "writing-emphasis course" at the end of the course description listed in the Departments and Courses of Instruction section of this catalog. Prerequisite to a writing-emphasis course is satisfactory performance on the Upper-Division Writing-Proficiency Examination or, in the case of students whose papers are evaluated as unsatisfactory on the examination, permission of the student's major department.

EXAMINATIONS

MID-SEMESTER EXAMINATIONS—It is expected that all mid-semester examinations will occur during a regularly scheduled class period of the course. For those multiple-section courses in which it is impossible to offer mid-semester examinations during the regular class period, the following requirements for offering the examination at an alternate time must be met: (1) the course shall be identified in the schedule of classes as requiring combined hourly examinations at a time different from the regular class period; (2) the times at which combined hourly examinations will be given shall be listed in the schedule of classes; (3) the controlling academic dean shall approve such action in advance; and (4) students whose schedules conflict with the time scheduled for the combined examination shall be provided an alternate time for taking the examination.
EXAMINATIONS REQUIRED—All courses offered for credit shall include a final examination given at the regularly scheduled examination time. Examinations are prohibited on scheduled class days during the week in which regularly scheduled final examinations begin. Specific exceptions for certain courses may be granted by obtaining prior approval from the appropriate department and academic dean. Students shall be informed of any such exceptions prior to the end of the fourth week of classes.

PROFICIENCY AND EXemption EXAMINATIONS, CREDIT BY EXAMINATION

Students may establish credit or proficiency in various disciplines at the University under any of several modes. They are:

I. The Advanced Placement program administered by the College Board;
II. The College-Level Examination Program (also administered by the College Board);
III. Departmental exemption or proficiency examinations;
IV. Special Examination for Credit or Grade.

In no case may the sum of credits earned through the above examinations and/or University of Arizona correspondence courses exceed 60 units toward an undergraduate degree. No graduate credit may be established in this manner.

I. Advanced Placement from High School

The Advanced Placement program recognizes that certain students are often able to complete college-level courses while attending high school. The College Board provides course descriptions and professional consultants to help schools establish college-level courses. The program administers and grades the examinations and sends the results to the students’ prospective colleges.

Successful completion of these examinations, which are administered in the student’s high school, entitles the student to be considered for advanced placement, or to be granted college credit, or both depending upon the area and the examination scores. Advanced Placement without credit never reduces the total units remaining to be earned for the bachelor’s degree, but allows the student to commence studies in the particular field at a higher level than otherwise possible. Advanced placement with credit reduces the units remaining to be completed for a degree. Final decision regarding credit or placement is in all cases the prerogative of the department concerned. The three top scores on Advanced Placement examinations are 5, 4, and 3; in many cases, a placement score of at least 3 will suffice for advanced placement and credit.

The following is a list of the Advanced Placement examinations offered and their course equivalents at the University:

<table>
<thead>
<tr>
<th>Name of Advanced Placement Exam</th>
<th>Univ. of Arizona Course Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>American History</td>
<td>Hist. 130a-130b</td>
</tr>
<tr>
<td>Art</td>
<td>Art 117, 118, 119</td>
</tr>
<tr>
<td>History of Art</td>
<td>Art 101, 102</td>
</tr>
<tr>
<td>Studio art</td>
<td>Intro. biology, 4-8 units of credit</td>
</tr>
<tr>
<td>Biology</td>
<td>Chem. 103a-103b, 104a-104b</td>
</tr>
<tr>
<td>Chemistry</td>
<td>C.Sc. 115</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Engl., 3 units of lower-division credit</td>
</tr>
<tr>
<td>English</td>
<td>Hist. 101a-101b</td>
</tr>
<tr>
<td>European History</td>
<td>Fren. 201a-201b, 305a-305b</td>
</tr>
<tr>
<td>French Language</td>
<td>Fren. 201a-201b, 250a-250b</td>
</tr>
<tr>
<td>French Literature</td>
<td>Ger. 101a-101b, 201a-201b, 315a-315b</td>
</tr>
<tr>
<td>German</td>
<td>To be determined</td>
</tr>
<tr>
<td>Latin Virgil, Latin Lyric</td>
<td>Math. 123 or 125a</td>
</tr>
<tr>
<td>Math-Calculus AB</td>
<td>Math. 125a-125b</td>
</tr>
<tr>
<td>Math-Calculus BC</td>
<td></td>
</tr>
</tbody>
</table>
No grades are recorded for courses credited through the Advanced Placement program. University policy encourages prospective students to avail themselves of any Advanced Placement programs suitable to their college goals, since successful achievement in them will substantially increase students' freedom in designing their university programs of study.

II. College-Level Examination Program (CLEP)

The examinations offered under the CLEP were designed primarily to allow people who may not have been formal students for many years to achieve college-level credit for knowledge acquired through self-education and experience. By successful performance on CLEP examinations, many have been encouraged to pursue further a college or university education.

Additionally, these examinations are seen increasingly as of value to students formally engaged in degree programs, as a means of satisfying certain course or area requirements, or for earning extra course credits, without having to enroll formally in the courses. Students should consult their academic advisers or the offices of their college deans for information as to how their examination credits can be most effectively applied.

All CLEP examinations are available through the Testing Center in Tucson. A limited list of CLEP examinations is available also through the testing centers in Tempe and Flagstaff. Resident students at the University of Arizona should contact the Testing Center at the Student Resource Center for additional information regarding these examinations.

The University of Arizona accepts for college credit both the General and the Subject examinations of the CLEP, providing satisfactory scores are attained. Scores of 500 or better on the General examinations will entitle the student, upon registration at the University, to 6 units of credit in each of the five General examinations: (1) English Composition; (2) Humanities; (3) Mathematics; (4) Natural Sciences; (5) Social Sciences-History.

From 3 to 16 units of credit, depending upon the examination, may be earned by scores of 50 or better on Subject examinations (41 for College French Levels I and II and College Spanish Levels I and II). The number of units of credit earned is listed in parentheses following the corresponding test indicated below.

American Government (3)
American History I (Early Colonization to 1877)(3)
American History II (1865 to Present)(3)
American Literature (6)
Analysis & Interpretation of Literature (6)
General Biology (8)
Calculus w/Elementary Functions (10)
College Algebra (3)
College Algebra-Trigonometry (5)
College Composition (6)
Computers & Data Processing (3)
Educational Psychology (3)
Foreign Language
College French I,II (8)
College German I, II (8 or 16)
College Spanish I, II (8)
Freshman English (6)
General Chemistry (6)
General Psychology (3)
Human Growth & Dev. (3)
Introduction to Business Mgmt.(3)
Introductory Accounting (6)
Introductory Business Law (3)
Introductory Macroeconomics (3)
Introductory Microeconomics (3)
Introductory Micro- & Macroeconomics (6)
Introductory Marketing (3)
Introductory Sociology (3)
Trigonometry (3)
Western Civilization I (Ancient Near East to 1648) (3)
Western Civilization II (1648 to Present) (3)

Other examinations will be added as they become available.

**NOTE:** A maximum of 6 semester hours of general elective credit will be allowed for completion of one or more of the following: Subject Examination in College Composition, Subject Examination in Freshman English, General Examination in English Composition. Whether this credit will satisfy the University Freshman English requirement is determined by the Director of Composition following interview and written performance.

CLEP credit in English, in composition or literature, may not be applied toward either an English major or minor.

For both prospective and currently enrolled students utilizing CLEP examinations, credit will not be awarded in subjects at the same level. In addition, resident students will not be awarded credit through CLEP for courses equivalent to, or at a lower level than, other courses they have already established in formal course work.

Passing scores for subjects credited through the CLEP are recorded simply as CR (credit), and may not necessarily be stated in terms of a specific course equivalent. No record is made of failing scores.

### III. Exemption or Proficiency Examinations

A number of colleges and departments regularly offer exemption or proficiency examinations covering introductory or basic areas of their disciplines. These examinations are designed and graded by the individual departments. No credit is awarded on the basis of successful performance on these, but they allow a student two privileges: (a) the opportunity of enrolling in advanced-level courses in the area of proficiency; or (b) the opportunity of satisfying various college or departmental "area" or proficiency requirements without taking prescribed courses.

Proficiency or exemption examinations for many courses are available to any student currently enrolled in a degree program at the University. Capable students wishing to increase their elective freedom are encouraged by university policy to examine the opportunities provided through the various proficiency examinations.

At the discretion of the department, the proficiency examination may include laboratory projects or other evidence of satisfactory skills in addition to or instead of the written examination. A fee is normally charged for these examinations.

**FOREIGN LANGUAGE PROFICIENCY EXAMINATIONS**—It is possible for students to meet the language requirements in whole or in part by passing a noncredit proficiency examination at the two- or four-semester level.

Foreign students will be allowed credit by transfer in their native language only for those courses taken during the years equivalent to the United States college years.

The completion of the course levels set in this paragraph satisfies the requirement: Or.S. 404b (Arabic); Or.S. 400b (Modern Chinese); Fren. 201b, 302b; Ger. 201b; Clas. 202b (Greek); Or.S. 403b (Hebrew); Or.S. 408b (Hindi-Urdu); Ital. 201b, 302b; Or.S 402b (Japanese); Clas. 201b (Latin); Or.S. 405b (Persian); Port. 201b, 202b; Russ. 201a or 201b; Span. 201b, 202b, or 373.

Passing the proficiency examination at the required level in a foreign language fulfills the language requirement in colleges requiring a foreign language. Passing a course for which the required level is prerequisite also establishes proficiency in that language. Credit may not be earned merely by passing the proficiency examination.

**PROCEDURES AND GENERAL REGULATIONS FOR EXEMPTION OR PROFICIENCY EXAMINATIONS**

1. Proficiency or exemption examinations are available only to students enrolled in degree programs.
2. In no case does passing an exemption or proficiency examination lower the total number of units required for the bachelor's degree.
3. In normal circumstances, a student may not take a proficiency examination for the same course more than twice.

4. Proficiency or exemption examinations are normally given early in the semester or during summer orientation. The student must contact the appropriate department concerned for additional information and instructions.

5. Students wishing to sit for a proficiency or exemption examination in a language not normally taught must contact the Office of the Dean of Arts and Sciences for information.

6. The exemption or proficiency examinations are administered only on the University of Arizona campus.

7. The results of exemption or proficiency examinations, if successful, are reported in writing directly to the Office of Student Information, Registration and Records, with a copy to the student.

8. The remarks portion of the student's academic record will be annotated with a statement indicating the student passed the proficiency examination at the appropriate level.

IV. Special Examination for Credit or Grade

Any student currently enrolled or previously withdrawn in good standing at the University of Arizona may earn credit toward an undergraduate degree through the use of special examinations. The responsibility for preparing for these examinations rests entirely with the student; faculty members are under no obligation to assist with such preparation.

Undergraduate courses currently offered by the University and designated in the catalog “CDT” may be taken for credit by examination. Courses designated “GRD” may be taken for grade by examination or credit by examination. Other courses generally have been excluded from this option; at department discretion, however, any course may be made available for grade by examination or credit by examination.

OPTIONS:

1. **Special Examination for Credit:** Passing grades, recorded as “CR” (credit), become a permanent part of the student's record but are not used in computing the cumulative grade average. Failing grades are not recorded.

2. **Special Examination for Grade:** All grades, whether passing or failing, are permanently recorded and used in computing the cumulative grade average.

LIMITATIONS:

1. The credit so earned may not duplicate units already presented for admission to the University, either collegiate or subcollegiate.

2. The credit may not be in a course which is equivalent to, or more elementary than, another course in which the student is enrolled or for which the student has already received credit. The head of the examining department has the responsibility of determining the application of this limitation in each student's case.

3. No credit may be earned by this type of examination for beginning or intermediate language courses in the native language of the applicant.

Special examinations are constructed and administered by the department concerned. They are designed to reflect and explore the scholastic equivalent of the course, and are more comprehensive than the usual "final exam." The examinations may be written or oral, or both, and they may include course projects, laboratory projects, written reports, or other evidence of proficiency.

PROCEDURES:

1. Applications for Special Examination for Credit or Special Examination for Grade may be obtained from the Registrar.

2. The application must be approved by the student's advisor.

3. The examining instructor and the head of the examining department must determine the eligibility of the applicant and sign the application.

4. The application is returned to the Registrar, and the $21-per-unit fee is paid to the University Cashier. No department may schedule a special examination until notified by the Cashier that the fee has been paid.
5. The examination is scheduled by the faculty member responsible, normally during the same semester in which the application is made.

6. The grade (CR or letter grade) is reported to the Registrar. The examination, together with the student’s graded examination paper and any appropriate evaluations of oral performance or projects, is then filed with the department for at least one year.

7. The student may change the type of special examination for those courses designated “GRD” in the catalog any time before the scheduled hour of the examination by filing a new application. No additional fee will be charged.

**GRADUATE CREDIT FOR SENIORS**

A senior within 15 units of completing requirements for graduation may register for graduate work if recommended by the head of the department and approved by the Dean of the Graduate College. A petition for graduate credit in excess of senior requirements must be filed with the dean at the time of registration or within 10 days thereafter. The number of units of graduate credit for which a student may petition is limited to the difference between the 16-unit maximum of the Graduate College and the number of units needed to complete bachelor’s degree requirements.

The Dean of the Graduate College will not approve a petition unless the senior has a grade average of 3.000 or better on all work already completed in the University, is proceeding toward graduation as directly as possible, and does not propose a semester load to exceed 16 units.

**ABSENCES**

Students are expected to be regular and punctual in class attendance. The University believes that students themselves are primarily responsible for attendance. Instructors will provide students with written statements of their policies with respect to absences. Excessive or extended absence from class is sufficient reason for the instructor to recommend to the college dean that the student be administratively dropped from the course. For those courses in which enrollment is limited, missing the first class session may be interpreted as excessive absence. If this action is filed by the end of the fourth week of classes, it will result in cancellation of registration in the course. If the student is administratively dropped after the end of the fourth week of classes, it will result in a failing grade being awarded in that course.

The student is encouraged to notify the Office of the Dean of Students when an absence from class of one week or more is unavoidable. The office will maintain a file of such reports available to instructors upon request.

**DISHONEST SCHOLASTIC WORK**

The Code of Academic Integrity places full responsibility on the student for the content and integrity of all academic work submitted as homework, examinations, etc. The first step in dealing with an alleged violation of the code is a student-faculty conference with the Dean of Students. More serious cases or student appeals of a student-faculty hearing may be referred to the University Hearing Board, which is composed of faculty and student members representing all colleges of the University. Additional information or a copy of the complete code may be obtained from the Office of the Dean of Students.

**LEAVING THE UNIVERSITY**

**FORMAL WITHDRAWAL**—Formal withdrawal from the University is initiated in the Office of the Dean of Students. The effective date of withdrawal is the date withdrawal papers are taken from that office. Seven class days are allowed for completion. No withdrawal may be initiated after the last day of classes of any semester.

**DISMISSAL FROM COURSES OR FROM THE UNIVERSITY**—Reprehensible conduct or failure to comply with university regulations may result in a student’s dismissal from a course or from the University at any time. The Dean of Students Office is responsible for this procedure. Such action is posted on the student’s academic record. Students suspended from the University are
denied student privileges during the period of suspension, and may not register for correspondence work except with permission of the dean of the college in which they have previously registered. They may not enroll in Continuing Education courses, nor establish credit by examination during the period of suspension.

**MEDICAL WITHDRAWAL**—Medical withdrawal is initiated from the Student Health Service. Adequate medical documentation must be supplied by the student. Students who withdraw from the University for medical reasons and who are medically encumbered must have their readmissions approved by the Student Health Service.

**RETROACTIVE WITHDRAWAL**—Under appropriate circumstances a student may petition for withdrawal after completion of classes for a term. If the student has experienced severe physical or psychological stress of such nature as to prevent satisfactory completion of course work in the semester or term in question, the student may petition for relief for that semester or term. This petition must be accompanied by adequate documentation.

**TRANSCRIPTS**—Official transcripts are issued to other institutions, offices or agencies designated by the student. When the student is required by the institution or agency to present an official transcript personally, it will bear the notation “issued to student.” (See “Transcript Fee” in Expenses and Fees section.)
Graduation Requirements

THE UNIT SYSTEM—Credit for a degree is based upon a unit system. The unit of credit is the semester hour. The unit system is described under “Scholarship Requirements” in the Academic Guidelines section. Minimum units required for bachelor’s degrees are:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Units Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Architecture</td>
<td>167</td>
</tr>
<tr>
<td>Bachelor of Arts</td>
<td>125</td>
</tr>
<tr>
<td>in Art</td>
<td>125</td>
</tr>
<tr>
<td>in Drama</td>
<td>125</td>
</tr>
<tr>
<td>in Education</td>
<td>126</td>
</tr>
<tr>
<td>in Media Arts</td>
<td>125</td>
</tr>
<tr>
<td>in Music</td>
<td>123</td>
</tr>
<tr>
<td>Bachelor of Fine Arts (except major in Art Education, 127 units)</td>
<td>125</td>
</tr>
<tr>
<td>Bachelor of Landscape Architecture</td>
<td>130</td>
</tr>
<tr>
<td>Bachelor of Music: Major in Performance (Guitar)</td>
<td>128</td>
</tr>
<tr>
<td>Major in Performance (Keyboard)</td>
<td>130</td>
</tr>
<tr>
<td>Major in Performance (String Instrument)</td>
<td>130</td>
</tr>
<tr>
<td>Major in Performance (Voice)</td>
<td>130</td>
</tr>
<tr>
<td>Major in Performance (Wind Instrument and Percussion)</td>
<td>130</td>
</tr>
<tr>
<td>Major in Jazz Studies</td>
<td>127</td>
</tr>
<tr>
<td>Major in Music Education (Choral)</td>
<td>125</td>
</tr>
<tr>
<td>Major in Music Education (Instrumental)</td>
<td>133</td>
</tr>
<tr>
<td>Major in Theory &amp; Composition</td>
<td>132</td>
</tr>
<tr>
<td>Bachelor of Science</td>
<td>125</td>
</tr>
<tr>
<td>in Aerospace Engineering</td>
<td>132</td>
</tr>
<tr>
<td>in Agricultural Engineering</td>
<td>131</td>
</tr>
<tr>
<td>in Agriculture</td>
<td>130</td>
</tr>
<tr>
<td>in Business Administration</td>
<td>125</td>
</tr>
<tr>
<td>in Chemical Engineering</td>
<td>137</td>
</tr>
<tr>
<td>in Civil Engineering</td>
<td>135</td>
</tr>
<tr>
<td>in Computer Engineering</td>
<td>133</td>
</tr>
<tr>
<td>in Education</td>
<td>125</td>
</tr>
<tr>
<td>in Electrical Engineering</td>
<td>130</td>
</tr>
<tr>
<td>in Energy Engineering</td>
<td>130</td>
</tr>
<tr>
<td>in Engineering Mathematics</td>
<td>128</td>
</tr>
<tr>
<td>in Engineering Physics</td>
<td>127</td>
</tr>
<tr>
<td>in Family and Consumer Resources</td>
<td>130</td>
</tr>
<tr>
<td>in Geological Engineering</td>
<td>141</td>
</tr>
<tr>
<td>in Geosciences</td>
<td>131</td>
</tr>
<tr>
<td>in Health Sciences: Major in Health Education</td>
<td>128</td>
</tr>
<tr>
<td>Major in Medical Technology</td>
<td>135</td>
</tr>
<tr>
<td>Major in Occupational Safety and Health</td>
<td>137</td>
</tr>
<tr>
<td>in Hydrology</td>
<td>135</td>
</tr>
<tr>
<td>in Industrial Engineering</td>
<td>131</td>
</tr>
<tr>
<td>in Materials Science and Engineering</td>
<td>129</td>
</tr>
<tr>
<td>in Mechanical Engineering</td>
<td>130</td>
</tr>
<tr>
<td>in Mining Engineering</td>
<td>139</td>
</tr>
<tr>
<td>in Nuclear Engineering</td>
<td>132</td>
</tr>
<tr>
<td>in Nursing</td>
<td>140</td>
</tr>
<tr>
<td>in Public Administration</td>
<td>125</td>
</tr>
<tr>
<td>in Renewable Natural Resources</td>
<td>130</td>
</tr>
<tr>
<td>in Speech and Hearing Sciences</td>
<td>125</td>
</tr>
<tr>
<td>in Systems Engineering</td>
<td>131</td>
</tr>
</tbody>
</table>
CHOICE OF CATALOG UNDER WHICH STUDENTS MAY BE GRADUATED—Candidates for bachelor's degrees may elect to fulfill degree requirements as outlined in any one catalog in effect during their dates of registration for university credit at the University of Arizona, with the following exception: Students who withdraw from the University for more than two consecutive semesters must meet degree requirements as outlined in the catalog in effect at the date of their reenrollment for university credit or any subsequent catalog in effect during their dates of registration for university credit. Students admitted to the University directly from an Arizona community college may, provided not more than two consecutive semesters have elapsed since their attendance at the community college, elect to fulfill degree requirements as outlined in any one catalog in effect during their dates of attendance at the Arizona community college, or any subsequent catalog in effect during their dates of registration for university credit. This provision does not apply to the grade average requirements for graduation, which are governed solely by those in effect during the student's dates of attendance for university credit at the University of Arizona.

Students should decide as early as possible which catalog is to be used in meeting degree requirements, and follow carefully the curriculum outlined therein.

GRADUATION AVERAGE—A graduation average of 2.000 for all university credit course work undertaken and for any work satisfied by the Special Examination for Grade is required for the bachelor's degree. Note: The graduation grade average is based only on credit earned in residence at the University of Arizona.

MAJOR AVERAGE—The colleges of Architecture, Arts and Sciences, Business and Public Administration, Education, Engineering and Mines, Nursing, and Pharmacy as well as the School of Health-Related Professions and certain departments require an average of 2.000 or better for all university credit work undertaken in the major field or for any work satisfied by the Special Examination for Grade if in the major.

UNIVERSITY CREDIT REQUIREMENT—A minimum of 30 units of university credit from the University of Arizona is required for the bachelor's degree. It is further required that 18 of the final 30 units offered toward the degree be university credit. Various departments have specific university-credit requirements for their majors, and students should consult individual departmental information sections for this information. Correspondence credit and/or credit by examination is not university credit.

UPPER-DIVISION UNIT REQUIREMENT—All students are required to have a minimum of 30 upper-division units (300, 400, or 500 level courses) for graduation. It is recommended that these units be included among the final units taken toward the degree (see section on University Credit Requirement.)

CORRESPONDENCE STUDY—A maximum of 60 units toward a bachelor's degree may be earned through correspondence instruction and/or credit by examination.

APPLICATION FOR BACHELOR'S DEGREE CANDIDACY—The University awards degrees three times annually: in May, in August (at the close of the summer session), and in December (at the close of the fall semester). Candidates for bachelor's degrees are required to file at the degree certification section of the Student Information, Registration and Records office for degree candidacy according to the following schedule:

<table>
<thead>
<tr>
<th>Date of Degree</th>
<th>Application to be filed no later than</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>May 1 of the year preceding graduation</td>
</tr>
<tr>
<td>August</td>
<td>Dec. 1 of the year preceding graduation</td>
</tr>
<tr>
<td>December</td>
<td>March 1 of the year of graduation</td>
</tr>
</tbody>
</table>

A fee of $10 (nonrefundable) is required to be paid when the application is filed. A fee of $2 will be charged for late filing. Late applications will not be accepted after the last official day to register for credit for the semester/term in which the degree is to be awarded.

Each senior is provided with an official check of remaining degree requirements, following filing of the application for degree candidacy, under the curriculum designated in such application. A fee of $5 will be charged for any additional degree check necessitated by a student's subsequently changing catalog or curriculum.
CHANGES IN DEGREE-APPLICATION INFORMATION—Once the application has been filed, applicants are required to notify the degree-certification section promptly of subsequent changes in the following information, as originally submitted: (1) anticipated date of graduation; (2) degree, major, minor, catalog being used; (3) name, local address and telephone number, permanent address. Failure to do so may result in delay in awarding of degree.

COMPLETION OF DEGREE REQUIREMENTS IN ABSENTIA—Degree candidates who find it necessary to leave the University and complete final course requirements through correspondence or transfer work are required to notify the degree-certification section of such plans, preferably before leaving the University. In any case, the degree-certification section must be notified of the intent to complete the degree in absentia no later than one month before the desired degree date.

SECOND BACHELOR'S DEGREE—Candidates for a second bachelor's degree at the University must offer no fewer than 30 units in addition to the units required for the first degree, and must meet all requirements for the second degree. The additional units may be completed concurrently with those applying on the first degree; however, at least 30 units of university credit must be completed for each degree.

AVERAGING OF GRADE FOR FINAL NON-UNIVERSITY CREDIT COURSE—Students who lack not more than a one-semester course toward the fulfillment of curriculum and minimum-graduation-average requirements, may apply, as the final course to complete the degree, a single one-semester course either in residence at another accredited institution or in correspondence work through the University of Arizona. Permission must be obtained from the academic dean, prior to enrolling for the course, to apply the grade received in such a course toward the graduation average. This provision may be applied also to the required separate average of 2.0000 in the major field if prior permission is obtained from the major professor and the academic dean.

CLEARANCE OF ACCOUNTS—Degree candidates are required to clear any indebtedness to the University before completion of degree requirements will be officially certified or the diploma released.
Expenses and Fees

The Board of Regents reserves the right to change all fees and charges without notice if necessary. Fees cited in the catalog are based on information available at the time of publication. Students wishing current information should contact the Office of Admissions.

The University cannot extend credit. Therefore, all students must have sufficient funds upon entering to defray their immediate expenses. An estimate of the amount required for the first month in residence, covering board for one month, room for one semester on the campus, registration, tuition, incidental fees, books, supplies, etc., is $1403.00 for residents of Arizona. For nonresidents, the estimated amount is $2965.00.

EXPENSES AND FEES—PER SEMESTER

1986-1987*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration fee</td>
<td></td>
</tr>
<tr>
<td>Seven or more units</td>
<td>$568.00</td>
</tr>
<tr>
<td>One through six units</td>
<td>$60.00 per unit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonresident tuition**</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Twelve or more units</td>
<td>$1,562.00</td>
</tr>
<tr>
<td>Seven units</td>
<td>$910.00</td>
</tr>
<tr>
<td>Eight units</td>
<td>$1,040.00</td>
</tr>
<tr>
<td>Nine units</td>
<td>$1,170.00</td>
</tr>
<tr>
<td>Ten units</td>
<td>$1,300.00</td>
</tr>
<tr>
<td>Eleven units</td>
<td>$1,430.00</td>
</tr>
<tr>
<td>One through six units</td>
<td>waived</td>
</tr>
</tbody>
</table>

*1987-88 and 1988-89 fees were not available at the time of catalog printing and are subject to change.

**In addition to the registration fee required of all students.

PAYMENT OF FEES—All fees are payable through preregistration or on registration day as the final step in the registration procedure. The University accepts checks for the amount due at the time of registration—do not send checks in advance—but cannot advance cash on checks. The University cannot accept installment payments, and all fees for the semester must be paid in full at the time of registration. The registration of a student whose check is returned by the bank unpaid is considered incomplete, and a $12.50 fee will be assessed.

CONCURRENT ENROLLMENT—NONRESIDENT TUITION—It is unlawful for any nonresident student to register concurrently in two or more public institutions of higher education in this state, including any university, college, or community college, for a combined student credit-hour enrollment of seven semester hours or more without payment of nonresident tuition at one of such institutions.

Any nonresident student desiring to enroll concurrently in two or more public institutions of higher education in this state, including any university, college, or community college, for a combined total of more than six semester hours, who is not subject to nonresident tuition at either of such institutions shall pay the nonresident tuition at the institution of his or her choice in an amount equivalent to nonresident tuition at such institution for the combined total of semester hours for which the nonresident student is concurrently enrolled.

NONCREDIT FEE—Fees for "no-credit" or "audit" units are the same as regular credit units, including the nonresident tuition, if applicable.
LATE REGISTRATION FEE—A student who fails to complete payment of all fees during the two-day registration period will be assessed a $10.00 nonrefundable late fee.

CLASSIFICATION OF PERSONS FOR TUITION PURPOSES

The Arizona Board of Regents is required by law to establish for the universities under its jurisdiction and control uniform guidelines and criteria for the classification of students for payment of tuition. Attention is invited to relevant provisions of the constitution, statutes, and laws of Arizona, including Sections 3 and 6, Article 7 of the Constitution (which provisions have been held by the Supreme Court of Arizona to govern domicile for all purposes), Sections 15-1625, 15-1626, and 15-1801 through 15-1807 of the Arizona Revised Statutes, as amended.

A. A person who does not qualify to enroll as an in-state student and who is taking seven or more units must pay a nonresident tuition, in addition to other established fees and charges that are required for all students. An out-of-state student enrolling for twelve or more units on campus must pay an out-of-state tuition fee each semester in addition to a registration fee. Out-of-state tuition is waived for students enrolling for no more than six units.

B. The general rule is that in order to obtain in-state status for tuition purposes, a student must establish his/her domicile in Arizona at least one year immediately prior to the last day of regular registration for the semester in which the student proposes to attend the University. Arizona domicile occurs when a person is physically present in Arizona with the intention of making Arizona his or her permanent home.

There are certain exceptions from the general rule. A student may also be eligible for in-state status if he or she can establish that, on or before the last day of regular registration, he or she meets one of the following criteria:

1. **DEPENDENT.** The student and his or her parent are domiciled in Arizona but have not met the one year durational requirement, and the parent is entitled to claim the student as a dependent for federal and state tax purposes.

2. **TRANSFERRED EMPLOYEE.** The student is domiciled in Arizona, but has not met the one year durational requirement, and is an employee or spouse of an employee transferred to Arizona by his or her employer for employment purposes.

3. **MILITARY.** The student is not domiciled in Arizona, but is a member of the U.S. Armed Forces stationed in Arizona pursuant to military orders or is a member's spouse or dependent child as defined in A.R.S. section 43-1001.

4. **NATIVE AMERICAN.** The student is not domiciled in Arizona, but is a member of a Native American tribe whose reservation land lies partially in Arizona and another state and is a resident of such reservation.

C. Mere presence of a person in the State of Arizona for one year does not necessarily establish a domicile for classifying that person as an in-state resident. No person shall be deemed to have gained or lost a domicile by reason of his or her presence or absence while a student at any institution of learning.

D. The person must have his or her domicile determined prior to registration and payment of fees. The responsibility of registration under proper status is placed upon the individual. Prompt filing of the required domiciliary information will enable the University to determine classification prior to registration. The Board of Regents has promulgated a publication entitled: *Summary of Tuition Classification Policies*, which is incorporated by reference in this catalog, and the attention of all persons concerned with classification for tuition purposes is directed to this publication available in the office of the domicile classification officer in Room 305, Administration Building. (These materials include: (a) definitions related to domicile; (b) guidelines, rules, and regulations applied to determine domicile; and (c) information on procedures for appeal.)

An affidavit must be completed and filed prior to any decision concerning domicile. The affidavit is required upon original registration or upon a desired change in classification or after an absence for a semester or more.
In all cases where the records indicate that the student's domicile is not in Arizona, out-of-state tuition will be assessed. Any student found to have made a false or misleading statement concerning his or her domicile shall be subject to dismissal from the University.

E. Classification officers of the University shall be designated to determine domicile. If there is any question as to domicile, the matter should be brought to the attention of the classification officers and passed upon prior to registration and payment of fees. The same classification officers can, during the registration period published by the University or at other times, pass upon the domicile of a person.

F. The President of the University shall appoint one or more appeals committees to hear the cases of individuals who believe that the decision regarding their domicile is not consistent with the laws of the State of Arizona or the summary promulgated by the Arizona Board of Regents. An appeal shall be filed in the office of the domicile classification officer. It shall be written, signed by the student, and accompanied by a sworn written statement of all facts relative to the matter. Notice of appeal shall be filed at any time within 35 days from the last day of registration published by the University. The person appealing shall have the right to appear and testify before the committee and to be represented by an advisor.

**SUMMARY OF MINIMUM ANNUAL ESTIMATED EXPENSE FOR FULL-TIME CAMPUS STUDENTS, 1986-87**

The Board of Regents reserves the right to change all fees and charges without notice, if necessary.

**LEGAL RESIDENTS OF ARIZONA:**

<table>
<thead>
<tr>
<th>Expense</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration fee*</td>
<td>$1136.00</td>
</tr>
<tr>
<td>Residence halls, average rate **</td>
<td>$1041.00</td>
</tr>
<tr>
<td>Meals in university cafeteria</td>
<td>$1600.00</td>
</tr>
<tr>
<td>Books and supplies</td>
<td>$230.00</td>
</tr>
</tbody>
</table>

**Total minimum annual expense**

$4007.00

**NONRESIDENTS OF ARIZONA:**

<table>
<thead>
<tr>
<th>Expense</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonresident registration fee*</td>
<td>$1136.00</td>
</tr>
<tr>
<td>Nonresident tuition fee***</td>
<td>$3124.00</td>
</tr>
<tr>
<td>Residence halls, average rate **</td>
<td>$1041.00</td>
</tr>
<tr>
<td>Meals in university cafeteria</td>
<td>$1600.00</td>
</tr>
<tr>
<td>Books and supplies</td>
<td>$230.00</td>
</tr>
</tbody>
</table>

**Total minimum annual expense**

$7131.00

*The registration fee for seven or more units includes services and facilities of student activities, Student Union, Health Service, Parking, Alumni Association and Artist Series. Students taking fewer than seven units pay $60.00 per unit per semester. The fee includes Health Service and Parking.

**Residence hall rates range from $711.00 to $1325.00 per student per year and are subject to increase for the 1987-88 and 1988-89 academic years.

***For seven through 11 units of course work, the nonresident tuition per semester is $910.00 for 7 units; $1040.00 for 8 units; $1170.00 for 9 units; $1300.00 for 10 units; $1430 for 11 units. The nonresident tuition is waived for students taking fewer than 7 units.

All students should add to this list incidental personal expenses as needed. The residence hall reservation deposit is $100.00. Students taking military science should add a deposit of $25.00.

All fees, except residence hall rent and deposit, are payable through preregistration or on registration day as the final step in the registration procedure. Do not send checks in advance.

**RESIDENCE HALL FEES**—Residence hall rent must be paid in accord with the Residence Hall License Agreement. A rent prepayment is required for fall applicants within two weeks of assignment notification.
Deposits on rooms will not be refunded for cancellations after June 1 preceding the fall semester, nor after January 5 for the second semester, except in case the University is unable to provide accommodations.

**RESIDENCE HALL RATES, effective 1986-87**

(Subject to increase for 1987-88 and 1988-89)

<table>
<thead>
<tr>
<th>RESIDENCE HALLS:*</th>
<th>Entire Academic Year</th>
<th>Fall Semester Payment</th>
<th>Spring Semester Payment</th>
<th>Spring Semester ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconino, Manzanita-Mohave, Maricopa, Apache-Santa Cruz, Graham, Greenlee, Kaibab-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huachuca, Yavapai</td>
<td>$1041.00</td>
<td>$625.00</td>
<td>$416.00</td>
<td>$521.00</td>
</tr>
<tr>
<td>Arizona-Sonora</td>
<td>$996.00</td>
<td>$598.00</td>
<td>$398.00</td>
<td>$498.00</td>
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<tr>
<td>Coronado</td>
<td>$1221.00</td>
<td>$733.00</td>
<td>$488.00</td>
<td>$611.00</td>
</tr>
<tr>
<td>Billman, International House,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comstock</td>
<td>$1084.00</td>
<td>$650.00</td>
<td>$434.00</td>
<td>$542.00</td>
</tr>
<tr>
<td>Gila, Yuma</td>
<td>$711.00</td>
<td>$427.00</td>
<td>$284.00</td>
<td>$356.00</td>
</tr>
<tr>
<td>Hopi, Papago</td>
<td>$749.00</td>
<td>$449.00</td>
<td>$300.00</td>
<td>$375.00</td>
</tr>
<tr>
<td>Cochise</td>
<td>$834.00</td>
<td>$500.00</td>
<td>$334.00</td>
<td>$417.00</td>
</tr>
<tr>
<td>Sierra</td>
<td>$774.00</td>
<td>$464.00</td>
<td>$310.00</td>
<td>$387.00</td>
</tr>
<tr>
<td>Navajo, Pinal</td>
<td>$960.00</td>
<td>$576.00</td>
<td>$384.00</td>
<td>$480.00</td>
</tr>
<tr>
<td>Babcock (std. double occupancy)</td>
<td>$1325.00</td>
<td>$795.00</td>
<td>$530.00</td>
<td>$663.00</td>
</tr>
</tbody>
</table>

**II. SUMMER RATES:**

Five-Week Summer Session
Manzanita-Mohave .......................... $184.00 each session
Babcock (std. double occupancy) ........ $222.00 (minimum) each session

Conference Groups:
Daily and Weekly
(over four weeks) ......................... Rates Available on Request.

**III. FAMILY HOUSING RATES:**

Effective July 1, 1986 (Subject to increase for 1987-88 and 1988-89)

Family Housing Complex (Per Month)—Includes Utilities:
Efficiency Unfurnished .................. $194.00
Efficiency Furnished .................... $226.00
One-Bedroom
Unfurnished ............................. $279.00
One-Bedroom Furnished .................. $306.00
Two-Bedroom Unfurnished ............... $334.00
Two-Bedroom Furnished ................. $371.00

*Rates for single rooms when available: 160% per person of the regular rental rate in all halls except Arizona and Sonora. Guaranteed double rooms, when available, in Arizona and Sonora: 140% per person of the quadruple rate.

**BOARD**—There are ten food service operations located in the Student Union Memorial Building and two at the Park Student Center, each of which operates on a self-sustaining basis for the convenience of students. Students and members of the University faculty and staff may purchase an ALL ABOARD meal plan debit card or pay cash at any university food outlet. The amount of food purchases by the average student on-campus is approximately $200 per month. ALL ABOARD is a computerized system that automatically withdraws purchases by the card holder and shows the balance available. Students can purchase as little or as much as they like and, unlike cash purchases, no sales tax is added.
The University reserves the right to prescribe rules under which its students shall board at the university cafeteria, with private families, in fraternity houses or elsewhere, whether these rules are or are not published in its General Catalog.

MILITARY UNIFORMS AND EQUIPMENT—The departments of Army, Navy and Air Force of the United States government supply uniforms without cost to students taking military training. Each student in military science or aerospace studies must deposit $50.00 to cover damage to or loss of uniform or equipment. This deposit, less any charge for damage or loss, is refunded at the close of the year or upon withdrawal from the course. To obtain refund, property must be turned in to the Military Property Custodian within seven days after withdrawal from or completion of the military course, and the refund order obtained from the Military Property Custodian must be cashed before the following June 30 or be forfeited. Property must be turned in or its total money value be paid to the University.

BREAKAGE DEPOSIT—A breakage deposit is required of each student registered for laboratory work in certain departments. This deposit, less the value of apparatus broken by the student, is returned upon completion of the course.

LABORATORY PENALTY FEE—Students who, upon the termination of their work in a course, fail to check their desks and clear their accounts with the department concerned will be assessed a penalty of $5.

FIELD-TRIP FEES—Trips to nearby mines, mills, smelters, and power plants are made during the year by students in mining, metallurgy, and geology, and in mechanical, civil, and electrical engineering. Trips to ranches and ranges are made by students in agriculture courses, and to points of historic and prehistoric interest by students in anthropology. Students in economics may make trips to industrial plants and business houses. Students pay their transportation and personal expenses.

Students registered for Chemical Engineering 304 pay a field trip fee of approximately $150 to cover transportation and lodging.

CHANGE OF SCHEDULE—For any change in schedule other than withdrawal with a failing grade of E, a fee of $2 will be charged. This fee is effective immediately upon completion of registration.

CREDIT-BY-EXAMINATION FEE—A fee of $21 per unit is charged for all special examinations for credit.

COLLEGE-LEVEL EXAMINATION FEE—The fees for examinations administered under the College Level Examination Program (CLEP) are $30 each for the Subject examinations and $30 for each General examination; plus a $5 administration fee.

FOREIGN LANGUAGE EXAMINATION FEE—A fee of $10 is charged to take any one foreign language examination. Examinations in French, German, Russian, and Spanish are administered nationally by the Educational Testing Service. The fee is paid to ETS at the time of registration. For other foreign language examinations, the fee is paid to the University cashier at the time of registration.

MUSIC FEES—A fee of $40 each semester for one half-hour per week or $60 per semester for a one-hour-per-week private lesson in applied fields of piano, organ, voice, band, or orchestral instrument is charged. A music major registering for more than one weekly lesson will pay a maximum fee of $60 each semester.

MUSIC INSTRUMENT RENTAL—Students enrolled for individual instruction may rent instruments, if available, for a rental fee each semester. The complete schedule of rental fees is listed in the Departments and Courses of Instruction section of this catalog under "Music."

STUDENT TEACHING FEE—The student teaching experience is scheduled generally during the fall or spring semester. It will not be available, except in rare instances, during the summer session. For those exceptional circumstances when student teaching is provided during the
summer session, the student will be assessed an additional fee of $200 to cover costs of supervision. In any event, approval for student teaching during the summer session must be obtained early in the fall semester of the previous year.

**LIBRARY IDENTIFICATION CARD REPLACEMENT FEE**—Library borrower identification cards, if lost or stolen, must be reported to the librarian's office. They can be replaced at a fee of $1.

**TRANSCRIPT FEE**—Students may order copies of their official academic record (transcript) from the Office of Student Information, Registration, and Records. The fee for regular transcript service is $3 per copy. The fee for immediate service or special handling is $4 per copy. Transcripts will not be issued for students whose records indicate indebtedness to the University.

**PHOTO I.D. REPLACEMENT FEE**—The replacement fee for lost or stolen I.D. cards is $10. Students must report to the Office of Student Information, Registration, and Records for replacement.

**FEE RECEIPT REPLACEMENT FEE**—If student's fee receipt is lost or stolen, a duplicate may be obtained by payment of a $10 nonrefundable fee.

**GRADUATION EXPENSES**

**DEGREE CANDIDACY**—Every candidate for a degree is required to pay a fee of $10 (nonrefundable) at the time of filing application for degree candidacy. A fee of $2 will be charged, in addition, for late filing for bachelor's-degree candidacy (see Graduation Requirements section). Each senior is provided with an official check of remaining degree requirements, following filing of the application for degree candidacy, under the curriculum designated in such an application. A fee of $5 will be charged for any additional degree check necessitated by a student's subsequently changing catalog or curriculum. A fee of $1 will be charged for duplicate copies furnished.

**PROCESSING THESIS**—A fee of $10, to cover the cost of binding two copies of the thesis or dissertation for the library, is required of each graduate student at the time of submitting the thesis or dissertation.

**DISSERTATION MICROFILM FEE**—$25

**CAP AND GOWN FEE**—Degree candidates participating in the commencement exercises are required to wear the prescribed academic costume, which may be purchased through the University Bookstore.

**REFUNDS OF TUITION AND FEES**

All refunds and deposits that may be due a student will be first applied to encumbrances owed the University. Refunds due will be forfeited unless called for on or before the following June 30.

**TUITION, REGISTRATION, MUSIC AND SPECIAL COLLEGE FEES**—See Schedule below.

<table>
<thead>
<tr>
<th>Schedule of Refunds*</th>
<th>1-5 days</th>
<th>6-10 days</th>
<th>11-15 days</th>
<th>16-20 days</th>
<th>21-25 days</th>
<th>Thereafter</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>less $10</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*The refund schedule begins with the first day of class and applies to weekdays only (Mon.-Fri.). Sufficient time must be allowed for final clearance of registration fee payment checks before refunds will be made.
CANCELLED REGISTRATION—A student whose registration is cancelled because of scholarship failure the preceding semester will be refunded his or her fees in full. A student on the delinquent scholarship report for the first semester (failing to maintain the grade average required for his or her class and thereby automatically placed on probation) who completes registration for the second semester may, upon filing a withdrawal within two weeks of such registration, be refunded fees in full. This refund must be approved by the Registrar.
Scholarships and Financial Aid

The University of Arizona provides access to a full range of federal, state, and privately donated financial aid funds to its students through the Office of Student Financial Aid (OSFA). Assistance is available to students based on financial need, academic merit, and program of study. The application process for financial aid begins with the completion of an American College Testing (ACT) application for student financial aid, entitled The Family Financial Statement, or the College Scholarship Service (CSS) application, entitled The Financial Aid Form. In addition, the Supplemental Application for Scholarship and Financial Aid must be completed.

In 1985-86, the Office of Student Financial Aid administered $58.1 million in aid, which assisted 18,029 students at the University. Awards are competitive, so early application is urged. Students should apply as soon as possible after January 1 of the year in which they will begin their academic career. The ACT application forms are widely available from high school counselors, community colleges, and the OSFA. Students must file a separate application for the Guaranteed Student Loan Program, as described below.

FEDERAL AID PROGRAMS

Federal aid programs comprise over 80 percent of the total aid available through the University of Arizona. For undergraduate students, the base of funding begins with the Pell Grant Program. For graduate students, the Guaranteed Student Loan usually is the first source of funding.

SUPPLEMENTAL EDUCATION OPPORTUNITY GRANTS—The SEOG Program is a direct grant to undergraduate students demonstrating exceptional financial need. Eligibility is determined by the Office of Student Financial Aid.

COLLEGE WORK STUDY—The College Work Study Program allows students to defray part of their cost of education through work experience. Many job placements are career related, offering both valuable experience and income to the student. The recipient may work up to 20 hours per week in an on-campus or off-campus placement.

HEALTH PROFESSIONS STUDENT LOANS—The Health Professions Student Loan Program is intended to assist medical and pharmacy students in meeting their educational expenses. Loans are at nine percent interest with a nine-month grace period after graduation before repayment to the University begins. The amount of the loan award is determined on the basis of the student's calculated need.

NURSING STUDENT LOANS—Loans are available to students enrolled in the College of Nursing at an interest rate of six percent. The amount of the loan is determined on the basis of the student's financial need, and repayment of the loan begins six months after the student leaves school.

PELL GRANTS—The Pell Grant Program is funded by the federal government in order to provide primary access for students for their undergraduate degrees. Eligibility is established by the federal government and students are funded at the level appropriate to their dependency status, living accommodations, and enrollment level.

GUARANTEED STUDENT LOANS—The Guaranteed Student Loan Program is available to both graduate and undergraduates to meet educational expenses. Loans are made by local lending institutions, including banks, credit unions, and other financial institutions. The loans are federally insured for repayment and lenders are paid a subsidy on the interest rate charged at eight percent as long as the student is enrolled in school. Repayment begins six months after the borrower leaves school and continues over a five-to-ten-year repayment period. Applications are available from the Office of Student Financial Aid or from local lenders.
PERKINS LOANS (FORMERLY NATIONAL DIRECT STUDENT LOANS) — The Perkins Loan allows students to borrow for undergraduate or graduate education at five percent interest. The amount of the loan is determined on the basis of financial need and repayment begins nine months (effective July 1, 1987, for all new borrowers) after the borrower is no longer enrolled in school. Various deferment provisions for service, death or disability are available.

SUPPLEMENTAL LOANS FOR STUDENTS AND PARENT LOANS FOR STUDENTS—The SLS and PLUS programs are available to undergraduate and graduate students. They have a higher interest rate (12%) than other loans described in this section and repayment begins 60 days after the loan is taken. Students whose families show no financial need can participate in these programs. A separate application is required.

The loans listed in this section can be considered for consolidation into a single repayment by qualified agencies. Contact OSFA for details.

INSTITUTIONAL STUDENT AID

Various departments on campus employ students in non-work-study positions to perform a variety of functions. The employing department decides on the selection of the student. Student financial aid recipients must be aware that institutional earnings from all sources are required to be reported to the Office of Student Financial Aid. In limited circumstances, students' financial aid packages may require adjustment in order to coordinate the earnings with other offers of aid.

SCHOLARSHIPS—Academic scholarships are offered on the basis of financial need, grade-point average, leadership qualities, and community service. Funds are provided by private donors to the University of Arizona. Most scholarships are intended for undergraduate students who are residents of the State of Arizona. Scholarship selection is dependent on the student's overall achievement and may be limited to specific fields of study. Through submission of a single application, the student applicant will be considered for all of the scholarships available. Students should also contact their individual departments or colleges regarding funds which may be available through those sources.

TEMPORARY LOANS—The Temporary Loan Program is intended to assist students with short-term funding problems. Generally, loan amounts are limited to $150 to assist students in meeting extraordinary costs for a 90-day period of time. Registration loans are also available for students for whom financial aid is pending but not yet paid at the time of registration.

All students are encouraged to apply for financial aid, regardless of their parents' financial status. The broad range of financial aid resources available to the Office of Student Financial Aid provides access on a variety of levels. Students who do not have financial need may still qualify for academic scholarships, temporary loans, or other programs. Therefore, please feel free to contact the Office of Student Financial Aid for further information. In addition, each high school and community college in the State of Arizona has available a copy of the catalog of scholarships at the University of Arizona for students' review.

WAIVERS—Waivers of resident registration fees are offered to a number of students each year based on academic achievement, talent and/or need. Students must apply using the ACT Family Financial Statement. Top ranking Arizona high school seniors will be considered for waivers and scholarships once they are identified by their respective high school. A limited number of nonresident waivers also exist.
Provisions for Superior Students

THE HONORS PROGRAM

The quest for excellence is continuously nourished at the University of Arizona. The University Honors Center provides students with a unique opportunity to join this quest for excellence in an atmosphere that is both personal and stimulating.

Admission to the Honors Program is limited to those students who have distinguished themselves academically. Incoming freshmen must rank in the top 5% of their class or achieve an ACT score of 29 or a combined SAT of 1300. Transfer students must have accumulated a 3.5 grade-point average on a 4.0 scale. Once admitted to the program, honors students are provided with a personalized educational opportunity that focuses attention on small classes, usually within the range of 12-15. Classroom sessions are structured such that there is heavy emphasis on the development of verbal skills, writing, and problem solving. A variety of honors seminars, colloquia, introductory departmental courses, studio workshops, and independent studies are available. There is ample opportunity for personalized research and laboratory work. In addition, students are able to participate in a program of faculty-student dialogues, peer-help sessions for incoming freshmen, tutoring, an honors semester abroad program where students spend five months studying in London, England, and a series of monthly honors forum luncheons designed to bring students and faculty together to interact informally and to listen to prominent scholars discuss some of their research. In most instances, a student's experience in the program is culminated with the completion of a special honors project conducted during the senior year.

Participation in the Honors Program affords students a number of special privileges. For most Arizona residents, admission to the program carries with it eligibility for a Regents Fee Waiver Scholarship. Honors students are provided with extended library benefits, use of special study areas in the libraries, and access to the Honors Center Common Room.

The thrust of the Honors Program is to permit students to extend the boundaries of their minds beyond the scope of the ordinary university experience. It seeks to provide opportunities which enhance the development of the whole person—that individual who is sensitive, humane, knowledgeable, inquisitive, and who seeks a clearer understanding of the past, present, and future.

Further information regarding the Honors Program may be obtained by contacting The Honors Center, Education 112, 621-6901.

ACADEMIC HONORS AND AWARDS

UNIVERSITY ACADEMIC HONORS are bestowed as recognition of outstanding academic achievement and as a means to further encourage sound scholarship. They are awarded to every undergraduate student attaining the required proficiency. All academic honors become part of the official record and are noted on the transcript. For some awards, students also receive plaques and certificates. The University of Arizona supports academic achievement and we are pleased to recognize and reward undergraduate students whose performance merits special attention.

DEAN'S LIST—Three categories are awarded every semester based on units completed for credit and letter grade (excluding all Pass/Fail and "S" grades). Also, all grades of "I" must be made up before the honor is bestowed.

1. DEAN'S LIST WITH DISTINCTION is based on 15 units and a 4.000 grade-point average.
2. DEAN'S LIST is based on 15 units and a grade-point average of 3.500-3.999.
3. HONORABLE MENTION is based on 12 units of 3.500 and above grade-point average.
Students awarded these academic honors receive a certificate. This recognition becomes part of the official record and appears on the transcript.

**ACADEMIC DISTINCTION**—Two categories are awarded annually based on units completed for credit and letter grade (excluding all Pass/Fail and "S" grades). Also, all grades of "I" must be made up before the honor is bestowed.

1. **HIGHEST ACADEMIC DISTINCTION** is based on 30 units and a 4.000 grade-point average.
2. **ACADEMIC DISTINCTION** is based on 30 units and a grade-point average of 3.500-3.999.

Students awarded these academic honors are recognized at the Honors Convocation. Those students with a 4.000 grade-point average receive plaques. Those students with a 3.500-3.999 grade-point average receive certificates. These honors become part of their official records and appear on their transcripts.

**GRADUATION WITH ACADEMIC DISTINCTION**—Three categories are awarded for superior scholarship in work leading to the bachelor's degree. This honor, based upon graduation grade-point average, becomes part of the official record, is awarded upon graduation and appears on the transcript and diploma of the recipient.

1. **SUMMA CUM LAUDE** is awarded to candidates whose grade-point average is 3.900 or higher.
2. **MAGNA CUM LAUDE** is awarded to candidates whose grade-point average is 3.700-3.899.
3. **CUM LAUDE** is awarded to candidates whose grade-point average is 3.500-3.699.

To be eligible for distinction at graduation, bachelor's degree candidates must have completed at least 60 units in undergraduate residence at the University of Arizona, with letter grades that carry a grade-point value in a minimum of 45 units. Also, in computing the above grade-point averages, only work in residence is considered.

**GRADUATION WITH HONORS** is bestowed on students who have completed all requirements of the University-wide Honors Program. This academic recognition becomes part of the official record and is noted on the transcript and diploma of the recipient. Honors students also wear a special stole at graduation.

**OTHER AWARDS AND HONORS** in recognition of outstanding academic achievement are bestowed through the various colleges and departments. Also, colleges and departments offer participation in discipline-based honor societies and associations. Interested students should contact departmental and college advisors.
Student Services

COUNSELING AND ADVISING

The University offers a variety of academic support services for students. The faculty, the faculty advisors, the heads of departments, and the deans of the colleges keep regular office hours for consultation. The Health Service provides health counsel; the Student Resource Center provides orientation programs, counseling, testing, study skills assistance, job placement and career planning; and the Office of Student Information, Registration and Records directs admissions, keeps cumulative files of student achievements, and issues the schedule of classes which students should read in order that they may plan their courses and obtain necessary information about the University.

DEAN OF STUDENTS OFFICE—The student's life outside the classroom is an integral part of the learning experience. Through services and staff, the Dean of Students Office provides support and advisement to students in areas such as residence life, disabled students services, international student activities, Greek life, off-campus student services, student activities and organizations, and veterans services.

Additionally, the Dean of Students Office is responsible for the enforcement of university policies and procedures, including the Code of Conduct and the Code of Academic Integrity. Students seeking to withdraw from the University must do so through the Dean of Students Office.

The Dean of Students staff works to help students build their campus community, assists with the resolution of problems, and advocates for new student programs. Office staff are frequent resources for students, parents, and other faculty for the successful resolution of problems. The Dean of Students Office is available to service the total university community and is located on the second floor of Old Main.

STUDENT RESOURCE CENTER—The Student Resource Center, located in the Old Main Building, houses six separate programs aimed at strengthening the students’ academic efforts. The main goal of these programs is to increase the likelihood that students will do well academically from the moment they are admitted as students. A description of these programs and their location follows:

Counseling—The Student Counseling Service (SCS) is staffed by psychologists who provide services to students seeking help with career, academic, personal or relationship problems. These services are offered through individual and group counseling, couples counseling, short courses and workshops dealing with skill development, and consultation with students’ groups and organizations. SCS staff members also offer consultation to university faculty and staff regarding matters relating to student development, welfare and well being, in or out of the classroom.

Most of these services are free to registered university students. Exceptions include fees for testing and counseling which extends beyond ten sessions.

Regular hours of SCS operation are 8:00-5:00, Monday through Friday. Students are asked to drop in at SCS, Second Floor, Old Main, or call for an appointment at 621-7591.

Testing—The Testing Center (TC) provides many out-of-class testing services needed by students. The Center administers two credit-by-exam programs (CLEP and DANTES) where students receive college credit by demonstrating college-level proficiency in various areas of study. Qualifying exams, such as the Law School Admissions Test, Graduate Record Exam, Pre-Professional Skills Test, Medical College Admissions Test, etc., as well as preparation courses for some of these exams, are available through the center. Math placement testing is also provided. Other services include career planning testing, employment application test administration, handicapped test administration and information about dates and locations of off-campus testing of interest to university students.

Study Skills—The Academic Learning Skills Center (ALSC) offers classes in reading improvement and seminars promoting efficient study habits. These classes start near the beginning and middle of each semester. Advanced learning skills in math and science are also available, as well as individual study counsel.

A special program for students with learning disabilities called SALT (Special Academic Learning Techniques) provides assistance in academic planning, study skills, research and writing skills, special test administrations, computer assisted learning and word processing,
personal and group counseling, career counseling and job search skills. Special admission consideration is given when the University application indicates the diagnosis of a learning disability. Application for the SALT program is made directly to ALSC, Old Main. SALT is a fee-based program.

The Tutoring Center serves as a clearinghouse for all tutoring services on campus. Three distinct programs are offered: The U of A Tutoring Hotline links students with appropriate tutors, the Tutoring Program for High Risk Courses focuses on high risk freshmen and sophomore courses, and the Program for International Teaching Assistants (ITAs) focuses on the improvement of classroom English-speaking ability of the ITAs who teach at the University. The goal of this service is to improve the learning environment of both graduates and undergraduates.

Placement—The Career and Placement Service (CPS) provides a centralized university career development and placement center for students and alumni. The office assists individuals with: (1) career exploration and decision making, (2) acquisition of experiences to test their career interests and develop employment skills, (3) development of job seeking skills, and (4) facilitation of contact with prospective employers. Numerous programs are offered to meet these comprehensive career development objectives.

Career exploration may be conducted through the use of various media in the Career Resources Center, including the computerized DISCOVER program, videotapes and printed occupational materials. Individual assistance is available through counseling sessions with staff.

Career interests may be explored and tested further through full- and part-time summer and semester positions. The Cooperative Education Program (COOP), the Summer Career Orientation Experience program (SCORE), the Internship Program and the job listings in the Job Center provide several means to obtain career-related experiences.

Placement—The Career and Placement Service (CPS) provides a centralized university career development and placement center for students and alumni. The office assists individuals with: (1) career exploration and decision making, (2) acquisition of experiences to test their career interests and develop employment skills, (3) development of job seeking skills, and (4) facilitation of contact with prospective employers. Numerous programs are offered to meet these comprehensive career development objectives.

Orientation, Advising, Retention—The Orientation, Advising, and Retention Office (OAR) administers all campus-wide orientation programs. Orientation programs include placement examinations in English, math, and most foreign languages, survival seminars that clarify processing, advising, and pre-registration or registration. OAR administers the Transfer Assistance Peer Program (TAPP), an excellent program for new transfer students. Students, parents, and academic colleagues having questions related to entry to the many campus academic and support programs can seek initial assistance in the OAR office.

Evaluation—The Office of Student Affairs Research (OSAR) creates and provides a central data base for decisions by senior administrators on ways to increase student productivity and well being. Data are developed on graduation rates, semester by semester retention rates, and on other indicators of student progress as the need arises. Consultation to other offices, as well as reference files on student outcome studies, are maintained within OSAR.

THE OFFICE OF MINORITY STUDENT AFFAIRS (OMSA) —The purpose of the Office of Minority Student Affairs is to recruit minority students to the University and to retain those minority students who enroll. Through the OMSA recruitment component, prospective minority students may receive assistance with the completion of admission and financial aid applications and with other procedures leading to enrollment at the University. The OMSA retention component provides matriculated minority students support through tutoring in math, English and general subject areas, professional and peer advising, career awareness services, study skills programs and other related services. Additionally, the office coordinates several developmental programs at the senior and junior high school levels and works with several summer enrichment programs at the University. OMSA is located in Old Main, Room 235.

ASSISTANT DEANS OF BLACK, HISPANIC AND NATIVE AMERICAN AFFAIRS—These officials assist students in their transition from the home environment into the University community by counseling at both the academic and personal-adjustment level, and by soliciting wider campus involvement in the programs and affairs of the Black, Hispanic, and Native American student. This office provides support for successful progress through the University. This office is located in Old Main, Room 235.

THE SUMMER BRIDGE PROGRAMS—The New Start Summer Program and the UA Summer Bridge Program are designed for graduating high school seniors intending to enroll as freshmen at the UA. Through a variety of activities, these six-week programs offer students an opportunity
to become better prepared to meet the challenges awaiting them and to help ease the transition to the college environment. The program's eligibility criteria and costs vary. For further information, contact the Assistant Director of Summer Bridge Programs located in Old Main, Room 235.

DIRECTOR OF THE INTERNATIONAL STUDENT OFFICE—The Director of the International Student Office is generally responsible for coordinating services to international students and scholars. The director works closely with students in the areas of adjustment to campus and community life and adjustment in academic procedures and requirements. Individuals are referred, when appropriate, to academic advisors, counseling staff, health staff, and others. The International Student Office is located on the second floor of the Nugent Building.

DISABLED STUDENT SERVICES PROGRAM—Through its support services, this program seeks to expand opportunities for disabled students to participate fully in the educational process and broader campus life. Individualized services promote independence and responsibility. Ongoing programs provide the campus and the community with opportunities for increased understanding of disabling conditions.

OFF-CAMPUS STUDENT CENTER—The Off-Campus Student Center introduces off-campus students to the academic, social, cultural, and recreational programs offered through the University community. It also serves as a bridge linking off-campus students to the many on-campus resources supported through the Student Affairs Division such as career planning, tutoring, counseling, and leadership development. The center publishes a student newsletter named the Town Cat Rendezvous which features activities of special interest to off-campus student populations. Involvement and interaction with other off-campus students are promoted and encouraged at the Off-Campus Student Center which is located in the Student Union, Room 107.

SWITCHBOARD—Supported by ASUA, this service is designed to help people help themselves by providing them with resources upon which they can draw. Switchboard is located on the second floor of the Student Union in Room 209A and can be contacted at 621-1000 for crisis help and referral.

CLINICAL SERVICES

The STUDENT HEALTH SERVICE helps students maintain their physical and mental health, and is a campus resource for counseling on health problems. Regularly enrolled students become eligible for care at the beginning of the semester for which registration fees have been paid. Continuing students who were registered during the spring semester but are not registered for either, or both, summer sessions may become eligible upon payment of the Optional Eligibility Fee. Every student, born in 1957 or later, must meet the requirement of having been administered measles vaccine during 1968 or later and rubella vaccine during 1969 or later. These vaccines are available at no cost at the Student Health Center. Additionally, every entering student is requested to submit a completed Health History form together with a record of immunizations.

Services—In general, the services available at the Student Health Center approximate those of the family physician. The Student Health Service offers an essentially prepaid plan of limited, defined benefits. Nominal charges are made for laboratory tests, x-ray services, and prescriptions filled at the Student Health Service pharmacy. While immediate payment for charges is recommended, delayed payment can be arranged. In addition, Visa and MasterCard are accepted for payment. During regular school sessions, general medical care is provided; however, the Student Health Service is unable to provide all services during academic holidays, vacation periods, summer sessions, and semester breaks.

Special Clinics available at the Student Health Center include orthopedics, gynecology, dermatology, allergy, immunization and minor surgery. Chronic and pre-existing illnesses, as well as problems requiring complex therapeutic and rehabilitative care, may require outside consultation and referral to the local medical community. In such cases, where services exceed the benefits of the prepaid program, the cost must be assumed by the student. Occasionally, an illness involving hazard to self or others may require temporary withdrawal from the University.
confidential, counseling service open to all students who are eligible for care at the Student Health Service. The Mental Health Section offers short-term individual, couple, and group therapy, as well as workshops in health and mental health-related areas.

**Health Promotion and Education**—The Student Health Service places a strong emphasis on health promotion and lifestyle management. Health Educators are available for individual counseling and group presentations on a wide variety of health education, promotion, and prevention subjects. Special programs on self-care are offered through the Self Care Center. Fitness and Nutrition Drop-In Services as well as Cardiopulmonary Resuscitation courses are available.

**Insurance**—Medical Insurance for Students, Arizona University System, is available to all students regularly enrolled at the University. This insurance is not required for services at the Student Health Center, but is intended to help offset direct cost of extended medical care.

**Medical Records**—The relationship between a Student Health Service physician and a student is a personal one and professional confidence is carefully maintained. Release of information may be obtained only by specific written authorization from the student concerned.

**SPEECH AND HEARING CLINIC**—The Department of Speech and Hearing Sciences maintains a speech and hearing center where university students may receive services. Diagnostic and referral assistance for any Arizona citizen is offered.

**STUDENT UNION POST OFFICE (SUPO)**

Students living in campus dormitories will be assigned a Student Union Post Office box after being assigned to a dorm. Students must show a dorm receipt in order to obtain a box. Until such time as a post office box has been assigned, students with reservations in one of the campus residence halls may have their mail addressed to “S.U.P.O. 10,000, Student Union Post Office, Tucson, Arizona, 85720.”

Returning residence hall students who had Student Union Post Office boxes in the spring semester will have them automatically reserved for the next year only by paying their residence hall deposit before July 1 and checking in with the Student Union Post Office with a dorm receipt for fall semester.

Any student who has not been given residence hall assignments before coming to the University and whose local address is uncertain, should have his or her mail directed to General Delivery, Main Post Office, Tucson, Arizona, 85710, until a definite residence is determined. Immediately after the student has established a definite residence, he or she should send change-of-address cards to all individuals and organizations from which he or she may expect to receive mail. These cards are available at the Student Union Post Office. There are a limited number of boxes available to rent to students who live off campus. These must be applied for in person at the Student Union Post Office.

**THE UNIVERSITY LIBRARIES**

The University Library system contains more than 5,000,000 items, including books, periodicals, microforms, maps, government publications, manuscripts, and nonbook media. Basic holdings cover all fields of instruction, and there are especially strong collections in anthropology, geology, arid lands, Spanish and Latin-American language and literature, American agriculture, Southwestern Americana, Arizoniana, 20th century photography, history of science, science fiction, and 18th and 19th century British and American literature. Through the library the University is a member of the Center for Research Libraries and the Association of Research Libraries. The library is also a member of the AMIGOS Bibliographic Network and through that and other agencies can borrow materials for student and faculty research on interlibrary loan. The library offers reference service, online searching of computerized data bases, and bibliographic course-related instruction.

The University Library system consists of the Main Library which houses the Central Reference Department, Government Documents, the Media Center, the Map Collection and the Current Periodicals, Newspapers, and Microforms Room; the Science-Engineering Library; and the following Branch Collections: the Oriental Studies Collection, the Music Collection, the Center for Creative Photography, the Southwest Folklore Center, Special Collections, and the Library Science Library. Four large but separate library facilities are the College of Law Library, the Architecture Library, the Arizona Health Sciences Center Library and the Arizona State Museum Library. In addition, several other departmental libraries, such as the Division of
Economics and Business Research Library, the Steward Observatory Library, the Herbarium, and the Lunar and Planetary Sciences Library, have been established to serve special research needs.

CENTRAL REFERENCE—Houses the library's main card catalog and reference materials for the social sciences, fine arts and humanities.

GOVERNMENT DOCUMENTS—A regional depository for U.S. government documents; houses almost a million items.

MEDIA CENTER—Houses all the library's nonbook materials except microforms and music tapes and records.

MAP COLLECTION—A depository for USGS maps, houses a fully cataloged collection of almost 200,000 maps on every subject.

CURRENT PERIODICALS, NEWSPAPERS, AND MICROFORMS -- Displays current issues of the 5200-plus periodicals received in the Main Library, subscribes to over 150 newspapers and has a collection of microforms which numbers nearly 2 million.

SCIENCE-ENGINEERING LIBRARY—Houses all materials on science and technology; has over 360,000 volumes, over a million microforms, and displays current issues of its 4500-plus periodicals.

MUSIC COLLECTION—Houses the library's collection of 50,000 scores, 28,000 sheet music and 25,000 recordings. Facilities for listening are provided.

CENTER FOR CREATIVE PHOTOGRAPHY—Houses the library's archive of over 100 famous 20th century photographers. The center's collections are internationally known.

SOUTHWEST FOLKLORE CENTER—Houses musical tapes and manuscript archives of Southwest music and folklore.

LIBRARY SCIENCE LIBRARY—Houses the library's collection of professional library literature in support of the Graduate School of Library Science.

SPECIAL COLLECTIONS—Houses the library's collections of Arizoniana and Southwestern Americana, special subject collections, rare books, fine printing, manuscripts and the University of Arizona archives.

ORIENTAL STUDIES COLLECTION—Houses books, periodicals and newspapers in the Chinese, Japanese, Arabic, Persian, Hindi, Urdu, Turkish and other oriental languages; has over 160,000 items.

LAW LIBRARY—This library now contains over 175,000 volumes, including the reported cases of all the jurisdictions in the United States and substantially all the English reported cases; American and English statutory law; decisions of federal administrative agencies; complete sets of leading legal periodicals; a carefully selected collection of legal encyclopedias, digests, treatises, and textbooks; and a developing collection of civil law with emphasis on Latin America.

HEALTH SCIENCES CENTER LIBRARY—This specialized library, which serves the University Hospital as well as the colleges of Medicine, Nursing and Pharmacy, contains almost 150,000 cataloged volumes and receives approximately 3,100 serial titles. The collection includes books, journals, and nonprint materials in the health sciences.

ARCHITECTURE LIBRARY—This specialized library houses a collection with emphasis on the topics of design, architectural history and theory, graphic communication, and building technology including over 10,000 cataloged volumes, 120 periodicals and over 24,000 slides for architecture faculty use. This library is open to the University community and general public on a reference basis.
Housing Facilities, Student Conduct and Campus Life

The University recognizes the importance of residence hall living as an integral part of the total educational program. The residence halls provide a living/learning environment that reflects responsible citizenship and concern for others and offers opportunities for individual growth and development. A broad range of programs are offered in the residence halls which provide opportunities to form friendships, heighten self-awareness, increase autonomy and broaden perspectives on the world. Inherent in a community living environment are community standards of behavior. Students who choose the option of living in a residence hall are expected to conform to the community standards.

The residence halls are fully staffed by live-in personnel. The head residents and resident assistants are skilled in all facets of community living. Students should feel free to seek assistance from a staff member on any type of problem or question which may arise. Faculty fellows are also available in several halls to serve as academic resources for residents.

RESIDENCE HALL FACILITIES—Twenty-two residence halls are clustered in four separate residential communities on campus and offer a variety of living options to approximately 5,000 students. The options include both single-sex halls and co-ed halls; various locations; a range of rental rates and a variety of architectural styles.

Rooms in the residence halls are completely furnished, including pillows. Students are requested not to bring additional furniture with them but do need to provide their own blankets, sheets, pillowcases, bedspread and towels. Students care for their own rooms. Custodial service is provided for other portions of the halls.

Four residence halls are accessible for wheelchairs and have other special equipment for handicapped students: Coconino, Yuma, Papago and Yavapai.

RESIDENCE HALL AGREEMENT AND OCCUPANCY OF ROOMS—All students applying for a residence hall are required to sign a Residence Hall License Agreement for the full length of the term for which application is being made. The occupancy agreement terms are concurrent with the regular university academic sessions. Students may apply for the academic year; spring semester only and/or individual or all summer sessions. Exceptions to the occupancy requirements are provided in the terms and conditions of the Agreement.

The rental rate does not cover occupancy during the Christmas recess. All halls are closed during the Christmas recess with the exception of International House and Babcock. All halls are kept open for students during the Thanksgiving and spring recesses. Additionally, limited facilities are available to continuing students, at additional charge, during periods between the beginning and end of the academic years and the summer sessions.

Only the students assigned to a specific room may occupy that room. Room changes within a hall must be approved in advance by the Head Resident of that hall. When necessary, students may be required to move to another room to consolidate unassigned space or exercise the option of occupying unassigned space in their room at additional cost. Students may transfer from one residence hall to another only with advance approval from the Department of Residence Life.

The University reserves the right to change the residence of any student, or to deny or cancel accommodations in cases where such action is deemed desirable.

Students are required to vacate their rooms and check out of the hall within 24 hours after their last final exam, withdrawal, suspension, academic disqualification or disciplinary dismissal from the hall.

RESIDENCE HALL RESERVATION—in order to apply for a residence hall room, the student must first be officially admitted to the University. Accompanying the notification of admission is the Residence Hall License Agreement, Terms and Conditions of that Agreement and description and rental rates of the halls. Students desiring a reservation should complete the application/agreement form and return it with the $100.00 deposit to the Department of Residence Life. Do not send cash. The University cannot be responsible for any cash deposits sent through the
mail. Make checks payable to the University of Arizona. Room deposits may not be submitted until notice of admission is received from the admissions office. The room deposit, in addition to being a guarantee against cancellation of housing application, applies against damage or loss to university property or to other debts to the University. It does not apply on the rent. The deposit is refunded when a student leaves the residence hall, if all charges for loss or damage and debts to the University have been paid.

Notification of residence hall assignments for the fall is mailed to applicants beginning late May. Failure to provide required rent prepayment within two weeks of assignment notification will result in cancellation of reservation and forfeiture of deposit. Demand regularly exceeds available space and, therefore, early application is encouraged. Priority for assignment is based on the date the Residence Hall Agreement and deposit are received by the Department of Residence Life.

Residence in halls is ordinarily restricted to students registered for 12 or more units of regular university work and is not open to noncredit, nondegree or correspondence students. Exceptions must be approved by the Department of Residence Life.

HOUSING FOR MARRIED STUDENTS AND SINGLE-PARENT FAMILIES—The Family Housing Complex of 420 apartments is located in northeast Tucson about 12-15 minutes from the University. Applications may be submitted after a person has been officially admitted to the University. Additional information and application forms may be obtained from The Family Housing Office, 3401 N. Columbus, Tucson, AZ 85712.

TEMPORARY HOUSING—Temporary housing at the beginning of the fall semester is available through "Gimme Shelter," ASUA Switchboard, Student Union.

HOUSING OFF THE CAMPUS—Listings of off-campus housing are available in the Associated Students office (above the Bookstore) through the ASUA Tenant's Association. Numerous such listings are also given in Tucson's daily newspapers.

CHANGE OF ADDRESS—it is the student's responsibility to keep the University informed at all times of his or her current Tucson address. Change-of-address forms are available in the Office of Student Information, Registration and Records.

THE UNIVERSITY CAFETERIA—The University operates numerous dining facilities in the Student Union Memorial Building, as well as a dining hall located in the Park Student Center on the corner of Fifth Street and Park Avenue.

The University reserves the right to prescribe rules under which its students shall board in the University cafeteria, with private families, in fraternity and sorority houses, or elsewhere, whether these rules are or are not published in the General Catalog.

STUDENT CONDUCT

GENERAL RESPONSIBILITY—When a student accepts admission to the University of Arizona, the University assumes that the student thereby agrees to conduct himself or herself in accordance with its community standards. The University reserves the right, on the recommendation of the Dean of Students and with the approval of the President, to terminate at any time the enrollment of a student who violates these standards. Evidence of unsatisfactory citizenship may be an overt violation of a specific standard, or social behavior that is not acceptable.

For a detailed statement of university regulations, refer to the Code of Conduct available in the Office of the Dean of Students.

USE OF NARCOTIC DRUGS—The use by a student, or the sale, possession, or giving as a gift by him or her of narcotic drugs, sedatives, stimulants, psychotherapeutic drugs, psychedelic agents of any variety, prescription drugs other than such as may be prescribed by a physician for the student's individual use, or of any of the foregoing in violation of federal or state law, is incompatible with and inimical to the social, health, and safety standards and educative purposes of the University, and shall be cause for disciplinary measures, including suspension or expulsion, regardless of action or inaction by civil authorities with respect to violations of the law above mentioned.
USE OF AND CONDUCT UPON UNIVERSITY PROPERTY—The grounds and properties of the three universities of the State of Arizona are owned by the state through the Arizona Board of Regents for the use and benefit of the respective institutions. Such properties are devoted to and maintained for the sovereign function of supplying higher education to the people, and are not places of unrestricted public access.

Neither the state nor the Board is obligated to furnish or supply in such grounds and properties a forum or locale for the commission of crime, disorders, violence, injuries to persons or property, or the incitement or encouragement thereof, or any conduct or activity whatsoever which will interfere with or is harmful, disruptive, or inimical to the educational function aforesaid.

Accordingly, in the light of the foregoing and in the exercise of the jurisdiction and control vested in it by law, the Arizona Board of Regents has formally adopted and promulgated the following ordinance and regulation:

No person or persons may enter upon the grounds, buildings, roadways, or properties of the University of Arizona, Arizona State University, or Northern Arizona University, nor may a person or persons there be or remain, for the purpose of or in the actual or threatened commission of, any one or more of the following: a breach of the criminal laws (state or national); violent, obscene, or disorderly conduct; injury to or destruction of property; interference with free access, ingress, or egress; injury to person or persons; seizure or exercise of unpermitted control of properties of the institution; trespass; conduct harmful, obstructive, or disruptive to, or which interferes with, the educational process, institutional functions, contractual arrangements, or the public peace and tranquility; conduct likely to foment uproar or violence; or the incitement, support, encouragement, aid, or abetment of any or all of the foregoing.

Access to, enjoyment of, and presence upon or within the areas aforesaid are conditioned upon compliance with the foregoing ordinance and regulation. Any and all persons not in compliance with the foregoing, or in threatened or actual violation thereof, will be denied entry to or upon such areas, or will be evicted therefrom, as the case may be. More specific details regarding conduct appropriate to a university campus are found in the separately published Code of Conduct.

AUTOMOBILES, MOTORCYCLES, BICYCLES

MOTOR VEHICLE AND MOTORCYCLE REGISTRATION—Any vehicle operated and parked on university property, other than a pay lot or metered zone must register and properly display a current university parking permit. Permit restrictions are in effect generally, from 7:00 a.m. to 5:00 p.m., Monday through Friday.

University employees and continuing students may be able to preregister in April for preferential parking assignments for the coming year. New employees and students will register before their first day of employment or classes. Any vehicle brought on campus after these times must be registered immediately and no later than the first university business day after arriving on campus. The demand for parking space is high, but the supply is low. Parking is a privilege, not a right, and the purchase of a parking permit does not guarantee a space.

ISSUANCE OF PERMITS—Parking and Transportation Services is the sole campus unit authorized to issue parking permits. Parking permits are valid for a full year beginning August 15. Permits are permanently assigned to the registrant and may not be transferred to another person. Annual permits and/or gate cards will be issued only after: (1) presentation of a valid identification card for employees OR a current paid fee receipt for students; (2) submittal of completed and signed parking permit application form; (3) clearance of all outstanding parking fees and fines incurred by the registrant; (4) payment of fee, if any.

Information and purchase of permits may be obtained at the Parking Permit Office, 1508 E. Sixth Street, Tucson, AZ 85721. (602) 621-3137. Hours: Monday through Friday, 7:30 a.m. - 5:00 p.m. (except on university holidays).

BICYCLE REGISTRATION—Bicycles may be registered on the mall during the first week of classes each semester. For other registration times, please contact 621-1800. Bicycles must park only within the boundaries of marked bicycle parking areas and/or properly attached to a bicycle parking unit. Bicycles are subject to removal when attached to access or egress ramps blocking pedestrian access or stored in buildings. General rules of the road are enforced at all times.
PENALTIES—Regulations are subject to enforcement at all times including academic recess periods (e.g., Thanksgiving break, Spring break, final exam week, between semesters and summer sessions). On official university holidays, permit restrictions are lifted but general regulations are enforced. It is the responsibility of the user to obtain a copy of the regulations and comply with them. Failure to do so may result in issuance of a citation, removal of the vehicle, encumbrance of academic records, oral or written reprimand, withdrawal or suspension of vehicle parking privileges, or regular institutional discipline.

PARKING DURING ATHLETIC EVENTS—Residence hall students and others parked in lots reserved for athletic events will be required to move their vehicles upon notice of lot closure.

ELIGIBILITY FOR EXTRACURRICULAR ACTIVITIES

Extracurricular activities relate directly to and encompass membership in university-recognized student organizations and groups, professional honoraries, coordinating councils, service groups and special events and projects. Intercollegiate athletics for men and women (NCAA and PAC-10) are governed by their own standards of eligibility for participation.

Any student, undergraduate or graduate, who is currently enrolled in the University may participate in these activities. However, where specified in these activities, a student may be required to meet additional qualifications and criteria for membership or participation. All elected or appointed officers of these activities, to be eligible to hold these leadership positions, must at the time of their election or appointment be in good academic standing and currently enrolled in the University for a minimum of 7 units. When a student continues in office from one semester to the next, the student must have successfully completed a minimum of 7 units the previous semester.

Exceptions to these provisions must be approved by a review committee made up of three students appointed by the President of the ASUA and three faculty members appointed by the Vice President for Student Affairs. More specific details regarding eligibility are found in the Code of Conduct, the Student Handbook, and the Rules and Regulations Handbook.

INTERCOLLEGIATE ATHLETIC POLICY—Intercollegiate athletics are sponsored primarily as an aid to the educational purposes of the University. Full control of all phases of this program remains with and is administered by the faculty and staff of the University. Students participating in athletics must have conformed to normal entrance requirements and must maintain acceptable progress toward a college degree.

Requirements for participation in and regulations covering conduct of intercollegiate athletics are administered under standards set by the Arizona Board of Regents, the National Collegiate Athletic Association, and the Pacific-10 Conference.

Scholarships awarded to properly qualified students who participate in athletics are administered by a committee of the Office of Student Financial Aid under standards applying to all such awards. All funds for the support of the athletic program, regardless of source, are accounted for by the University Comptroller and are included in the annual audits.

ASSOCIATED STUDENTS

The student body is organized under the title, Associated Students of the University of Arizona. The purpose is to enable students to assume the privileges and responsibilities of self-government, and the direction and management of student activities and enterprises. Governing authority of the association is vested in the Student Executive Council, the Senate, and the Student Courts.

The functions of the ASUA are classified under publications, activities, committees, special events, and operations.

Official publications of the Associated Students are the Arizona Daily Wildcat (newspaper), the Desert (yearbook), Summer Wildcat (summer newspaper), Student Handbook, Campus Calendar, Student and Faculty-Staff Directory, and the Renters' Handbook.

Just a few activities receiving financial support from the Associated Students through the Student Relations Budget Committee and the ASUA Senate are: the Traditions Committee, the debate team, moot court team, the Army and Air Force ROTC Drill Teams, Camp Wildcat, Switchboard, Liaison for Neighborhood Knowledge, the Black Student Union, Movimiento
HOUSING FACILITIES, STUDENT CONDUCT AND CAMPUS LIFE

Estudiantil Chicano de Aztlan, the Amerind Club, and various foreign-student organizations. Examples of sports clubs receiving financial support include rodeo, soccer, rugby, lacrosse, and bowling.

Student government acts as a liaison and communications vehicle with students, faculty, administration, regents, and legislature through the following programs and services: Projects Council, Polls and Surveys, Speakers Board, Special Events, Spring Fling, Concerts, Voter Action, Public Relations, Campus Athletic Board, Escort Service, Discount Card Program, Tutoring Service, Lecture Notes, Legal Aid, Student Health Advisory Committee, Switchboard, Teacher/Course Evaluation, Tenants Association, Whistle-Stop, Women’s Center.

The ASUA Executive Council appoints students to several all-university committees such as Campus Community Relations, Cultural Events, Lectures, Parking and Traffic, and Registration Procedures.

OFFICE OF STUDENT ACTIVITIES AND ORGANIZATIONS

The Office of Student Activities and Organizations is responsible for the planning, promotion and implementation of a number of co-curricular activities. These include the following areas: The Office of Greek Life, which manages fraternities and sororities; Parent Weekend activities; club and organization administration, which includes registration and recognition.

Additionally, this office publishes the Student Handbook, coordinates the Project Volunteer Program and the Student Leadership Development Program, which include peer leadership activity, retreats, skill building workshops and academic course work.

The office also provides advising assistance to certain ASUA programs and services, including concerts and Spring Fling. Opening of school social activities are also planned and coordinated by this office.

FRATERNITIES AND SORORITIES

Fraternity and sorority membership is an adjunct to a university education. It takes over where the University's role leaves off in the classroom. It is an experience in living together and sharing maintenance, self-government, and personal relations in a community that profits socially and intellectually. In addition, fraternities and sororities offer opportunities for leadership, campus participation, community involvement and involvement as alumni/alumnae. They organize the social lives of their members to promote their educational objectives. Mutual selection based upon congeniality and common purposes forms the basis for these organizations. The University of Arizona recognizes the need for the total growth of the individual during his or her academic experience and, therefore, has made a strong commitment to organized activities such as social fraternities and sororities. These groups are considered university-recognized student organizations and, therefore, are subject to policies and regulations set by the University for recognized clubs and organizations.

FRATERNITIES—Alpha Epsilon Pi, Alpha Gamma Rho, Alpha Kappa Lambda, Alpha Phi Alpha, Alpha Tau Omega, Beta Theta Pi, Delta Chi, Delta Tau Delta, Kappa Alpha Order, Kappa Alpha Psi, Kappa Sigma, Lambda Chi Alpha, Omega Psi Phi, Phi Delta Theta, Phi Gamma Delta, Phi Kappa Psi, Phi Sigma Kappa, Pi Kappa Alpha, Sigma Alpha Epsilon, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Zeta Beta Tau.

SORORITIES—Alpha Chi Omega, Alpha Delta Pi, Alpha Epsilon Phi, Alpha Kappa Alpha, Alpha Phi, Chi Omega, Delta Gamma, Delta Sigma Theta, Gamma Phi Beta, Kappa Alpha Theta, Kappa Gamma Gamma, Pi Beta Phi, Sigma Kappa.

HONOR SOCIETIES, PROFESSIONAL AND OTHER ORGANIZATIONS

SCHOLASTIC HONOR SOCIETIES

Alpha Chi Sigma—Chemistry
Alpha Zeta—Agriculture
Beta Alpha Psi—Accounting
Beta Gamma Sigma—BPA
Gamma Sigma Delta—Agriculture

Kappa Delta Pi
Omicron Nu—Family and Consumer Resources
Phi Beta Kappa—Liberal Arts and Sciences
PROFESSIONAL ORGANIZATIONS

Agricultural Business Club
Alpha Epsilon Delta — Premedical
Alpha Kappa Psi — BPA
Alpha Tau Alpha — Agricultural Education
American Home Economics Association
American Institute of Architects
American Institute of Chemical Engineers
American Institute of Industrial Engineers
American Institute of Mining, Metallurgical and Petroleum Engineers
American Marketing Association
American Medical Student Association
American Nuclear Society
American Pharmaceutical Association
American Society of Agricultural Engineers
American Civil Engineers
American Society of Interior Designers
American Society of Landscape Architects
American Society of Mechanical Engineers
American Water Resources Association
Angel Flight
Animal Sciences Graduate Students
Anthropology Club
Arizona Association of Student Nurses
Arnold Air Society
Associated Students of Agricultural Engineering and Agricultural Mechanics
Audio Engineers Society
BPA Student Council
Black Engineering Science Students Today
Coordinated Council of Nursing Students
Fashions Dimensions Club
Featherless Bipedis (Philosophy)
Food Science Club
Higher Education Students Organization
History Graduate Association
Kappa Beta Pi — Law, Women’s Association

Kappa Psi — Pharmacy
Lambda Alpha Beta
Library Students Association
Linguistics Circle
MBA Student Association
Management Information Systems Association
Minority Pre-Law Association
Movimiento Estudiantil Chicano de Aztlan (M.E.Ch.A.)
Muslim Student Association
Personnel Club
Phi Alpha Theta
Phi Beta Lambda
Phi Chi Theta
Phi Delta Chi — Pharmacy
Phi Delta Psi — Law, Men
Pi Alpha Alpha
Pi Lambda Theta — Education
Plant Pathology Club
Public Administration Students Association
Recreation Club
Sigma Alpha Lota — Music, Women
Sigma Delta Chi — Journalism
Society of Range Management
Society of Automotive Engineers
Society of Criminal Justice
Society of Physics Students
Society of Professional Journalists
Society of Reliability Engineers
Soils Club
Student Chapter of the Wildlife Society
Undergraduate Geology Club
University of Arizona Dietetics Club
University of Arizona Student Nurse’s Association

DEPARTMENTAL ORGANIZATIONS—A number of university departments have organizations, some open to all students taking courses in the department, some limited to majors in the department, and some with only elected membership.

STUDENT LEADERSHIP AND SERVICE SOCIETIES

Black Key — Seniors
Bobcats — Seniors
Chain Gang — Juniors
Chimes — Juniors
Mortar Board — Seniors
Order of Omega — Fraternity/Sorority members

Preludes — Freshmen
Primus — Freshmen
Sophos — Sophomores
Spires — Sophomores
Wranglers — Undergraduates
RELIGIOUS ACTIVITIES

Organizations on the campus which are designed to foster the spiritual, intellectual, and social interest of various religious faiths or denominations are: Advance for Christ, American Baptist Campus Ministry, Campus Christian Center, Baha'i Community of Tucson, Baptist Student Union, Beal Center, Campus Ambassadors Christian Fellowship, Lutheran Campus Ministry, United Campus Christian Ministry, United Methodist Campus Ministry, Episcopal Campus Ministry, American Baptist Campus Ministry, Campus Crusade for Christ, Chi Alpha, Christian Science Organization, The Church of Jesus Christ of Latter-Day Saints, Hillel Foundation, Humanists Association, Intervarsity Christian Fellowship, Islamic Center at Tucson, Church of Christ, Little Chapel of All Nations, Muslim Student's Association, Newman Catholic Center, Quaker University Organization, Sikh Dharma, Unitarian Universalists, United Campus Christian Ministry, and Wesley Foundation (Methodist). For further information please contact the respective organization.

SPECIAL CULTURAL OPPORTUNITIES

UNIVERSITY ARTIST SERIES—The University of Arizona Performing Artist Series has become the pacesetter for diversified programs in music, dance and theatre with outstanding national and international artists and companies. The programs provide a unique opportunity for the entire student body to experience more deeply the fine arts, and supplement regular instruction for students working more directly with music, dance, and drama. The programs also serve as a cultural outreach to the Tucson community and surrounding area, often providing master classes and special workshops in addition to the performance.

The programs are consistent with the University's overall goals of higher education and remain within the University's financial resources. Special ticket arrangements are available for the regular student body (all students registered for at least 7 units). Dates are carefully coordinated with other activities on campus and allow for selective special events throughout the season.

UNIVERSITY OF ARIZONA MUSEUM OF ART—The museum presents a continuous series of temporary exhibitions that complement the museum's excellent permanent collection which spans the Middle Ages through the 20th century. (For further information, see the Divisions of Research and Special Public Service section.)

ARIZONA STATE MUSEUM—Open to students and the public. Prehistoric and recent Indian cultures of Arizona and the Southwest are interpreted through permanent exhibitions. Special temporary exhibits are presented throughout the year.

THE UNIVERSITY OF ARIZONA POETRY CENTER—A 1960 gift of Ruth Stephan, the rapidly growing poetry collection numbers over 15,000 volumes of poetry, has an extensive collection of literary magazines and poetry readings on tape, and is available daily for use by students, faculty and the community. The collection includes poetry of all ages and various nations, with emphasis on American and British poets. It also includes books about poetry and poets. The center regularly sponsors campus readings by nationally known poets and writers throughout the year.

THE ANNIE W. RIECKER LECTURESHIP FOUNDATION -Established in 1953 by Mrs. Eleanor Riecker Ritchie as a memorial to her mother, the original endowment of $10,000 has been increased by the contribution of a friend of the University to a total of $15,000. The income provides for one lecture during each academic year, delivered by a visiting speaker approved by the Board of Regents. The subject of the lecture is one of interest to the faculty and student body but not a part of any formal university course. The first Riecker Memorial Lecture was delivered during the academic year 1954-55.

DRAMA SERIES—The Department of Drama offers a University Theatre Season each year. The Mainstage Series presents classical, contemporary and musical theatre productions showcasing versatile theatre artists which are an integral extension of the educational process. The Studio Series is primarily an outlet for student talent with an eclectic repertoire designed to promote the professional growth of the students.
MUSIC SERIES—The School of Music offers a wide range of special programs throughout the year, many of them free to the public. Sunday afternoon concerts by university orchestras, bands, and choirs are held in the University Auditorium, while faculty and student solo and chamber recitals as well as smaller ensemble concerts are held in Crowder Hall. Selected concerts by guest artists and opera productions by the School of Music's Opera Theatre are offered at a nominal cost to all students and faculty.

Through special arrangements with the University, the following organizations offer programs of interest to faculty and students periodically throughout the year.

INTERNATIONAL ARTS SOCIETY—A cinema club, society membership is open to the faculty, staff, and student body of the University. A program of outstanding American and foreign films is presented throughout the academic year.

ARIZONA EARLY MUSIC SOCIETY—Sponsors concerts by ensembles and soloists performing medieval, Renaissance, and Baroque music.

ARIZONA FRIENDS OF MUSIC—These concerts present distinguished chamber music ensembles.

PIANISTS' FOUNDATION OF AMERICA SERIES—Concerts by artist-pianists presented in Crowder Hall of the School of Music.
Colleges and General Divisions
MAJOR FIELDS FOR BACHELOR’S DEGREES

Major work leading to a bachelor’s degree is offered in each of the following fields:

- accounting
- aerospace engineering
- agricultural communications
- agricultural economics
- agricultural education
- agricultural engineering
- agronomy
- animal sciences
- anthropology
- architecture
- art education
- art history
- astronomy
- atmospheric sciences
- biochemistry
- business economics
- chemical engineering
- chemistry
- child development and family relations
- civil engineering
- classics
- clothing and textiles
- communication
- computer engineering
- consumer studies and family resource management
- creative writing
- criminal justice administration
- dance
- drama education
- drama production
- drama – musical theatre
- dramatic theory
- early childhood education
- earth science
- ecology and evolutionary biology
- economics
- electrical engineering
- elementary education
- energy engineering
- engineering mathematics
- engineering physics
- English
- entomology
- extended English
- finance
- food science
- food service management
- French
- general agriculture
- general biology
- general business administration
- general fine arts studies
- general home economics
- general studies
- geography
- geological engineering
- geosciences
- German
- Greek
- health education
- health services administration
- history
- home economics and journalism
- home economics education
- home economics extension education
- horticulture
- human services administration
- hydrology
- industrial engineering
- interior design
- irrigation
- Italian
- jazz studies
- journalism
- landscape architecture
- language arts – social studies
- Latin
- Latin American studies
- linguistics
- management information systems
- marketing
- materials science and engineering
- mathematics
- mechanical engineering
- media arts
- medical technology
- merchandising and fashion promotion
- Mexican American studies
- microbiology
- mining engineering
- molecular and cellular biology
- music
- music education
- natural resource recreation
- nuclear engineering
- nursing
- nutritional sciences
- occupational safety and health
- operations management
- Oriental studies
- performance
- personnel management
- philosophy
- physical education
- physics
- plant pathology
- plant sciences
- political science
- Portuguese
- psychology
- public management
- public recreation administration
- range management
- real estate
- regional development
- rehabilitation
- religious studies
- Russian
- Russian and Soviet studies
- secondary education
- social studies
- sociology
- soil and water science
- Spanish
- speech and hearing sciences
- studio art
- systems engineering
- theory and composition
- watershed management
- wildlife and fisheries science
- women's studies

*Teaching majors only.
**Students wishing to teach at the secondary school level must select a subject area teaching major (see the College of Education section of this catalog).
ABBREVIATION GUIDE

The abbreviations listed below are used throughout this catalog to refer to the disciplines indicated:

a.ec.  agricultural economics
a.ed.  agricultural education
a.en.  agricultural engineering
a.m.e. aerospace and mechanical engineering
a.ph.  animal physiology
acct.  accounting
agri.  agriculture
A.in.s. American Indian studies
an.s.  animal sciences
anat.  anatomy
anes.  anesthesiology
anth.  anthropology
appl.  applied mathematics
a.r.l arid lands resource sciences
arch.  architecture
art.  art
astr.  astronomy
atmo.  atmospheric sciences
b.a.d. business administration
bioc.  biochemistry
B.S.  Black studies
c.e.  civil engineering
c.d.f.r child development and family relations
c.he.  chemical engineering
chem.  chemistry
clas.  classics
comm.  communication
coun.  counseling and guidance
cp.lit. comparative literature and literary theory
c.s.  consumer studies
c.sc.  computer science
c.t.  clothing and textiles
dance

dram.  drama
e.c.e. electrical and computer engineering
e.m.  engineering mechanics
ecol.  ecology and evolutionary biology
econ.  economics
ed.a.  educational administration
ed.p.  educational psychology
Engl.  English
ento.  entomology
ex.s.s. exercise and sport science
f.c.m.  family and community medicine
f.c.c.  family and consumer resources
fin.  finance and real estate
Fren.  French
Gen.  geological engineering
gene.  genetics
geog.  geography and regional development
geos.  geosciences
Ger.  German
gero.  gerontology
h.ed.  higher education
h.e.  home economics education
hist.  history
hth.  health education
honr.  honors
h.ps.c.  history and philosophy of science
h.r.p.  health-related professions
hum.  humanities
hydro.  hydrology
i.d.  interior design
ids.  interdisciplinary
i.med. internal medicine
Ital.  Italian
jour.  journalism
I.ar.  landscape architecture
L.A.S. Latin American studies
law  law
l.c.  language, reading and culture
l.s.  library science
ling.  linguistics
m.a.r.  media arts
m.a.p.  management and policy
M.A.  Mexican American studies
math.  mathematics
m.c.b.  molecular and cellular biology
med.  medicine (interdepartmental)
med.t.  medical technology
micro.  microbiology and immunology
m.i.s.  management information systems
mktg.  marketing
m.m.a.  mining engineering
m.n.  mineral economics
m.s.e.  materials science and engineering
mus.  music
music (performance studies)
ne.e.  nuclear and energy engineering
n.s.  naval science
nur.  nursing
nutr.  nutritional sciences
obi.g. obstetrics and gynecology
ophthalm.  ophthalmology
opti.  optical sciences
Ors.  Oriental studies
os.h.  occupational safety and health
path.  pathology
pharm.  pharmacology and toxicology
ped.  pediatrics
pharm.  pharmacology (College of Medicine)
phil.  philosophy
ph||pr.  pharmacy practice
ph.sc.  pharmaceutical sciences
phys.  physics
ping.  planning
pl.t.  plant pathology
pl.s.  plant sciences
pol.  political science
Port.  Portuguese
psy.  psychology
psy|l.  psychiatry
psy|c.  psychology
psy|s.  psychiatry
psy|t.  psychology
p|ty.s.  planetary sciences
R.i.s.  Romance languages
r.m.  range management
rel|t.  religious studies
r.n.r. renewable natural resources
ronc.  radiation oncology
Russ.  Russian and Slavic languages
s.a.e.  special education and rehabilitation
s.i.e.  systems and industrial engineering
soc.  sociology
sp.h.  speech and hearing sciences
Span.  Spanish
stat.  statistics
surg.  surgery
s.w.  soil and water science
t.e.t.  teaching and teacher education
tox.  toxicology
v.sc.  veterinary science
w.f.sc.  wildlife and fisheries science
w.r.a.  water resources administration
w.s.  women's studies
w.s.m.  watershed management
College of Agriculture

The College of Agriculture provides professional education for a wide range of career opportunities in agriculture, natural resources, and in family and consumer resources. The various curricula offer professional preparation for careers in agri-business, government, public service agencies, retail and service industries, human health institutions, the food service and processing industry, financial institutions, youth development agencies, conservation and environmental organizations, farming and ranching, research, extension, communications and education. A broad education in a professional knowledge area is combined with foundation courses in the natural and social sciences, communications and the humanities to develop a well-rounded academic experience.

College responsibilities include instruction, research and extension. The academic units of the college include ten departments and two schools. The departments are Agricultural Economics; Agricultural Education; Agricultural Engineering, Animal Sciences; Entomology; Nutrition and Food Science; Plant Pathology; Plant Sciences; Soil and Water Science; and Veterinary Science. The School of Renewable Natural Resources is organized into four divisions: Forest-Watershed Resources; Landscape Resources; Range Resources; and Wildlife, Fisheries and Recreation Resources. The School of Family and Consumer Resources is organized into four divisions: Child Development and Family Relations; Clothing, Textiles and Interior Design; Counseling and Guidance; and Home Economics Education/Consumer Studies. The college also participates in the management of the university departments of Biochemistry, Microbiology and Immunology, and Molecular and Cellular Biology where several college faculty hold joint appointments.

DEGREES

The college offers the Bachelor of Science in Agriculture, the Bachelor of Landscape Architecture (B.L.A.), the Bachelor of Science in Family and Consumer Resources, and the Bachelor of Science in Renewable Natural Resources. Each student is assigned a faculty adviser who provides undergraduate guidance and counseling.

The College of Agriculture offers graduate studies leading to both the Master of Science and the Doctor of Philosophy degrees with majors in a large number of disciplines. In addition, a Master of Agricultural Education, a Master of Home Economics Education, and a Master of Landscape Architecture are available.

University credit may be earned in certain graduate courses at the University of Arizona facilities away from Tucson.

UNDERGRADUATE MAJORS

Agricultural Communications  Home Economics and Journalism
Agricultural Economics  Home Economics Education
Agricultural Education  Home Economics Extension Education
Agronomy  Horticulture
Animal Health Science  Interior Design
Animal Sciences  Irrigation
Child Development & Family Relations  Landscape Architecture
Clothing and Textiles  Merchandising & Fashion Promotion
Consumer Studies & Family Resource Management  Natural Resource Recreation
Early Childhood Education  Nutritional Sciences
Entomology  Plant Pathology
Food Science  Plant Sciences
Food Service Management  Range Management
General Agriculture  Soils and Water Science
General Home Economics  Watershed Management
Wildlife and Fisheries Science
Optional minor programs of study are available to undergraduates enrolled in the College of Agriculture and the College of Arts and Sciences. The list of approved minors includes the following:

- Agricultural Economics
- Agronomy
- Consumer Studies
- Food Science
- Horticulture
- Irrigation
- Natural Recreation Resources
- Nutritional Sciences
- Plant Science
- Range Management
- Soil and Water Science
- Watershed Management
- Wildlife and Fishery Science

A minimum of 20 units of course work must be completed with a grade-point average of 2.00 or better to successfully complete the minor. A minimum of 12 units must be upper-division course work. Twelve credit hours of course work must be in residency at the University of Arizona. Consult the school and department listings in this catalog for additional information about minors.

Completion of a minor is not required for graduation in the College of Agriculture. Students interested in minors in the humanities, social and behavioral sciences or the sciences need to consult the section on minors in the College of Arts and Sciences.

GENERAL CURRICULA

All undergraduate students in the College of Agriculture will select one of the following six curricula depending on their career objectives. All undergraduate students in the School of Renewable National Resources will follow the natural resources curriculum with the exception of landscape architecture students, who will follow the requirements for the Bachelor of Landscape Architecture degree. Undergraduate students in the School of Family and Consumer Resources will follow the family and consumer resources curriculum.

I. AGRICULTURE—This curriculum offers broad preparation in the field of agriculture with the major emphasis on technical aspects of agriculture.

II. AGRICULTURAL SCIENCE—This curriculum is for students who desire more intensive education in the basic and agricultural sciences as well as those who wish to prepare for professional schools and graduate study.

III. AGRICULTURAL BUSINESS—This curriculum is for students who require a substantial knowledge of some phase of technical agriculture but wish to prepare themselves for ultimate careers in middle- or upper-level management of agricultural enterprises and related industries.

IV. FAMILY AND CONSUMER RESOURCES—This curriculum is for students interested in preparation for professional positions in one of the many and varied areas in family and consumer resources. It also provides an excellent general education for personal and family living and prepares students to be informed, effective and competent citizens. Students should consult the listing for the School of Family and Consumer Resources.

V. LANDSCAPE ARCHITECTURE—This curriculum provides students with a professional program of study in the planning, design and management of landscape resources.

VI. NATURAL RESOURCES—This curriculum is for students interested in the management and aesthetics of water, wood, range, recreation, wildlife, and fisheries. Students should consult the listing for the School of Renewable Natural Resources.
## MINIMUM REQUIREMENTS FOR UNDERGRADUATE DEGREES IN AGRICULTURE

### B.S. in Agriculture—Curriculum in:

**| Group | Ag. | Ag.Sci. | Ag.Bus.* |
---|---|---|---|
| I. GENERAL COURSES | Fr. Comp. | 6 | 6 | 6 |
| | Communications | | | |
| | a. Comm. 100, 102 | 3 | 3 | 3 |
| | b. Elec. (oral or written Engl.)** | 3 | 3 | 3 |
| | Upper-division writing-proficiency examination*** | | | |
| | (Group Total) | (12) | (12) | (12) |
| II. AGRICULTURE | A.Ec.† | 3 | 3 | 3 |
| | Major Subject | 16 | 16 | 16 |
| | Electives†† | 18 | 12 | 6 |
| | (Group Total) | (37) | (31) | (25) |
| III. BIOLOGICAL & PHYSICAL SCI. | Bio. | 4 | 4 | 4 |
| | Chem. | 8 | 16 | 4 |
| | Phys., Atmo., Geos. | 3 | 8 | 0 |
| | Math. or Stat.‡ | 3 | 9 | 9 |
| | Electives‡‡ | 10 | 13 | 3 |
| | (Group Total) | (28) | (50) | (20) |
| IV. SOCIAL SCI. & HUM.# | Econ.201a | 3 | 3 | 3 |
| | Electives | 9 | 9 | 9 |
| | (Group Total) | (12) | (12) | (12) |
| V. ELECTIVES—Electives vary. At least 9 units must be taken outside the College of Agriculture. | BUSINESS CORE | 0 | 0 | 33 |
| | TOTAL REQUIRED FOR GRADUATION | 130 | 130 | 130 |

*In the business curriculum, the student must complete M.A.P. 275 and one of the following: M.A.P. 373 or 375 or A.Ec. 439; and Math. 115 and 123 (Acc. 300a or 310 may be substituted for Math. 123). The business core includes Acc. 200, 210; Econ. 201b, 300, 330; Fin. 311 or A.Ec. 450, M.A.P. 305 or A.Ec. 215; M.A.P. 320; M.I.S. 111; Mitg. 361 or A.Ec. 213; an additional course in one of the departments listed in the business core. Students in the business curriculum have an advisor in their chosen majors as well as an advisor in the Department of Agricultural Economics. A.Ec. majors must follow the same requirements as the agri-business curriculum with the exceptions described under the department. **Elective units are to be selected from a college-approved list. **Students awarded an unsatisfactory mark must complete an additional writing course from a college-approved list. †A.Ec. course is to be selected from A.Ec. 217, 231, 242, or Econ. 201b. ††Six units of electives must be from one or more areas outside the major. ‡The math. or stat. requirements can be fulfilled by M.A.P. 275; any math. department course except 101, 105a-105b, 122, 150, 202, 402 or 405. Math. 402 and 405 may be used as Group III electives; 101, 105a-105b, 106, 116, 150, and 202 shall be listed in Group V. †††Electives in the biological and physical sciences are to be selected from the following: astr., atmo, chem., ecol., enfo., geos., hydr., math., micr., m.c.b., phys. or p.l.p. The following courses may be selected and counted as Group III electives: P.S. 100, 228, V.Sc. 250, An.S. 213, N.F.S. 406a-406b. #The required social science/humanities units are to be selected from at least two of the following: anth., art., child development and family relations, clas., comm. dram., econ., ed., Engi., ethnic studies, foreign lang., geography, hist., Hum. 250a-250b-250c, jour., mus., Ors., phil., pol., psych., reli., soc., and w.s.

### GENERAL INFORMATION

The College of Agriculture participates in several international programs. Current activities include projects in Portugal, Cape Verde, Brazil, The Gambia, Mexico, Peru, Lesotho, Mauritania, and Egypt. Interaction with Peace Corps, the Agency for International Development, and the U.S. State Department through the Office of International Programs provides unique opportunities for student and faculty evaluation of world resource problems.

The college includes the following resource facilities: Agricultural Communications, Agricultural Statistics, Remote Sensing, Council for Environmental Studies, and the Office of Arid Lands Studies.
Fellowships, Scholarships, and Awards—The college awards numerous scholarships and fellowships to undergraduate and graduate students enrolled in programs of study in agriculture, natural resources, and family and consumer resources.

Outstanding Senior Awards—Each year the faculty selects an outstanding senior in each department and school.

Dean's Honor List—This honor is reserved for students who carry no fewer than 12 units of work in a semester and attain a grade-point average of 3.5000 or better.

Scholastic Societies—The college recognizes the scholarship societies of Alpha Tau Alpha, Alpha Zeta, Gamma Sigma Delta, and Omicron Nu.

Honor Program—The college participates in the University-wide Honors Program.

Internship—The College of Agriculture provides internship opportunities to qualified students who wish to receive training and practice in actual service with technical, business, or government establishments.

Peace Corps—The Peace Corps office at the University of Arizona is a function of the Office of International Agriculture Programs in the College of Agriculture. The Peace Corps Office provides international volunteer placement counseling and processes Peace Corps and United Nations Volunteer Program applications from university students and staff.

Cooperative Education—The college participates in the University Cooperative Education Program.

SCHOOL OF FAMILY AND CONSUMER RESOURCES

The School of Family and Consumer Resources is concerned with personal and group values that are desirable outcomes of successful family life through the use of personal, family and social resources for the attainment of these values. It deals with social, economic, aesthetic, technological, managerial, health, and ethical aspects of family relations, child development, clothing, housing, and interior design.

The undergraduate program has as its major objectives: (1) general education for personal and family living, (2) specialization in various aspects of family and consumer resources in preparation for professional positions, and (3) courses to enrich the professional preparation of students in other colleges.

The school is organized into four divisions: Child Development and Family Relations; Clothing, Textiles, and Interior Design; Counseling and Guidance; and Home Economics Education/Consumer Studies.

The school offers the degree of Bachelor of Science in Family and Consumer Resources with majors in child development and family relations (emphasizing child studies, family studies, or a combination of the two); early childhood education; clothing and textiles; interior design (design track or merchandising track); merchandising and fashion promotion; home economics education; home economics extension education; consumer studies and family resource management; general home economics; and home economics and journalism.

Students enrolled in majors in the School of Family and Consumer Resources may elect to choose a minor subject area with the approval of the student's advisor. An extension/nonformal education option to supplement the student's major is also available to all students in the School of Family and Consumer Resources. Students taking this option must take A.Ed./H.E.E. 220; H.E.E. 428; H.E.E./A.Ed. 448; F.C.R. 493; and F.C.R. 496; plus two elective courses from the approved list available from the student's advisor.

Requirements for the various curricula appear within the division offering the major (see Departments and Courses of Instruction section of this catalog). The course requirements listed with each curriculum are patterned from the outline below for the Bachelor of Science in Family and Consumer Resources degree.

GENERAL REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN FAMILY AND CONSUMER RESOURCES*
III. HUMANITIES
IV. COMMUNICATIONS

Upper-division Writing Proficiency Test**

V. BEHAVIORAL AND SOCIAL SCIENCE
VI. BIOLOGICAL AND PHYSICAL SCIENCE
VII. ADDITIONAL UNITS IN ONE GROUP FROM III, IV, V, OR VI

TOTAL UNITS REQUIRED FOR GRADUATION

*Students must select courses for the general requirements from an approved list available from the School of Family and Consumer Resources or from the student's advisor.

**Students awarded an unsatisfactory mark must complete an additional writing course from a college-approved list.

HONOR IN SCHOLARSHIP AND PARTICIPATION—Each year the faculty of the school chooses the outstanding senior family and consumer resources student. The name of the student so honored is engraved on the permanent Family and Consumer Resources Plaque.

HONORS PROGRAM—The School of Family and Consumer Resources participates in the University-wide Honors Program.

Family and Consumer Resources Organizations

UNIVERSITY OF ARIZONA STUDENT SECTION OF THE AMERICAN HOME ECONOMICS ASSOCIATION is open to all family and consumer resources students. It is the organization for college-age individuals affiliated with their professional organization.

THE UNIVERSITY OF ARIZONA STUDENT CHAPTER OF THE AMERICAN SOCIETY OF INTERIOR DESIGNERS—Any interior design major, with a 3.0000 or better grade average, may be a member of the society upon acceptance by the national organization.

THE FASHION DIMENSIONS CLUB is open to anyone interested in fashion and merchandising.

OMICRON NU is the national honor society for home economics. Membership is open to juniors and seniors with a 3.0 gpa or better. Membership is open to graduate students with a 3.5 gpa or better who have completed at least half of their graduate program.

OFFICE OF STUDENT COUNSELING, ADVISING AND RECRUITING (OSCAR) is the peer advising group in the School of Family and Consumer Resources. Students discuss University of Arizona policies and degree requirements, explore majors and clubs in the School of Family and Consumer Resources, discover career options and locate campus activities.

SCHOOL OF RENEWABLE NATURAL RESOURCES

The principal goals of the school are (1) to provide students with educational opportunities that will enable them to assume positions of responsibility and leadership in management, planning, design and study of renewable natural resources; and (2) to provide a foundation of basic general education that will enable graduates, regardless of their professional pursuits, to function as responsible citizens in their communities.

The school is organized into four divisions: Forest-Watershed Resources; Landscape Resources; Range Resources; and Wildlife, Fisheries and Recreation Resources.

The school offers the degrees of Bachelor of Science in Renewable Natural Resources with majors in watershed management, range management, natural resource recreation, and wildlife and fisheries science and the Bachelor of Landscape Architecture with a major in landscape architecture. Minors are available in watershed management, range management, natural resources recreation, and wildlife and fisheries science.

Specific requirements for the various curricula appear with the majors listed under Renewable Natural Resources (see Departments and Courses of Instruction section).
# Minimum Unit Requirements for Undergraduate Degrees in Renewable Natural Resources and Landscape Architecture

<table>
<thead>
<tr>
<th>Group</th>
<th>B.S. in R.N.R.</th>
<th>B.L.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. GENERAL COURSES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman Comp.</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Comm. 100, 102</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Comm. Elec. (oral or writ. Engl.)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 201a</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Upper-division writing-proficiency examination*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. MAJOR AND COLLEGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Subject</td>
<td>16</td>
<td>47</td>
</tr>
<tr>
<td>S.W. 200, 201</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Electives**</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>III. BIOL. &amp; PHYS. SCI.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecol., M.C.B.</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Chem.</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Math. or Stat.***</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Phys., Atmo., Geos. (incl. Phys. 102a)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Electives†</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>IV. SOCIAL SCI. &amp; HUM.#</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>V. ELECTIVES—At least 9 units must be taken outside the College of Agriculture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL REQUIRED FOR GRADUATION</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

*Students awarded an unsatisfactory mark must complete an additional writing course from a college-approved list.

**Must be from any division in R.N.R. or F.C.R. or from any department in the College of Agriculture.

***The math. or stat. requirements can be fulfilled by M.A.P. 275; any math. department course except 101, 105a-105b, 116, 122, 150, 202, 402, or 405. Math 402 and 405 may be used as Group II electives; 101, 105a-105b, 116 and 150 may be listed in Group V.

†Electives in the biological and physical sciences are to be selected from the following: astr., chem., c.sc., ecol., ento., geos., hydr., math., micr., m.c.b., phys., p.l.p., or s.i.e. The following courses may be selected and counted as Group III electives: P.L.S. 100, 228, V.Sc. 250, An.S. 213, N.F.S. 406a-406b.

#The required social science/humanities units are to be selected from at least two of the following: anth., art, c.d.tr., clas., dram., econ., educ., Engl., ethnic studies, foreign lang., geog., hist., Hum. 250a-250b-250c, jour., ling., m.a.p., mus., Or.s., p.l.n., phil., pol., psyc., reli., soc., and w.s.

## Honors Information

The school encourages outstanding students to participate in the University-wide Honors Program.

## Professional Student Organizations

Students in the school are encouraged to actively participate in their respective student chapters of national organizations and to attend and participate in national and local meetings of the professional societies whenever possible.

Active student chapters of the Society of American Foresters, the Society for Range Management, the Wildlife Society, the American Fisheries Society, and the American Society of Landscape Architects are available to students in the school.
College of Architecture

Architecture is the art and science of building. As a meeting place of the arts and sciences, it is innately interdisciplinary and has continuing vitality as a field of study or a life career. Students of architecture investigate both the broad relationships between human and natural forces and the relationships between materials and technologies required to realize architecture as built form. The college program is organized with the design studio as the element of focus.

Today, the architect may be involved with the design of a new community, a complex of buildings, an individual structure, or the smallest details of interior space. Architects may also be involved in programming and pre-design activities, site analysis, financial feasibility, user need analysis, management, administration, and related issues. The College of Architecture prepares students to participate in this broad spectrum of challenges in the shaping of our built environment to facilitate the needs of its inhabitants.

DEGREES

The College of Architecture offers a five-year program leading to the professional degree Bachelor of Architecture. The program is divided into four areas of emphasis: design, technology, practice and management, and history and theory. The first year is preprofessional. The professional years are composed of two parts: a three year core (consisting of the second, third, and fourth years), and the fifth year, which includes optional areas of study derived from the emphases listed above. Options include building design, community design, computer aided design, design development, economics and politics in architecture, historic preservation, housing design, building technologies, energy-conscious design, and design in arid regions. Offerings are limited by faculty availability and vary each year.

The college also offers a program of study leading to the degree of Master of Architecture. Two years of full-time study are normally recommended; however, students with a five-year Bachelor of Architecture degree from an accredited school of architecture may be able to complete the degree in less time. See the Graduate Catalog for additional information.

REQUIREMENTS

Admissions

PREPROFESSIONAL YEAR (FIRST YEAR)—See "Admission to Particular Colleges and Schools" in the Admission to the University section of this catalog. The nature of architectural education necessitates the extension of the general requirements for admission to the University. Admission to full standing in the College of Architecture requires all entering first-year students to present 16 units of acceptable high school credit as follows:

<table>
<thead>
<tr>
<th>Subject</th>
<th>High School Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>4</td>
</tr>
<tr>
<td>Elementary Algebra</td>
<td>1</td>
</tr>
<tr>
<td>Plane Geometry</td>
<td>1</td>
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<tr>
<td>Intermediate Algebra</td>
<td>1</td>
</tr>
<tr>
<td>American History and Social Studies</td>
<td>2</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>1</td>
</tr>
<tr>
<td>Physics (with Lab)</td>
<td>1</td>
</tr>
<tr>
<td>Other Laboratory Science</td>
<td>1</td>
</tr>
<tr>
<td>Electives</td>
<td>4</td>
</tr>
</tbody>
</table>

Students deficient in one or more of the high school courses listed above will be permitted to enter the College of Architecture. Applicants with deficiency in physics should take Phys. 102a or 106. Applicants with a deficiency in intermediate algebra should take Math. 116. All entrance deficiencies must be removed prior to admission to the professional phase of the program.

Applicants are advised to include among their electives additional courses in mathematics, such as trigonometry and advanced algebra. Applicants entering with an ACT score of 28
or SAT of 570 or higher in mathematics will not be required to take additional mathematics in the College of Architecture and may use the required mathematics units for additional open elective opportunities.

Students who have made a decision to pursue professional education in architecture are strongly advised to seek admission to the College of Architecture at their first opportunity in order to minimize the time required to complete the professional degree.

Students in the preprofessional year may not enroll in required professional phase courses except upon petition to the Student Affairs Committee. Preprofessional students may, however, enroll in architecture elective courses.

PROFESSIONAL PHASE (SECOND-FIFTH YEARS)—Admission to the professional phase is selective and competitive. To be considered for professional phase admission students must have completed all preprofessional courses, except electives, have earned a grade-point average of 2.00 or better (both cumulative and architecture), and have removed any high school deficiencies.

Completion of preprofessional courses with a 2.00 average does not assure a student of admission to the professional phase. The number of applicants admitted to the professional phase is limited by the resources of the college and a grade-point average considerably above 2.00 is normally required.

Selections for professional phase admission are made only once per year in early summer for the fall term. College resources do not allow midyear admission into the professional phase.

Minimum course requirements in the professional phase include the following areas:

Architectural design and graphic communication—201, 202, 301, 302, 401, 402, 451, 452, (6 units each), 222a-222b (3 units each)—54 units.

Architectural practice and management—270, 429, 439, 459 (3 units each)—12 units.

Architectural technology—228a-228b, 235, 236, 335, 336, 338a-338b (3 units each)—24 units.

Architectural history and theory—324a-324b, 424a-424b (3 units each); 444, 484 (2 units each)—16 units.

General education elective requirements—fine arts (3), social sciences and humanities (6), science and technology (6), business, management and government (6), architecture (6), open (9)—36 units.

TRANSFER STUDENTS—Applicants who are applying for transfer from other colleges or universities must present the same high school units as required for admission to the preprofessional year and also must meet the general university and college admission requirements as stated in this catalog. Except in cases of demonstrated merit, transfer credit for required College of Architecture courses will be allowed only for work taken in an architectural program that is accredited by the National Architectural Accrediting Board. Transfer students must also meet the requirements as noted for admission to the professional phase of the program.

Transfer applicants applying for advanced standing should forward a portfolio of their work to the College of Architecture at the time their application for admission is sent to the Admissions Office. The portfolio should include unofficial copies of all transcripts.

Students transferring from community colleges, other disciplines, or programs not accredited by NAAB will normally be required to spend a minimum of one semester in the preprofessional year and should consider enrolling at mid year, in January, if they wish to be considered for admission to the professional phase for the following August. Prospective transfer students should correspond directly with the college for advice regarding their status. Selections for professional phase admission are made only once per year in summer for the fall term. College resources do not allow midyear admission into the first semester of the professional phase.

APPLICATION DEADLINES—Students should apply by April 1 to the Office of Admissions. Students seeking advanced placement or admission to the professional phase should also correspond directly with the college for additional deadlines, information and applications.

GRADUATE STANDING—Prospective graduate students must apply directly to the Graduate College. For graduate standing admission requirements refer to the Graduate College.
Advancement

For advancement in any particular course sequence in the professional phase, individual course prerequisites must have been satisfied, and a cumulative grade-point average of 2.000 or better must have been maintained for the preceding academic year. For advancement to the final year, the student must have completed all requirements in the lower years.

REQUIRED CURRICULUM
PREPROFESSIONAL PHASE
(Recommended Sequence)

<table>
<thead>
<tr>
<th>Subject</th>
<th>First Semester</th>
<th>Units</th>
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<tbody>
<tr>
<td>Engl. 101 or 103H</td>
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<tr>
<td>Hist. 101 or 103</td>
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<td>Math. 117e</td>
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<td>Math. 118</td>
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<td>Arch. 114</td>
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REQUIRED CURRICULUM
PROFESSIONAL PHASE
(Recommended Sequence)

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<td>Arch. 228a*</td>
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<td>Arch. 235*</td>
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<td>Arch. 228b*</td>
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</tr>
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<td>Arch. 236*</td>
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<td>Arch. 336*</td>
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<td>Arch. 338a</td>
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</tr>
<tr>
<td>Arch. 335*</td>
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<td></td>
</tr>
<tr>
<td>Arch. 338b</td>
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<td></td>
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FOURTH YEAR

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<td>Arch. 424a*</td>
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</tr>
<tr>
<td>Arch. 439</td>
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</thead>
<tbody>
<tr>
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<tr>
<td>Arch. 424b*</td>
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<td></td>
</tr>
<tr>
<td>Arch. 429</td>
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</tr>
<tr>
<td>Arch. 444</td>
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FIFTH YEAR

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<th>Second Semester</th>
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<td>Arch. 452</td>
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<td>6</td>
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<tr>
<td>Arch. 459</td>
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<tr>
<td>Arch. 484</td>
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<td>Elective††</td>
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<tr>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>14</strong></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

*Course may be taken in another year but must be completed prior to entrance into the fifth year.
**Physics taken to fulfill a high school deficiency may not be used as elective credit. Students without high school or college physics must complete physics in the first year and should take Math. 117e and 118 first semester.
†Arch. 112 and 118 may be taken either semester.
††Arch. 120 must be taken in lieu of one elective prior to the fourth year. Electives are to be selected from five general areas of knowledge. Consult elective group list available in the College of Architecture.

RESOURCES AND ACTIVITIES

FACILITIES—The activities of the college are housed in the Architecture Building, which was constructed in 1966 and expanded in 1970 and 1978. It is a three-story facility that houses the majority of the design studios, classrooms and seminar rooms, a large and completely equipped audio-visual lecture hall, model shop, photographic darkroom, faculty offices, exhibition areas, archives and the college library. The library has an extensive collection of books and periodicals about architecture and related environmental design fields. An important and active part of this resource is the 35mm slide collection covering the historical and contemporary architecture of the world.

ACCREDITATION AND AFFILIATIONS—The program is fully accredited by the National Architectural Accrediting Board. The degree of Bachelor of Architecture is recognized and accepted by licensing agencies as the first professional degree leading to architectural licensing as recommended by the National Council of Architectural Registration Boards. The College of Architecture is affiliated with the Association of Collegiate Schools of Architecture and recognizes a student chapter of the American Institute of Architects. There is a regular liaison with the Southern Arizona Chapter of the American Institute of Architects and the Arizona Society of Architects, both of which lend support to the college.

PLACEMENT SERVICES—Fifth-year students and former students are eligible to register with the University Placement Service, which is in communication with organizations seeking graduates. College of Architecture graduating students are urged to register with the Placement Service no later than the beginning of their last semester of studies to avail themselves of the benefit of this service. Further information may be obtained by contacting the Director of the Placement Service or visiting the office on campus.

SCHOLARSHIPS AND FINANCIAL AIDS—All architecture majors are eligible to apply for university scholarships and aid. In addition, for students in the professional phase of the program there are special College of Architecture scholarships, as well as a short-term loan fund. For further information, refer to the section on Scholarships and Financial Aids.

AWARDS AND HONORS—Outstanding student accomplishments are recognized each year through the presentation of a number of awards, including the Outstanding Graduating Senior Award, the National School Medal of the American Institute of Architects, the Henry Adams Fund Award, the National School Medal of Alpha Rho Chi and Faculty Commendation Awards. The Dean's List citation goes to all students who attain a grade average of 3.500 or better for a semester while carrying no fewer than 15 units of work. For further information on Dean's List citations, see "Honors, Awards and Prizes" in Provisions for Superior Students section of this catalog.

STUDENT GUIDANCE—Each entering student is assigned a faculty advisor who is available for guidance and counseling throughout the academic year. The faculty advisers maintain regular office hours and students are encouraged to review their progress and problems with their advisors.
College of Arts and Sciences

The College of Arts and Sciences is the most comprehensive academic unit in the University of Arizona. Study in the college is designed to assist students within the arts and sciences—and throughout the University—in developing critical and open minds by providing an intellectual foundation in several areas of knowledge. An administrative, curricular and degree structure has been developed to support students' educational objectives, which may range from broad general education to highly specialized professional programs.

The College of Arts and Sciences is organized into four faculties—the Faculty of Fine Arts, the Faculty of Humanities, the Faculty of Science, and the Faculty of Social and Behavioral Sciences. Each faculty is composed of departments, schools, and committees offering programs at the undergraduate and graduate levels. The college is administered through a dean of each faculty.

ACADEMIC DIVISIONS AND DEGREE PROGRAMS

Faculty of Fine Arts

Departments: Art, Drama, Media Arts
School: School of Music
Committee: Committee on Dance

Degrees and Majors:
Bachelor of Fine Arts
Art Education
Dance
Drama Education
Drama Production
Drama - Musical Theatre
General Fine Arts Studies
Studio Art
Bachelor of Music
Jazz Studies
Music Education
Performance
Theory and Composition
Bachelor of Arts in Art
Art History
Bachelor of Arts in Drama
Dramatic Theory
Bachelor of Arts in Music
Music
Media Arts
Bachelor of Arts in Media Arts
Media Arts

Faculty of Humanities

Departments: Classics, English, French and Italian, German, Russian and Slavic Languages, Spanish and Portuguese

Committee: Religious Studies, Russian and Soviet Studies
70 COLLEGES AND GENERAL DIVISIONS

Degrees and Majors:

Bachelor of Arts

Classics
Creative Writing*
English
French
General Studies***
Greek**
Italian
Latin**
Portuguese
Religious Studies**
Russian
Russian and Soviet Studies
Spanish

* Listed under English
** Listed under Classics
*** Interdisciplinary; contact Office of Academic Services, Modern Languages 347.

Faculty of Science

Departments:

Astronomy, Atmospheric Sciences, Biochemistry, Chemistry, Computer Science, Ecology and Evolutionary Biology, Geosciences, Mathematics, Microbiology and Immunology, Molecular and Cellular Biology, Physics, Planetary Sciences, Speech and Hearing Sciences, Statistics

Institutes:

Lunar and Planetary Laboratory, Steward Observatory

Degrees and Majors:

Bachelor of Arts

Astronomy
Biochemistry
Chemistry
General Studies***
Geosciences
Mathematics

Bachelor of Science

Astronomy
Atmospheric Sciences
Biochemistry
Cellular and Developmental Biology
Chemistry
Ecology and Evolutionary Biology
General Biology
Geosciences
Mathematics
Microbiology
Physics

Bachelor of Science in Speech and Hearing Sciences
Speech and Hearing Sciences

*** Interdisciplinary; contact Office of Academic Services, Modern Languages 347.

Faculty of Social and Behavioral Sciences

Departments:

Anthropology, Communication, Geography and Regional Development, History, Journalism, Linguistics, Oriental Studies, Philosophy, Political Science, Psychology, Sociology

School: Graduate Library School

Committees:

American Indian Studies*, Black Studies*, Cognitive Science, Latin American Studies, Mexican American Research Center, Women's Studies

Institutes:

Bureau of Applied Research in Anthropology, Southwest Institute for Research on Women, Center for Southwest Studies
Degrees and Majors:

Bachelor of Arts
- Anthropology
- Communication
- Economics**
- General Studies***
- Geography
- History
- Journalism
- Latin American Studies
- Linguistics
- Mexican American Studies
- Oriental Studies
- Philosophy
- Political Science
- Psychology
- Sociology
- Women's Studies

Bachelor of Science
- Psychology

*A minor is available.

**A College of Business and Public Administration department.

***Interdisciplinary; contact Office of Academic Services, Modern Languages 347.

ADMISSIONS

Entering freshmen must meet college and university entrance requirements as described in Admission to the University section of this catalog. Special entrance requirements, if any, for a department major are listed in the departmental section. All entrance deficiencies must be removed prior to the sophomore year, or registration for the following semester will be cancelled by the University.

Transfer students are responsible for securing an evaluation of transfer course work. The Admissions Office (Admin. 322) will review officially the transcripts to determine course transfer credits and equivalencies. The entering transfer student who has not received an official evaluation may review the transcript for General Education Program course equivalencies with an academic advisor in Music 111 for Fine Arts students, and in the Office of Academic Services, 347 Modern Languages Building, for other students in the college. The evaluation of transfer course work in the major and minor disciplines is done by the major advisor.

ARIZONA COMMUNITY COLLEGES AND THE COLLEGE OF ARTS AND SCIENCES

The College of Arts and Sciences has a cooperative outreach program with Arizona community colleges to provide academic and student services information. In this program, a college academic advisor visits the community college campus to assist students interested in the degree programs of the college, and to provide program information to the community college counselor. The counselor provides the perspective of the two-year study plan, and the college advisor correlates the Associate of Arts or the Associate of Science curriculum with the requirements and structure of the Bachelor of Arts or Bachelor of Science. Students are able to select and to initiate studies that support college general education requirements and departmental major and minor areas of study. Emphasis is placed by both advisors on the evaluation of basic academic skills, in strengthening background in English composition, mathematics, reading and study skills, and in personal assessments or career exploration. Ultimately, transfer to the college is facilitated greatly because of the previously planned and partially completed degree program and the early receipt of information about University of Arizona student services such as financial aids and scholarships, admissions, and housing. Students wishing to participate in this outreach program should contact their community college counselor for information.
ACADEMIC ADVISING

The faculty and advisors of the college are committed to the supportive advising of students. Through its advising system, the college offers the individual student assistance in planning an academic program that meets general education requirements, the major requirements (see specific departmental requirements listed in the departments section of this catalog), and the 20-unit minor for the Bachelor of Arts and Bachelor of Science degrees.

Upon selecting a major area of study, a student is assigned a faculty advisor in the department of the major. In addition to helping students plan a program of study, the major advisor provides information regarding academic procedures, career and graduate education opportunities, and student support resources.

Although there is considerable flexibility in scheduling a program of study, a few majors require defined sequences of courses extending over seven or eight semesters. Students should meet with a departmental advisor when selecting a major in order to obtain departmental information regarding the program and to develop a sequential study plan.

All students entering the Faculty of Fine Arts declare a major and are assigned a major advisor in the selected department. Advising for the general fine arts students is provided in the Office of the Dean, Faculty of Fine Arts, Music Building, Room 111.

Within the Faculties of Humanities, Science, and Social and Behavioral Sciences, there is a dual advising system: the major department within the faculty, and in the Office of Academic Services, Modern Languages Building, Room 347. In this latter office, advisors are available throughout the year for general consultation, to assist the exploratory (undeclared) student, and to advise the general studies major.

IT IS ALWAYS THE STUDENT'S RESPONSIBILITY TO KNOW AND TO MEET DEGREE REQUIREMENTS.

HONORS AND SCHOLARSHIPS

To be eligible for one of the following honors, the student's grade-point average must be based on letter grade and credit, with all pass/fail and "S" grades excluded. All "I"s must have been made up before an honor is bestowed. Each type of honor is noted on the official transcript.

Academic Year Honors

Highest Academic Distinction requires a 4.000 GPA for a minimum of 30 units completed during the two semesters of the regular academic year.

Academic Distinction requires between a 3.500 and a 3.999 GPA for a minimum of 30 units completed during the two semesters of the regular academic year.

Semester Honors

Dean's List with Distinction requires a 4.000 GPA for a minimum of 15 units completed during the previous semester.

Dean's List requires between a 3.500 and a 3.999 GPA for a minimum of 15 units completed during the previous semester.

Honorable Mention requires a 3.500 GPA or above for 12 through 14 units completed during the previous semester.

The names of the recipients of each type of honor are posted by the dean's offices, and special memorabilia are presented at Honors Convocations.

SCHOLARSHIPS—Numerous scholarships and awards are made each year by the departments and college to academically qualified students. Further, the Office of Student Financial Aid has a comprehensive program of scholarships and financial aid.
HONORS PROGRAM—The faculties and departments of the college participate in and strongly support the University Honors Program. To encourage and recognize academic work of great depth and originality by undergraduates, virtually every department in the College of Arts and Sciences supplements its regular degree program with honors courses. Honors courses are specially designated by a department and carry an “H” after the course number.

HONOR SOCIETIES, PROFESSIONAL AND HONORARY ASSOCIATIONS:

Faculty of Fine Arts
American Guild of Organists—Student Chapter
American Musicological Society—Student Chapter
Dancer's Consortium
International Society for Music Education—Student Chapter
Kappa Kappa Psi—Band Fraternity for Men
Music Educators National Conference—Student Chapter
Music Teachers National Association—Student Chapter
National Student Speech-Language-Hearing Association
Phi Mu Alpha Sinfonia Fraternity of America—Men's National Professional Music Society
Pi Kappa Delta—National Speech Honorary
Sigma Alpha Iota—Women's National Music Honorary
Tau Beta Sigma—Band Fraternity for Women
Theta Alpha Phi—Honorary Fraternity for Theatre Arts

Faculty of Humanities
Delta Phi Alpha National Honorary—German
Dobro Slovo—Russian and Slavic Languages
Phi Beta Kappa—National Honor Society
Sigma Delta Pi—Spanish and Portuguese

Faculty of Science
Alpha Phi Sigma—Chemistry
American Geophysical Union—Atmospheric Sciences
American Meteorological Society—Atmospheric Sciences
Phi Beta Kappa—National Honor Society
Pi Mu Epsilon—Mathematics
Sigma Gamma Epsilon—Geosciences
Sigma Xi—Atmospheric Sciences
Society of Earth Science Students—Geosciences
Society of Physics Students—Physics
Society of Women Engineers Student Chapter—Statistics

Faculty of Social and Behavioral Sciences
Alpha Kappa Delta (Alpha Chapter)—Sociology
Gamma Theta Upsilon—Geography and Regional Development
Kappa Tau Alpha—Journalism
Latin American Studies Association—Latin American Area Center
Phi Alpha Theta—History
Phi Beta Kappa—National Honor Society
Phi Sigma Alpha—Political Science
Psi Chi National Honorary—Psychology
Society of Professional Journalists—Student Chapter

GENERAL EDUCATION PROGRAM

Although the general education courses are degree-specific by faculty, the requirements share the common aim of extending the boundaries of a student's education to embrace exploration and learning in other disciplines. To be able to listen and read critically; to think, speak and write clearly; to appreciate the application of the sciences and social sciences and the power of the humanities and the arts; to understand the definitions and processes of various fields of knowledge—these are the goals of this part of an Arts and Sciences education.

The requirements of the General Education Program are specific to the student's degree program and are listed on subsequent pages according to faculty by degree.
Bachelor of Arts and Bachelor of Science

The Bachelor of Arts and the Bachelor of Science degrees are offered in all four faculties of the college, and have in common the following General Education Program.

This program is designed to offer students the opportunity: to learn how different disciplines define, acquire, and organize knowledge; to enhance their understanding of the reciprocal influences of western and non-western cultures; to examine values; to develop analytic, synthetic, linguistic, and computational skills useful for lifelong learning; to develop a common foundation for wide-ranging dialogue with peers; and to acquire a critical and inquiring attitude, an appreciation of complexity and ambiguity, a tolerance for and empathy with persons of different backgrounds or values, and a deepened sense of one's self.

The following requirements within the skills and proficiencies portion of the program are given in their entirety. The study areas, including specific courses, will be found in BookLink, a booklet which is published each semester prior to registration. BookLink discusses each study area, describes the courses, identifies the instructor, and notes basic course objectives so that students and advisors can make informed decisions. Copies of BookLink are available in each department, in the Office of Academic Services (347 Modern Languages Building) and in the office of the Dean of the Faculty of Fine Arts (Music Building 111) prior to each registration period. Check each semester for the latest edition of BookLink in order to have the most current listing of available courses.

I. BASIC SKILLS AND PROFICIENCIES

Each student must take and abide by the results of any placement/proficiency examinations, auditions, or portfolio reviews required by the appropriate department prior to enrollment in the following courses. In addition, it is possible to satisfy the freshman composition, mathematics, and foreign language requirements by any examinations authorized by the departments responsible for these courses.

A. FRESHMAN COMPOSITION (6-9 units)

All freshmen must enroll in one of the following three sequences:

1. Engl. 100 (exposition, review of syntax and usage), 101 (exposition, emphasis on essays), and 102 (critical papers on selected subjects);
2. Engl. 101 and 102;
3. Engl. 103H and 104H (Honors).

Placement is based on scores resulting from the UA Freshman Composition Placement Exam, and the English section of the American College Test or the Test of Standard Written English portion of the Scholastic Aptitude Test.

B. MATHEMATICS (3 units)

College Algebra (Math. 117e), or any 3-unit mathematics course numbered above 117e is required. There is a mandatory placement examination.

It should be noted that many departments require specific mathematics courses in support of their majors.

C. FOREIGN LANGUAGE (0-16 units)

This requirement may be met by demonstrating proficiency in a single foreign language at the fourth semester level, in one of the following ways. Most departments have placement examinations.

1. Successful completion of a fourth semester course taught in the foreign language;
2. Successful completion of the second semester of an intensive foreign language course;
3. Through an examination administered by the appropriate UA language unit;
4. For students whose native language is other than English, either
   a. by successful completion of an intermediate level course in a foreign language; or
   b. by successful completion of Engl. 101 and 102, or Engl. 107 and 108.
Transfer credit is allowed only for courses taken at the college level (as defined by the specific department). College of Arts and Sciences departments may require or recommend specific languages in support of their major or preferred minor.

II. STUDY AREAS

The study areas’ courses encourage the investigation of relations among and between disciplines. In seeking to identify similarities and differences in subject matter, methods, aims, and results of the various approaches to knowledge, the student will explore the extent to which different modes and forms of knowledge can be integrated, and the ways in which they resist integration. All students should also be able to understand better the segregative boundaries which exist in human society, particularly those which have been maintained arbitrarily on the basis of gender, class, race, or ethnic identity. Finally, courses listed among the study areas are designed to introduce and epitomize their respective disciplines, so as to enable the student to make informed decisions about majors and careers. In consultation with an academic advisor, a student may elect to waive a total of 3 units in one of the following groups: A. Western Civilization; C. Individuals, societies, and institutions, except the gender, class, race or ethnicity course; or D. Non-western Civilization.

These requirements may be fulfilled during any semester of the undergraduate years. However, at least one course in each study area should be completed before the beginning of the fifth semester. Transfer credit may be allowed for courses in which equivalency has been established.

A. WESTERN CIVILIZATION (9 units)

Fundamental to the aims of this study area is the awareness that we are historical beings, shaped by the experience and acts of our predecessors, and that in turn we shape the lives of those who follow us. These courses examine western civilization as a collective heritage of ideas, values, and literary and artistic expressions, but also as a continuous process that adapts that heritage to social, political, scientific, and economic changes and experiences.

Students are required to choose one three-semester approved course sequence in western civilization.

B. BIOLOGICAL AND PHYSICAL SCIENCES (8 units)

These courses introduce students to the language and practice of science in various fields, to the methods used to pose and test hypotheses, and to the logic involved in developing theories.

This requirement is to be satisfied by two approved courses, four units each, which include laboratory work. Each student is strongly encouraged to take either one two-semester sequence in the biological sciences (which include biochemistry, ecology and evolutionary biology, microbiology and immunology, molecular and cellular biology) or one two-semester sequence in the physical sciences (which include astronomy, atmospheric sciences, chemistry, Geog. 103a-103b and 104a-104b, geosciences, Hydr. 101a-101b, physics, planetary sciences).

C. INDIVIDUALS, SOCIETIES, AND INSTITUTIONS (9 units)

Courses in this area afford the opportunity to examine systematically individual and collective behavior, and to explore the basic concepts and theories used in analyses of personal, social, cultural, political, economic, philosophical, religious and scientific issues. As a result, there is a clearer understanding of issues of self-identity, social difference and social status, the role of science in society, and the effects of major institutions on individual experiences. This requirement is to be met by taking three 3-unit approved courses, offered in at least two different departments. In addition, one of the courses offered in fulfillment of this requirement must focus systematically on gender, class, race, or ethnicity, even if 3-units are waived from this study area.

D. NON-WESTERN CIVILIZATION (3 units)

Non-western civilizations include those within the pre-Columbian New World, Africa, Asia, and the Middle East. The courses introduce the values, traditions, and development of one or more of these cultures and civilizations. Studied in conjunction with the western civilization study area, courses in this group provide a greater understanding of the reciprocal influences of western and non-western civilizations.
E. THE ARTS AND LITERATURE (3-3 units)

The purpose of this study area is to provide opportunities to explore the processes by which visual, performing, and literary artists produce their works, and to evaluate the significance of those works in larger cultural contexts.

One approved 3-unit course in the arts and one approved 3-unit course in literature are required.

This General Education Program is governed by the General Education Committee of the College of Arts and Sciences, which decides which courses will be included and retained within it. The committee is composed of faculty members and students. It is the student's responsibility to have a clear understanding of the course work options within each study area. Credit in the general education study areas will be awarded only for the committee approved courses.

Transfer students should consult with an academic advisor in the deans' office for the application of completed courses in both basic skills and proficiencies, and study areas after the Transfer Evaluation Office has reviewed their transcripts for credit and equivalencies.

Earning an Associate of Arts, Associate of Science, or Associate of General Studies degree does not insure that the general education requirements have been met.

SUMMARY OF B.A./B.S. GENERAL EDUCATION REQUIREMENTS

I. BASIC SKILLS AND PROFICIENCIES
A. Freshman Composition 6-9 units
B. Mathematics 3 units
C. Foreign Language 0-16 units
TOTAL *9-28 units

*Less Advanced Placement or College Level Examination Program credit, if any.

II. STUDY AREAS
A. Western Civilization 9 units
B. Biological & Physical Sciences 8 units
C. Individuals, Societies & Institutions 9 units
D. Non-Western Civilization 3 units
E. The Arts & Literature 6 units

Less optional waiver 3 units
TOTAL 32 units

Bachelor of Science in Speech and Hearing Science

The Bachelor of Science in Speech and Hearing Sciences with major in speech and hearing science is offered through the Faculty of Science and has the following general education requirements.

I. BASIC SKILLS AND PROFICIENCIES
A. Freshman Composition (6-9 units)
B. Mathematics (5-6 units)
  Math. 117e or above plus one chosen from Math. 118, 119, 125 160 or equivalent
C. Foreign Language (0-16 units)
  Total 11-31 units

II. STUDY AREAS
A. Western Civilization (9 units)
B. Biological and Physical Sciences (16 units)
  Sixteen hours of general lab sciences to include human anatomy and physiology*
C. Individuals, Societies and Institutions (9 units)
D. Non-Western Civilization (3 units)
E. Arts and Literature
   One course in arts (3 units)
   One course in literature (3 units)
   Total 43 units

   Less optional waiver -3 units
   Total 40 units

*Students enrolled in the American Indian Professional Training Program should check with their advisors.

Bachelor of Fine Arts and Bachelor of Music

General education requirements vary among the several degree programs of the Faculty of Fine Arts. Bachelor of Arts programs require the general education course work described earlier in this catalog. Students enrolled in a Bachelor of Fine Arts or a Bachelor of Music degree program must satisfy the general education requirements shown below. Students should consult with departmental advisors for additional information.

Individual studies, special topics, experimental courses, and courses crosslisted from other home departments will be accepted in general education only if approval is granted by the dean prior to enrollment.

In extenuating circumstances, when students feel they need to include a course other than those listed, they should consult their departmental advisor and then submit a College Recommendation Form (obtainable in the dean's office) to the dean prior to enrollment in the course.

Students in all B.F.A. and B.M degree programs are required to complete 45 units outside of the major department, including the general education requirements.

BACHELOR OF FINE ARTS
(Majors in Studio Art, Dance, Drama Production, and Drama-Musical Theatre)

AND BACHELOR OF MUSIC
(Majors in Performance, Theory and Composition, and Jazz Studies)

I. COMMUNICATION AND CONCEPTUALIZATION

A. FRESHMAN COMPOSITION (6 units)
   1. Engl. 100, 101, and 102
   2. Engl. 101 and 102
   3. Engl. 103H and 104H (Honors)

B. MATHEMATICS (3 units)
   Three units of Math. 101 or 117 and above. (Media arts majors may take M.I.S. 111.)

C. ORAL COMMUNICATION (3 units)
   Selected from: oral interpretation, beginning acting, speech for radio-television, and media performance courses. Media arts majors are required to take Comm. 100 and 102. Drama production and drama—musical theatre majors may substitute Engl. 207 for this requirement.
II. STUDY AREAS (33 total units)

A. WESTERN CIVILIZATION (6-9 units)

Western civilization courses must be selected from outside of the student's major department from the following courses: Arch. 101, 324b; Art 117, 118; Dnc. 100, 259; Dram. 140a, 140b; Mus. 107, 108; Hum. 355; Phil. 111, 113; Or.S. 140a, 140b; W.S. 200; or from one sequence of western civilization courses: Fine Arts 207, 307, 317; Hist. 101, 102, 103; Hum. 250a, 250b, 250c, Engl. 251a, 251b, 251c, or Phil. 121, 122, 123.

To satisfy group II-A requirements, media arts students must include no fewer than 3 units from the following: Engl. 260, 261, 265, 267a, 267b, 268 or Dram. 140a, 140b.

B. SCIENCE (3 units)

Three units of science (laboratory or nonlaboratory) in the following departments: astronomy, atmospheric sciences, ecology, entomology, Geog. 103a, 103b (lab 104a, 104b); molecular and cellular biology, physics, planetary sciences, Sp.H. 260, 280; R.N.R. 135; W.F.Sc. 125, P.I.S. 100.

Media arts majors are required to take 4 units of laboratory science.

C. INDIVIDUALS, SOCIETY, AND INSTITUTIONS (6 units)

Courses to be selected from anthropology, economics, geography, (except Geog. 103a-103b and 104a-104b), history (except Hist. 101, 102, 103), M.Ar. 101, philosophy (except Phil. 111 and 113), psychology, sociology, American Indian studies, Black studies, Oriental studies (except Or.S. 140a-140b), religion, women's studies (except W.S. 200).

D. NON-WESTERN AND MINORITY STUDIES

Students are required to take at least one 3-unit course focusing on gender, race, ethnicity or non-western civilization. This course can be part of the general studies major, general education, or elective course work and must be approved by the program advisor.

E. THE ARTS (3-6 units)

From all fine arts offerings in departments other than student's major; with only one course of applied (studio / performance / production) arts accepted.

To satisfy Group II-E requirements, media arts students must include no fewer than 3 units from Art 101 or 104.

F. DEPARTMENT-SPECIFIED GENERAL EDUCATION COURSE WORK OUTSIDE OF THE MAJOR DEPARTMENT (12 units)

Some area II-F courses specified by the departments can be used to satisfy requirements in other study areas above. However, the student must take the minimum required units in each area.

Department of Art Requirements:

Students select from the following courses. Some of the courses are required for a particular study emphasis within the Department of Art, so each student should consult with an advisor in the designated study emphasis.

Anth. 430, Clas. 229, Dram. 105, 108, 109, 140a or 140b, 170, 474; Dnc. 100, 259, 270; Ecol. 159aR or 159bR, Jour. 301, Mktg. 361, 364; Mus. 107, 108; Phil. 110, 111, 433; M.Ar. 101, 200; W.S. 243a, 243b.

Committee on Dance Requirements:

Dram. 101, Mus. 107, 108, Phil. 110.

Department of Drama Requirements:

6 units of dramatic literature selected from the following courses:

Engl. 267a, 331, 431a, 431b, 432, 446, 468, 475, 485; Ger. 371; Clas. 346.

6 additional units determined in consultation with the student's study area advisor.
Department of Media Arts Requirements:
Three units from each of the following categories:
1. Art 241
2. Mus. 100
3. Art 117, 118; Mus. 107, 108

School of Music Requirements:
12 to 15 units, as specified by the student's major area advisor from the following courses:
Science and Mathematics: Phys. 102a, 102b, 107; Sp.H. 260, 280; C.S. 111; Astr. 100; Geos. 101a, 101b; Geog. 102a, 102b; Ecol. 102, 105; Pty.S. 105; N.E.E. 120; Math. 101, 117e, 118, 123; Chem. 112; Ento. 151; Atmo. 101a, 101b.
Social Sciences: Anth. 100, 102, 172; Econ. 201a, 201b; Hist. 104; Pol. 101; Arch. 101; Soc. 100, 160; W.S. 200; Bl.S. 220; Reli. 120; Or.S. 140a, 140b; M.A.S. 180a, 180b.
Humanities and Fine Arts: Dram. 100; Engl. 261, 267a, 267b; Art 117, 118; Dnc. 100, 259; Comm. 136; Clas. 250a, 250b; Phil. 111; Russ. 310; M.Ar. 101. Voice performance majors can count 12 units of foreign language study to satisfy requirements in area II-D.

BACHELOR OF FINE ARTS
(Majors in Art Education and Drama Education)

AND BACHELOR OF MUSIC
(Major in Music Education)

I. COMMUNICATION AND CONCEPTUALIZATION

A. FRESHMAN COMPOSITION (6 units)
Completion of one of the following sequences:
1. Engl. 100, 101 and 102
2. Engl. 101 and 102
3. Engl. 103H and 104H (Honors)

B. MATHEMATICS (3 units)
Math. 101 or 117 or above

C. ORAL COMMUNICATION (3 units)
Selected from: oral interpretation, beginning acting, speech for radio-television, and M.Ar. performance courses.

II. STUDY AREAS (33 total units)

A. WESTERN CIVILIZATION (6-9 units)
Western civilization courses must be selected from outside of the student's major department from the following courses: Arch. 101, 324b; Art 117, 118; Dnc. 100, 259; Dram. 140a, 140b; W.S. 200; or from one sequence of western civilization courses: Fine Arts 207, 307, 317; Hist. 101, 102, 103; Hum. 250a, 250b, 250c, Engl. 251a, 251b, 251c; or Phil. 121, 122, 123.

B. SCIENCE (3 units)
Three units of science (laboratory or nonlaboratory) in the following departments: astronomy, atmospheric sciences, chemistry, ecology and evolutionary biology, entomology, Geog. 103a, 103b (lab 104a, 104b), molecular and cellular biology, physics, planetary sciences, Sp.H. 260, 280; R.N.R. 135, W.F.Sc. 125, P.L.S. 100.

C. INDIVIDUALS, SOCIETIES AND INSTITUTIONS (9 units)
Required courses: Psyc. 101 and Hist. 106 or 107. One additional course selected from: anthropology, economics, geography and regional development (except Geog.103a-103b and 104a-104b), history (except Hist. 101, 102, 103), M.Ar. 101, polical science, psychology, sociology, American Indian studies, Black studies, Oriental studies (except Or.S. 140a-140b), religious studies, and women's studies (except W.S. 200)
Note: Examination in U.S./Arizona Constitutions or completion of Pol. 110 also is required, although not included in total units required in the study areas.

D. NON-WESTERN AND MINORITY STUDIES

Students are required to take at least one 3-unit course focusing on gender, race, ethnicity or non-western civilization. This course can be part of the general studies major, general education, or elective course work and must be approved by the program advisor.

E. The Arts (3-6 units)

From all fine arts offerings in departments other than student's major; with only 3 units of applied (studio/performance/production) arts accepted.

Art education majors can apply 6 units of upper division art history to area II-E.

Music education majors can apply 6 units of Mus. 330 to area II-E.

F. DEPARTMENT-SPECIFIED GENERAL EDUCATION COURSE WORK OUTSIDE OF THE MAJOR DEPARTMENT (15 units)

Fifteen designated units in the College of Education. Please consult art education, music education, or drama education advisor for designated units.

BACHELOR OF FINE ARTS
(Major in General Fine Arts studies)

I. COMMUNICATION AND CONCEPTUALIZATION

A. FRESHMAN COMPOSITION (6 units)

Completion of one of the following sequences:

1. Engl. 100, 101 and 102
2. Engl. 101 and 102
3. Engl. 103H and 104H (Honors)

B. MATHEMATICS (3 units)

Three units of Math. 101 or 117 and above.

C. ORAL COMMUNICATION (3 units)

Selected from: oral interpretation, beginning acting, speech for radio-television, and media arts performance courses.

II. STUDY AREAS

A. LITERATURE/FOREIGN LANGUAGE/JOURNALISM (12 units)

From two of the following areas:

1. Literature (or survey literature in a foreign language department).
2. Foreign language (8 units minimum in one language).

B. SCIENCE (3 units)

Three units of science (laboratory or nonlaboratory) in the following departments: astronomy, atmospheric sciences, chemistry, ecology and evolutionary biology, entomology, Geog. 103a, 103b; (lab 104a, 104b); molecular and cellular biology, physics, planetary sciences, Sp.H. 260, 280; R.N.R. 135, W.F.Sc. 125, Pl.S. 100.

C. INDIVIDUALS, SOCIETIES AND INSTITUTIONS (6 units)

Courses to be selected from anthropology, economics, geography and regional development (except Geog. 103a-103b and 104a-104b), M.Ar. 101, history (except Hist. 101, 102, 103), phil. (except Phil. 111 and 113), political science, psychology, sociology, American Indian studies, Black studies, Oriental studies (except Or.S. 140a-140b), religious studies, women's studies (except W.S. 200).
D. NON-WESTERN AND MINORITY STUDIES

All general fine arts studies students are required to take at least one 3-unit course focusing on gender, race, ethnicity or non-western civilization. This course can be part of the general studies major, general education, or elective course work and must be approved by the program advisor.

E. Engl. 207, 209, 210, 307 or 308 (3 units)

III. INTRODUCTORY FINE ARTS COURSES
(including western civilization course work) (24-25 units)

Students select four of the following fields and take the designated courses: Art 101 and 117 or 118, Dnc. 100 or 259 and 3 units of dance activity courses; Dram. 105 and 149, and 140a or 140b; M.Ar. 101, 200; Mus. 107 or 108, and 3 units of performance courses.

IV. FINE ARTS EMPHASIS COURSE WORK (48 units)

The candidate for this degree also must complete a minimum of 24 additional units of course work in one of the departments selected in section III above, and 12 additional units of course work in each of two other departments selected in section III. (With approval of the advisor, creative writing may be used as one of the 12-unit departments.) At least 24 units must be upper-division courses. At least 24 units in sections III and IV must be taken in residence.

All group IV courses must be taken in the home department, that is, the department actually teaching the course and for which the complete course description is included in the catalog.

General fine arts studies students take the writing-emphasis course designated in their department A (the department in which 24 units are taken).

FACULTIES OF HUMANITIES, SCIENCE, AND SOCIAL AND BEHAVIORAL SCIENCES

THE MAJOR

UNIT REQUIREMENTS FOR MAJOR AND DEGREE PROGRAMS—A minimum of 15 units within the major must be in courses in residency. No more than 48 units within the major may be applied toward the degree, and the following courses are included within the 48 unit maximum allowable in one department: Honors courses in the major and courses crosslisted with an academic committee (American Indian Studies, Black Studies, Latin American Studies, Mexican American Studies, and Religious Studies). Excluded from the 48-unit rule: freshman composition, the first year (elementary) of foreign languages, and courses crosslisted in a second academic department if the latter is the home department. A minimum of 90 units of the degree program must be in the liberal arts, either in residency or in transfer. Up to 30 units of economics may be counted toward the 90 units.

SELECTION OF THE MAJOR—Although the major declared in college may or may not accompany a student throughout his or her work life, it is the cornerstone of an undergraduate degree program. And it should reflect personal, career and life considerations. The major is selected from those listed under the three faculties, including the college's general studies major. If a student is particularly interested in the sciences, the major needs to be chosen early in the UA years to take advantage of specific course sequences. For the declared major, a departmental advisor within the chosen field will discuss and identify the courses and requirements which must be met.

ANSWERS TO SOME QUESTIONS REGARDING THE MAJOR

Do I have to declare a major when I apply (or after I'm enrolled)? The answer is both "yes" and "no". A major should be declared after enough exploration to know what discipline of study best suits one's character, needs, interests, and goals. Some entering students do know and are ready to commit themselves to a major—even at times to an accompanying minor. Other students have an idea, but need a few semesters with varied courses to focus that idea toward a
career goal. Some students will explore enough to know that they want to design their own major program—a possibility through the general studies major within the college. It is strongly recommended that a major be declared by the end of the sophomore year.

Can a major be changed? Yes. There is a specific procedure to follow, which also gives the student an opportunity to meet with the faculty advisor for the new field of study.

How and when is an advisor chosen? Upon enrollment, the college assigns each student either a college advisor or a major advisor. Exploratory students are advised by the Office of Academic Services college advisors until a major is declared. Majors are advised by the faculty advisors within the department of the major.

What is needed for graduate school? Generally, at minimum, a 3.0000 cumulative grade-point average. Specifically, students will be evaluated against the requirements established by the discipline and institutions to which they apply. Students should keep in close touch with the department's faculty advisor as they become more and more involved with their major or probable field of graduate study.

THE MINOR

The minor is of importance because it helps to broaden the understanding of the major field, as well as to support an additional personal interest. Usually it is selected to complement the major. The minor courses may come from whichever university department or program is of greatest personal interest, or is developed in conjunction with the major advisor. In some cases the major designates the appropriate minor. There are strict standards that must be met for the minor as designated below.

A 20-unit minimum minor is required in both the Bachelor of Arts and the Bachelor of Science degree programs (except the Bachelor of Science in Geosciences and the Bachelor of Arts with a major in Latin American Studies).

Each minor must contain 9 units in upper-division courses. The minor may not include freshman composition, first-year courses in a foreign language (except Greek, American Indian languages, the languages taught in the Department of Oriental Studies, Fren. 302b, Port. 202b, and Span. 202b), courses below Math. 124, military aerospace studies, military or naval science, or specified courses in exercise and sports sciences. In general, completion of this requirement must be met in one of the following ways:

A. Twenty units in one department, usually related to the major;
B. A split minor, wherein work is done in two related departments with at least 8 units in one and 12 units in the other;
C. A teaching minor for education majors (specific requirements described in the department sections of this catalog);
D. A structured business minor—see an Office of Academic Services advisor for more information;
E. A thematic minor, which is designed around a specific theme and which may include course work pertinent to the theme from more than one college. If this minor is made up of courses from three or more disciplines, it must be described on a form available from the departmental advisor or the Office of Academic Services. This form must be signed for approval by the major advisor, and is submitted to the Degree Certification Office at the time of filing for degree candidacy.

ELECTIVES

After selecting the major, minor, and general education course work, students may elect additional courses of their own choosing to complete the 125-unit requirement for graduation within the Faculties of Humanities, Science, and Social and Behavioral Sciences.
FACULTY OF FINE ARTS

THE MAJOR

The Faculty of Fine Arts requires students to declare a degree program at the time of application for admission to the University or upon entrance into the faculty. Students can file a change in major at any time upon approval of the Office of the Dean.

The course and total-unit requirements for majors are specified by individual departments in the Departments and Courses of Instruction section of this catalog. Course work used to satisfy other graduation requirements cannot be used to satisfy requirements of the major. Students must obtain a grade-point average of 2.00 or better for all work in the major.

For graduation with bachelor degrees other than the Bachelor of Fine Arts and the Bachelor of Music degrees, students must complete the general education requirements, a major, a minor, and appropriate electives. Bachelor of arts degrees are offered with majors in art history, dramatic theory, media arts, and music.

For graduation with Bachelor of Fine Arts and Bachelor of Music degrees, students must complete the general education requirements, a major, and appropriate electives. Bachelor of Fine Arts degrees are offered with majors in studio art, art education, dance, drama production, drama education, drama-musical theatre, and general fine arts studies. Bachelor of Music degrees are offered with majors in performance, music education, theory and composition, and jazz studies. For BFA and BM degrees, at least 45 general academic units must be taken outside the major department. The general education requirements are counted toward these 45 units. Students pursuing a BFA degree with a major in general fine arts studies must take at least 45 units outside the Faculty of Fine Arts. Students majoring in art education, drama education or music education must complete at least 56 units applicable to the degree with a grade-point average of 2.50 or better, must pass all three portions of the Pre-Professional Skills Test, and must obtain written permission from the Office of Student Services, College of Education, before being admitted to certain professional education courses. (See the College of Education section of this catalog for additional details.)

Fine arts students are encouraged to participate in both on-campus and nondepartmental, off-campus productions and performances. Participation cannot conflict, however, with commitments already made to departmental programs and to student colleagues in those programs. When such conflicts are imminent, students are responsible for consulting in advance with their department head or director.

THE MINOR

The minor complements the major area of study and is an essential component of the bachelor of arts and bachelor of science degree programs in the Faculty of Fine Arts. The required 20-unit minimum minor usually is completed in a department related to the major. The minor must be approved by the major advisor, who also advises the student in the minor area of study. Additional information about minors which are structured by some departments can be found in the departmental listings in this catalog and by contacting the major advisor. In general, completion of the minor can be accomplished in one of the following ways:

A. Twenty units in one department;

B. A split minor of work done in two departments, with at least 8 units in one and 12 units in the other;

C. A fine arts minor, composed of a broad survey of courses outside of the major department, which must include 6 to 9 units from 3 of the following departments: art, dance, drama, media arts and music;

D. A teaching minor for education majors (specific requirements described in the departmental sections of this catalog);

Course work used to satisfy other graduation requirements cannot be applied to the requirements of the minor.
GENERAL STUDIES MAJORS

These academic programs are intended for undergraduates who express interest in pursuing scholarly inquiry outside the established major and minor structure of the academic departments. Individual study plans of high academic caliber are designed by the student with the support of an advisor. Two general studies programs are offered by the college.

General Fine Arts Studies

The general fine arts studies major, offered by the Faculty of Fine Arts for the Bachelor of Fine Arts degree, combines general education requirements with introductory fine arts course work and concentrated study and participation in selected fine arts fields. For information regarding the specific requirements for this major, please refer to “General Education Program, Bachelor of Fine Arts, major in general fine arts studies” earlier in this section of the catalog.

Advising for general fine arts studies students begins in the Office of the Dean, Music Building 111. After the student has selected a department A, advising is done in that department. General fine arts studies students take the writing emphasis course in their department A.

General Studies

This major, offered through the Faculties of Humanities, Science, and Social and Behavioral Sciences for the Bachelor of Arts degree, permits a student to combine three disciplines into a coherent and intellectually challenging major. In designing the major, the student must consult with an advisor in the Office of Academic Services and with advisors in the three disciplines of interest. All proposals (or changes to previously approved proposals) are approved within the OAS. Requirements for this BA degree with a major in general studies must include completion of the following:

A. The General Education Program requirements;

B. The courses chosen within the three subject areas (disciplines). Each subject area must carry a minimum of 20 units, with a possible range of 24 units as designated by the individual disciplines; (See additional requirements below).

C. Elective courses to complete the minimum of 125 units required for the degree;

D. Thirty upper-division units;

E. Ninety units in liberal arts courses through the college or in transfer. Up to 30 units of economics may be included within this requirement.

Designing the major requires the student to: (1) prepare a written proposal, (2) meet with an OAS advisor, (3) have the final proposal accepted by the college, and (4) receive an OAS advisor’s signature on the major declaration form.

The written proposal, in describing the three subject areas, must include the rationale for the choice of the three areas, and indicate how the combination of subject areas and courses relate to and fulfill personal goals. Past, present, and future courses are incorporated to form the complete major, and they must be listed within each subject area in the sequence they were or will be taken.

The requirements for the major include the following:

1. Subject areas I and II must be in single programs or major fields of study in which a Bachelor of Arts or a Bachelor of Science degree is offered, or in the structured program of an academic committee within one of the three faculties;
2. Subject area III may include courses from within the three faculties, from within the Faculty of Fine Arts, or from another UA college. Courses in Subject Area III must be selected from no more than two related academic disciplines (divided equally), or from an approved combination of courses united by a common theme;

3. A minimum of 9 upper-division units are required within each of the three subject areas;

4. A minimum of 9 upper-division units within each subject area must be taken in residence at the UA;

5. A maximum of 9 units of independent study may be included among the three subject areas, with no more than six units in a single subject area;

6. A department within the three faculties may designate a minimum of six units of required course work from within its discipline;

7. All UA grade-point average standards must be met, including a cumulative GPA of 2.000 within all course work of the three subject areas;

8. Certain courses may not be used within any of the subject areas: freshman composition, the first year of a foreign language (except for Greek, American Indian languages, languages taught within the Oriental Studies Department, Fren. 302b, Port. 202b, and Span. 202b), mathematics courses below 124, military aerospace studies, military science, naval science, and specified courses in exercise and sport sciences;

9. At least one writing emphasis course must be taken from those specified by the department chosen from either subject area I or II;

10. The discipline of a subject area may not be used as a major or a second degree program.

GRADUATE DEGREE PROGRAMS

Curricula leading to masters and/or doctoral degrees are offered by most of the departments in the College of Arts and Sciences. Consult the Graduate Catalog for admission requirements, and consult with graduate academic advisors for information regarding the discipline's advanced level studies. Consideration of post-graduate admission and degree requirements may be instrumental in the development of your undergraduate study plan.

ACADEMIC PROCEDURES

ACADEMIC PROBATION AND DISQUALIFICATION—The deans monitor closely the work of those students who fail to meet minimal grade-point averages, and students with inadequate academic performance are placed on academic probation. Continued failure to meet university academic standards will lead to disqualification from the University for one semester. Upon return to the University, the student continues on probation, and additional unsatisfactory academic work will result in a second and permanent disqualification.

Note: Only grades earned at the University of Arizona will be used in calculating the cumulative grade-point average and in determining scholastic standing.

CHANGE OF COLLEGE—To enter the Faculties of Humanities, Science, and Social and Behavioral Sciences, a student must meet with a deans' office advisor in the Office of Academic Services. This meeting can be scheduled at any time throughout the semester. The student must present a copy of his or her current university transcript or an official evaluation of transfer courses, and with the advisor review the application of courses to the General Education Program. If a major has been selected, the student then takes the transcript and a copy of the evaluation of General Education Program courses to that department's major advisor. The major and minor requirements and options, and the application of completed courses to them is the responsibility of the major advisor. The final step to entering the college is to complete a "Change of College" form. The change of college is effective at the beginning of the following semester.
To enter the Faculty of Fine Arts, the student must present a copy of his or her current transcript to the dean's office, Music Building 111.

CHANGE OF MAJOR—A change of major implies a change from one major area of study to another within the college, or from undeclared to declared status. The dean's office advisors have the name and location of each departmental advisor. After completing a declaration of major form and handing it in at the dean's office, the change of major process will be complete. To declare a general studies major, go to the Office of Academic Services, 347 Modern Language Building; for the general fine arts studies major, go to Music 111.

COURSE LOAD—An average course load is 15-16 units of credit per semester in a four-year study plan. All courses, including those taken for credit, audit, by correspondence, or at another academic institution are counted in determining the maximum academic load. First semester freshmen must not exceed an 18-unit limit. Other students who wish to register for more than 18 hours must have a grade average of at least 3.0 and must secure permission in the dean's office.

WITHDRAWAL PROCEDURE—The college adheres to the University's change of schedule procedures. Scheduled classes may be added only through the University's late registration period early in each semester. Consult with an academic advisor about the addition of independent studies classes. The initial four weeks of a semester provide the opportunity to evaluate the content of a class, the syllabus, the course requirements, and the type of instruction, thus withdrawals filed during this period result in deletion of the course from the student's record. Withdrawal from a course must conform to the following calendar and procedures:

Week 1  
Instructor's signature required

Weeks 2 through 4  
Course withdrawals filed by the end of the fourth week of classes result in cancellation of registration in the course. No signatures are required.

Weeks 5 through 10  
Course withdrawals filed during this period require the instructor's and dean's signatures, and a grade of "W" or "E" will be awarded by the instructor and included on the permanent record.

Week 11 to end of semester  
Beginning with the eleventh week, withdrawal from a course is only with special permission of the dean and only under very exceptional circumstances.

GRADE APPEAL PROCEDURES—Grade appeal discussions are applicable only when the grade recipient believes a final grade included non-academic considerations that were not directly reflective of the course requirements as defined by the instructor. If a student is concerned about a grade, he or she must discuss it with the course instructor no later than the end of the fifth week of classes of the first regular semester after the semester or summer term in which the grade was awarded. If the issue is not resolved, then the student may contact the appropriate deans' office (Faculty of Fine Arts courses: Music 111; all other college courses: 347 Modern Languages) where the concept of grade appeal and the procedures will be explained. The appeal is handled by the office that represents the faculty member who offered the course regardless of the student's college or major.

INCOMPLETE GRADE—Students who receive an incomplete (I) grade have the responsibility to initiate with the instructor the procedure to complete the work. For specific information regarding the incomplete grade, see "Grading System" in the Academic Guidelines section of this catalog.

PASS-FAIL—The purpose of the pass-fail option is to encourage students to take courses according to their interests without requiring assignment of letter grades. The pass-fail option may not be used to fulfill the General Education Program, the requirements of the major and minor areas of study, nor to qualify for honors awards for high scholarship. For additional information see "Pass-Fail Option" under Academic Guidelines and "Honors, Awards, and Prizes" under Provisions for Superior Students elsewhere in this catalog.
AUDIT—Students wishing to attend courses for information without receiving credit or regular grade may register for “audit.” Courses for audit may be added during registration or through use of the drop/add procedure, but not at preregistration. The registration fee for audit courses is the same as for courses taken for credit. The course instructor establishes attendance and work standards. A department may have restrictions on courses open to audit students.

INDIVIDUAL STUDIES

Individual studies provide an opportunity for experiential education outside the normal classroom experience. Experiential education is a challenging learning process which encompasses skills, knowledge, application, and personal growth, and recognizes the student as an individual who learns in unique ways and who has unique goals.

The college encourages its students to integrate experience and learning through preceptorships, internships, legislative internships, practica, and independent studies. A department may have a limit on the number of units of this type of study which may be credited toward the major or toward the degree. For additional descriptions of individual studies options, see the “University-Wide House-Numbered Courses” section of this catalog.

WRITING PROFICIENCY

Completion of the Upper-Division Writing Proficiency Examination is a graduation requirement. Students who complete the examination satisfactorily should enroll in a writing-emphasis class in their major department. Students receiving a rating of unsatisfactory on the examination should consult with a major department advisor to select a composition review course. Satisfactory completion of the review course is required prior to enrollment in the writing-emphasis class. The general studies major should consult with an advisor in the Office of Academic Services about the writing-emphasis class. General fine arts studies majors should contact their advisor in department A.

The advanced-level transfer student should complete the examination immediately upon enrollment, and should consult with a departmental advisor about the writing-emphasis class.

See “University Requirements in Composition” under the Academic Guidelines section of this catalog for further information.

CORRESPONDENCE STUDY

Students currently enrolled in the college must secure a dean's approval prior to initiating correspondence study. Non-admitted individuals who have completed six or more units of correspondence study should meet with an academic advisor to discuss admission and degree program requirements. Credit earned in correspondence study courses is not considered residence credit at the University of Arizona, and the grades received will not be averaged into the cumulative grade-point average. Students who are on probation or who have been disqualified from the University must consult with an academic advisor prior to enrollment in a correspondence course.

DOUBLE-MAJOR AND SECOND-DEGREES

DOUBLE MAJOR—A student may create a double major by satisfying all of the requirements for the major in two departments within the college. Although there are restrictions on the degree and subject combinations (e.g., both majors must apply to the same degree—B.A., B.S., B.F.A. or B.M.), normally the minor area of study is modified to meet the departmental major requirements. It is essential to maintain contact with the advisor in both departments to ensure that all requirements are being met. Only one of the two majors is cited for the record; however, when filing for degree candidacy both majors are declared. The minimum units required for graduation are 125, with at least 15 units in each major taken as residency course work.

SECOND DEGREE—A second degree may be earned (e.g., B.A. and B.S.) by completing no fewer than 30 units in addition to the units required for the first degree, and meeting all general education and major requirements for the second degree.

Those students interested in the double major or second degree should meet with an advisor in their dean's office for specific information.
SPECIAL ACADEMIC PROGRAMS

Cooperative Education, Internship Program, and SCORE

Complete information on these programs is available through the Career and Placement Services Office of the Student Resource Center.

The COOPERATIVE EDUCATION PROGRAM provides students with opportunities to supplement academic studies with periods of career-related work experience prior to graduation. Co-op is a full-time, paid, experience which includes taking a semester away from formal studies to work in business, industry, and government throughout the United States. By carefully planning academic and co-op schedules it is possible to graduate in 4 1/2 to 5 years.

Requirements are: (1) completion of the freshman year, (2) completion of or current enrollment in one full-time UA semester; (3) a minimum GPA of 2.000. (Note: Many employers require considerably higher GPAs.)

The INTERNSHIP PROGRAM merits exploration if a student wishes to work part-time in a career-related position while attending the UA. Internship listings are for both paid and nonpaid positions.

The SUMMER CAREER-ORIENTED EMPLOYMENT PROGRAM is designed to help students find full-time, paid, career-related, work experience during the summer months. Employment opportunities exist in business, industry, and government throughout the United States.

Cooperative Program in International Management Careers:
College of Arts and Sciences/American Graduate School of International Management

The College of Arts and Sciences and the American Graduate School of International Management (Thunderbird) offer a cooperative program which combines liberal with professional education as preparation for an international career.

The college provides academic advising to undergraduates in readiness for the intensive graduate courses at Thunderbird. The complete program includes course work in foreign languages, related international and cultural studies, statistics, mathematics, computer science, specialization area. Matriculation in upper-division business courses requires the grade-point average specified under "Advanced Standing Policy" in the College of Business and Public Administration section of this catalog. The major may be selected in consultation with an advisor in the Office of Academic Services.

Business or public service and extended overseas experience make a valuable contribution to the overall success of the graduate. Students taking a technical degree can combine those skills with the specific curriculum of AGSIM.

Exceptional opportunities are open to both U.S. and foreign students who demonstrate maturity, leadership capabilities, and preparation in various phases of multinational business or international affairs. In 1986, women made up more than 35 percent of the enrollment.

Recommended courses in business have been combined with the Thunderbird preparatory program and the college's requirement of a minor. Consult an advisor in the Office of Academic Services, Modern Languages Building Room 347, for additional information.

Professional Student Exchange Program

This program, sponsored by the Western Interstate Commission for Higher Education and administered by the Arizona Board of Regents, enables Arizona students to enroll in one of five professional programs in other states at essentially the same expense to the student as residents of the state in which the school is located. The five programs are dentistry, occupational therapy, veterinary science, optometry, and osteopathy. The osteopathy program is through a separate (bilateral) contract with an osteopathic college. To qualify for the programs, students must maintain at least average grades in their preprofessional work and must have been legal residents of Arizona for the last five years prior to entrance into the professional school. Students receiving such assistance are required to return to Arizona to practice, or to
repay a portion of the funds expended in their behalf, including interest. For further information, the student is referred to the Office of Academic Services, Modern Languages, Room 347.

Evening Study Program

Office of Academic Services advisors are available to meet with individuals interested in completing a degree program through late afternoon or evening classes. Evaluation of completed course work, degree program planning, and consideration of the class offerings provide the re-entry or the beginning student with information regarding the changing needs of the adult learner. This pre-entry advising provides assistance with questions about the college, academic advising, career exploration, peer support, and referrals to campus services.

Foreign Service Careers

The United States Foreign Service is America's diplomatic, consular, commercial and overseas cultural and information service. Acceptance into the service is based on written and oral examinations. The written examination consists of seven areas: English usage, economics, administration, political science, consular information, cultural affairs and commerce. Students pursuing a foreign service career should obtain as broad an educational background as possible. Course work should include, but not be limited to: (1) English language skills with stress placed on an ability to speak and write persuasively, and to analyze and defend policies and proposals; (2) Foreign language competency in at least one language; and (3) knowledge in economics, political science (particularly international relations), area studies in geography and history of a chosen area, and U.S. government and history.

Students interested in more information should consult with the foreign service advisor in the Department of Political Science or an academic advisor in the Office of Academic Services.

Near Eastern Center

The Near Eastern Center is one of 12 federally funded Title VI centers for middle eastern studies in the United States. It encompasses offerings in anthropology, art, economics, geography, history, literature, philosophy, political science and middle eastern languages and cultures. It also has strong ties with the Office of Arid Lands, the Bureau of Applied Research in Anthropology, the College of Medicine, the Environmental Research Laboratory, and a variety of other specialized organizations and units on campus. The center does not offer a formal major in middle eastern studies, but does offer a specialization in middle eastern studies.

The center is a member of the Center for Arabic Studies Abroad, the American Research Center in Egypt, the American Institute of Maghreb Studies, the American Institute of Iranian Studies, and a variety of other organizations which provide opportunities for foreign study and research. The Middle East Studies Association is headquartered at the University of Arizona and the center is an active member in the Western Consortium of Middle East Studies Centers along with such institutions as UCLA, University of California, Berkeley, the universities of Texas and Washington, etc. Amongst its other activities the Consortium sponsors a summer program in Middle East studies which, in recent years, has been held in Seattle and Los Angeles. Fellowship support is available for both the normal academic year and for summer programs.

Study Abroad

The college encourages variety and diversity within the degree program. Foreign study is one way to gain an understanding of the language, culture, and history of another country. Study abroad is available through specific University of Arizona programs in France, England, Italy, Mexico, Brazil, China, and Taiwan. In addition, the University is a member of the Center for Arabic Studies Abroad and of the American Research Center in Egypt, both of which offer selected undergraduate and graduate students opportunities for intensive study of Arabic language, literature, and culture in Cairo, Egypt. The University also participates in a graduate exchange program with the National Taiwan and the Cheng Kung Universities in Taiwan. An exchange program with Soka University in Tokyo offers a year-long opportunity for the intensive study of Japanese. The University is a member of the American School of Oriental Research, which has student programs in ancient near eastern studies, biblical studies, and archaeology at its centers in Nicosia, Jerusalem, and Amman.
Prior to study at a foreign institution, four steps must be followed to insure that the study experience, course work, and credits earned are meritorious and applicable within a University of Arizona degree program: (1) consult with the director of the International Studies Office in the Nugent Building for information about academic institutions or study plans abroad, including those of the University; (2) consult with an academic advisor to review current academic progress, and to ascertain how planned foreign study will contribute to it; (3) consult with the Foreign Evaluation Office, Administration 316, to confirm that the planned foreign course work will be accepted in transfer by the University; and then (4) consult once again with an academic advisor to determine how course options will be applied in the degree.

Written confirmation of the application of foreign studies to the student's degree program must be placed with his or her college records; a special form is available for this record in the deans' office. The University will award credit only if an official transcript from the foreign university is received by the University of Arizona after the student's return.

3/2 PROGRAM

This is a cooperative academic plan developed by the College of Arts and Sciences and the College of Business and Public Administration, and approved by the Graduate College. The 3/2 Program offers highly qualified students in the College of Arts and Sciences the opportunity to earn both an undergraduate and the Master's of Business Administration degrees in five years. The student first completes three years of course work, meeting general education requirements, selected prerequisite courses and the requirements of the major field of study. The Graduate Management Admissions Test (GMAT) is taken, and application to the 3/2 Program is made during the second semester of the junior year. Qualified students are accepted for the senior year with continued study in 30 units of designated MBA courses. The 30 MBA units are used within the undergraduate degree program as the minor, as elective units, or as excess units. Upon completion of all degree requirements, the baccalaureate degree is awarded. Admission to the Graduate College to complete the MBA is based upon compliance with Graduate College requirements and procedures, and a minimum grade-point-average of 3.0000 in the 30 units of completed MBA classes.

Additional information is available through advisors in the Office of Academic Services of the College of Arts and Sciences, and in the Graduate Professional Programs Office, College of Business and Public Administration.

PREPROFESSIONAL PROGRAMS

For students who are interested in the fields of law, medicine, dentistry, occupational therapy, optometry, physical therapy, and osteopathic and podiatric medicine, preprofessional program advising is available from advisors in the department of a student's major field of study and in the Office of Academic Services. Students interested in other pre-professional programs which base preparatory studies in the arts and sciences—education, nursing, medical technology, pharmacy, veterinary medicine, health related professions, and so forth—should review those colleges' sections of this catalog for degree program information, and must establish their advising contacts with representatives within those colleges.

Law

At the college's orientation sessions prior to registration, there are special meetings for prelaw students. During the first and second years of undergraduate study, students should meet with the prelaw advisor, who can assist in planning a degree program and provide information about visits of law school representatives, scholarship competitions, and the two prelaw student associations: Phi Alpha Delta and the Minority Pre-Law Association.

A broad liberal education is considered an excellent preparation for a career in law. Students interested in attending law school should choose courses to strengthen their communication, analytical, and research skills, as well as courses that will provide an understanding of social, political, and economic institutions. Law school admission counselors do not recommend a particular major. They suggest that prelaw students select a major which reflects their interests and abilities, offers the functional skills necessary for a law career, and builds a foundation for a legal specialty.
Most fully accredited law schools require a bachelor's degree for admission. Students have the responsibility to find out the entrance requirements of the schools in which they are interested. In general, the most important admission criteria are the student's undergraduate grade-point average and Law School Admission Test (LSAT) scores.

Health Sciences

The prehealth professions advisor is available to all University of Arizona students wishing to qualify for admission to the professional schools. Students planning professional training in the health sciences most frequently pursue prehealth studies within the College of Arts and Sciences; however, the College of Engineering through biomedical engineering, and the College of Agriculture through premedical tracks in several of its majors, including nutrition and exercise physiology, also provide preparation options.

College of Arts and Sciences orientation and information sessions about the health science fields begin prior to the regular orientation and registration programs. Interested students may contact the Office of Academic Services for appointments and information while still in high school. Upon entering the University, general orientations and personal appointments are essential to planning the rather structured study plans of the prehealth courses that must be integrated with the major and minor fields of study and the General Education Program.

In addition to group and individual meetings with interested students, prehealth advising assists in the following activities.

Student File: This file must be organized during September of the junior year because medical and dental school application begins two full years before professional school matriculation. Candidates obtain a registration form from the prehealth professions advisor along with instructions concerning the autobiographical (personal) statement and transcripts that will be required for the application file. An undergraduate committee recommendation is an important part of the file.

Prehealth Professions Interview Committee: Senior faculty representing a broad spectrum of disciplines are selected for this committee, which holds individual interviews during spring term of the junior year. Many professional schools rank the committee reports among major criteria considered about the applicant.

Application to the Professional Institution: Applicants apply to medical and dental schools during the summer between the junior and senior year. Normally, formal application is through the American Medical College Application Service or the American Association of Dental Schools Application Service. The college's prehealth advisor provides application information for other types of professional schools.

Medicine

Although colleges of medicine differ in their specific entrance requirements, all emphasize a well-balanced cultural education, strong foundations in the natural sciences and mathematics, highly developed communication skills, a solid background in the social sciences and humanities and outstanding personal characteristics. Most of them require a bachelor's degree and all of them specify minimum requirements. A student planning to apply for admission to a particular medical college should refer to Medical School Admissions Requirements, published annually by the Association of American Medical Colleges, to insure that the specific requirements are met.

Evaluation is based upon the entire academic record, the Medical College Admission Test (MCAT), extracurricular activities, experience in a clinical or hospital setting, letters of recommendation, and personal interviews. Although no major is preferred, it is important that the student excel in the major.

The University of Arizona College of Medicine has established the following minimum requirements:

a. Successful completion of 90 semester units (30 upper division) or 135 quarter units (45 upper division) at an approved college or university;

b. Successful completion of two full semesters (or three quarters) in each of the following areas: general chemistry, organic chemistry, physics, general biology or zoology, and English;

c. Completion of the MCAT no later than the year preceding that in which the applicant plans to enter medical school.
In addition, applicants cannot be considered unless they are residents of Arizona, Alaska, Montana or Wyoming, which participate in the WICHE program.

Optometry

Entrance requirements for the 13 optometric schools and colleges vary slightly, but the minimum preoptometric requirements consist of two years of undergraduate course work (60 units), including one year each of English, general biology or zoology, inorganic chemistry and physics. Most of the institutions also require one semester each of organic chemistry and calculus and one year of psychology. The science courses should have laboratories and should be of preprofessional caliber. Students considering the study of optometry should contact either the American Optometric Association or the schools they intend to enter regarding specific requirements for admission. All applicants are required to take the Optometric College Admissions Test (OCAT), offered twice a year.

Podiatry

There are five colleges of podiatric medicine in the United States. Although all require at least 60 semester units (90 quarter units) of undergraduate course work, about 98 percent of the students selected have completed three or more years of prepodiatric education, and about 90 percent have a bachelor's degree. Minimum prepodiatric requirements consist of one year each of English, general biology or zoology, and inorganic chemistry; one semester each of organic chemistry and physics; and a variable number of other courses (including, in some cases, additional chemistry, physics, and mathematics), particularly in the humanities and social sciences. The science courses should have laboratories and be of preprofessional caliber. Students considering the study of podiatry should contact either the American Association of Colleges of Podiatric Medicine or the schools they intend to enter regarding specific requirements for admission. The colleges of podiatric medicine have adopted the Medical College Admission Test (MCAT) as an entrance requirement for applicant.

Dentistry

In many of the 60 schools and colleges of dentistry, the stated "formal minimum" preclinical training is two years and the "generally acceptable minimum" is three or four years. The vast majority of those accepted into dental school, however, have a bachelor's degree. Basic minimum requirements include one year each of biology, English, inorganic chemistry, organic chemistry, physics, and usually mathematics. Additional suggested or required course work varies considerably from a "broad liberal arts background" (courses in psychology are often mentioned) to art, sculpturing, and metal machine shop. A student planning to apply for admission to a particular dental school should refer to Admission Requirements of U.S. and Canadian Dental Schools, published annually by the American Association of Dental Schools, to insure that the specific requirements are met.

Evaluation is based upon the entire academic record, the Dental Admission Test (DAT), extracurricular activities, letters of recommendation, and personal interviews. Although no major is preferred, it is important that the student excel in the major. The DAT must be taken no later than the fall of the year preceding that in which the applicant plans to enter dental school.

Social Services

Students interested in professional careers in social work should plan on study through the master's degree. Because each graduate school of social work has its own statement of requirements, students should consult an academic advisor in the Office of Academic Services, examine catalogs from the graduate schools of social work, and contact those schools. Although the college has no degree program in social work, it does offer specific curricula oriented toward the common educational goals of the profession. In addition, ongoing volunteer work within the various social services provides valuable experience with agencies, organizational structures, social policies and programs, the client, and the community.
College of Business and Public Administration

The college offers professional education in business and public administration. Its purpose is to prepare men and women for managerial and professional positions in the public and private sectors. The college also provides continuing educational opportunities for those seeking to improve their positions. Faculty of the college are actively engaged in research on a wide range of economic and administrative topics.

The college has been a member of the American Assembly of Collegiate Schools of Business since 1948, and its undergraduate and graduate curricula in business are accredited by the assembly. Also, the college's graduate program in public administration is recognized by the National Association of Schools of Public Affairs and Administration.

The college faculty offers a rich combination of experience in professional management problems and practices, scholarship, teaching and research. Many members serve as consultants in industry, government, health care, education and transportation. The faculty averages $2.5 million annually in research grants and contributions. Several faculty members have authored texts which are widely used in management education throughout the United States. In addition, the faculty is well represented on the editorial boards of major professional publications.

The college includes the following departments: Accounting; Economics; Finance and Real Estate; Management and Policy; Management Information Systems; and Marketing.

DEGREE PROGRAMS

UNDERGRADUATE DEGREES—Two undergraduate degrees are offered by the college: the Bachelor of Science in Business Administration (B.S.B.A.), and the Bachelor of Science in Public Administration (B.S.P.A.). The structure and purposes of the two degrees are similar. Both provide a strong foundation in the arts and sciences in the freshman and sophomore years. Under both programs, the common body of knowledge necessary for effective management is thoroughly explored. Through the major, a comprehensive exposure to a particular field is obtained. Finally, there is the opportunity to enroll throughout the undergraduate years in courses outside the field of administration.

UNDERGRADUATE MAJORS—Within the B.S.B.A. degree program, students may select a major in accounting, business economics, finance, general business administration, management information systems, marketing, operations management, personnel management, or real estate.

Within the B.S.P.A. degree program, students may select a major in criminal justice administration, health services administration, human services administration, public management, or public recreation administration.

Students may elect to take a second major from among those offered in their degree program. The general business administration major, however, may not be combined with another major. Students selecting a second major must complete all the stipulated requirements for each.

The majors offered in the college are more fully described below. Minor fields are not available in the college.

Students interested in the Cooperative Program in International Management Careers should see "Special Programs" in the College of Arts and Sciences section of this catalog.

GRADUATE DEGREES—The Graduate College, through the College of Business and Public Administration, offers a number of graduate degrees for qualified students. These include the Master of Business Administration; Master of Public Administration; Master of Accounting; Master of Arts degree with major in economics; and Master of Science degree with majors in finance, management and policy, management information systems and marketing. Also, the
Graduate College, through the Graduate Committee on Planning, offers the Master of Science degree with a major in planning.

The Doctor of Philosophy degree is offered with majors in business administration and economics.

Detailed information on these programs is contained in the Graduate Catalog.

STUDENT ADVISEMENT

Students new to the college, whether just entering the University or transferring into the BPA College, should come to the Undergraduate Programs Office, BPA 108, for information and academic advising. Students with prior college-level work should bring transcripts of that work. Freshmen, sophomores and all general business administration majors are counseled by college advisors in the Undergraduate Programs Office.

Juniors and seniors in all majors except general business administration are advised through the department offering the major. Students should contact the department office to obtain a major advisor.

Information on all college degree programs, policies and requirements can be obtained at the Undergraduate Programs Office.

SPECIAL ADMISSION REQUIREMENTS

Incoming freshmen should present credit in mathematics as follows: one unit of elementary algebra, 1/2 unit of intermediate algebra, and 1/2 unit of advanced algebra.

Transfer students from community colleges must meet all freshman and sophomore requirements as shown below for the degree they wish to pursue, either by acceptable transfer credit or course work for university credit.

TRANSFER CREDITS

GENERAL STATEMENT—Undergraduate programs in business administration in universities normally concentrate the professional courses in the last two years of a four-year program. Only a limited amount of work in business courses is offered below the junior year. The objective of this policy is to permit the student to acquire a foundation of work in the basic arts and sciences as a prerequisite for professional courses in business.

All business programs accredited by the American Assembly of Collegiate Schools of Business require the students to take a minimum of 40% of the degree program in the arts and sciences, including work in mathematics, social science, humanities and the natural sciences. Students desiring a four-year degree are advised to take a majority of their work during the first two years in the arts and sciences, including a strong background in mathematics.

Students planning to take their first two years of work at a junior college or at another four-year institution should take only those courses in business that are offered as freshman- or sophomore-level courses at any of the three state universities. These lower-division courses are numbered 1 through 299. A maximum of 30 units of business and economics courses from community colleges will be accepted toward a bachelor's degree in business administration.

Professional business courses taught at the junior or senior year in the three state universities may not be completed at a two-year college for transfer credit in the business core or major (the introductory course in business law will be accepted as lower-division credit as an exception to this policy). Such courses may be utilized in the free elective category subject to the 30-unit limitation. Courses taught as vocational or career classes at the community colleges which are not taught in the colleges of business at any of the three state universities will not be accepted for credit toward a bachelor's degree. Courses taught in the upper division business core at the three state universities must be completed at the degree-granting institution unless transferred from an accredited four-year school.

Only 72 units of community college work may be applied toward a BPA College degree program.
SUGGESTED COURSES - The following general pattern of courses is recommended for students completing their first two years' work in a junior college and planning to transfer to one of Arizona's universities without loss of credit:

Maximum Preprofessional Courses: 30 units
- Accounting 6
- Economics 6
- Quantitative Analysis & Statistics 3
- Business Law 3
- Lower Division Business Electives 12

Maximum Gen'l Education: 34-42 units
- English
- Mathematics
- Science
- Humanities
- Social Science
- Electives

UPPER-DIVISION BUSINESS COURSES — Normally, the college accepts transfer credit in upper-division courses only from schools or colleges whose programs are accredited by the American Assembly of Collegiate Schools of Business.

Policies regarding transferable units vary among universities. For further information, see “Transfer Students” in the Admission to the University section of this catalog.

ADVANCED STANDING POLICY

Enrollment in upper-division (300 and 400 level) courses offered by the departments in the BPA College is restricted by the Advanced Standing Policy. This policy restricts enrollment in those courses during the fall and spring terms to those who qualify either as BPA students, non-BPA students, exempt program students or by catalog exemption.

All undergraduate students intending to register for the restricted upper-division courses offered by the BPA College must make application and have their eligibility established. Information and application forms are available in the Undergraduate Programs Office, BPA 108.

Ineligible students either erroneously or inadvertently admitted to any of the restricted courses will have their enrollment cancelled. All students are responsible for their own registrations and for having established their eligibility for any of the courses covered by the Advanced Standing Policy.

BPA or non-BPA students having attained advanced standing in the college, or those having catalog exemption status, who are absent from the University for at least one regular semester (regardless of reason) must reapply to have their eligibility revalidated prior to re-enrolling in the University.

ADVANCED STANDING REQUIREMENTS — Eligibility requirements for advanced standing are as follows:

BPA Students

Applicants must have

1. completed a minimum of 56 units, including all stipulated lower-division requirements* (pre-major requirements excepted);
2. completed a minimum of 12 units at the University of Arizona;
3. a grade-point average based on course work at the University of Arizona of not less than the minimum established by the BPA College**; and
4. an approved application on file with the BPA Undergraduate Programs Office under the Advanced Standing Policy.

*See each degree program description for details.
**Now 2.250; 2.500 required for students approved for fall 1988; see BPA Undergraduate Programs Office for current requirement.
Non-BPA Students

Applicants must have

1. completed a minimum of 56 units;
2. completed a minimum of 12 units at the University of Arizona;
3. a grade-point average based on course work at the University of Arizona of not less than the minimum established by the BPA College*; and
4. an approved application on file with the BPA Undergraduate Programs Office under the Advanced Standing Policy.

*Now 2.250; 2.500 required for students approved for fall 1988; see BPA Undergraduate Programs Office for current requirement.

Exempt Programs

Exempt programs must have the approval of the Dean of the BPA College and the dean of the college which offers the degree program. Students who qualify under this provision will be permitted to take only required upper-division BPA courses which have been specifically approved and designated in their major field of study.

Applicants must

1. be enrolled in a program approved as exempt and have a grade-point average based on University of Arizona course work at least equal to the minimum required in their own college, but not less than 2.000;
2. have completed a minimum of 56 units, 12 of which must have been at the University of Arizona;
3. have been enrolled in a non-BPA program for one full semester; and
4. have an approved application on file each semester with the BPA Undergraduate Programs Office under Advanced Standing Policy.

Catalog Exemption

To qualify for catalog exemption, one must be graduating under the requirements of the 1979-81 or earlier University of Arizona General Catalog. Such students must be registered as qualified under the Advanced Standing Policy with the BPA Undergraduate Programs Office.

Transfer Students

In any of the provisions above, applicants who would otherwise qualify except that they do not meet the requirement of completion of a minimum of 12 units at the University of Arizona will be given provisional permission to enroll in upper-division BPA courses until they have completed this minimum. Thereafter, they must meet all of the regular provisions of the policy. Such students must have an approved application on file with the BPA Undergraduate Programs Office.

PRESCRIBED CURRICULUM FOR BACHELOR OF SCIENCE IN BUSINESS ADMINISTRATION DEGREE

The purpose of the undergraduate curriculum in business administration is to provide a broad education to prepare the student for imaginative and responsible citizenship and leadership roles in business or society, both domestic and worldwide. The bulk of the professional course work is concentrated in the upper-division portion of the degree program following a basic foundation of general education. This foundation includes course work in communications, mathematics and quantitative methods, the language of commerce, the social and behavioral sciences, the natural sciences, world civilizations, values, and international multicultural experience.

The B.S.B.A. degree requires a minimum of 125 units including all of the areas and requirements detailed below. A minimum of 54 units must be completed in course work offered by departments outside of the BPA College. Additionally, a minimum of 57 units must be com-
pleted in upper-division courses numbered 300 or higher. A grade-point average of at least 2.0000 on all work undertaken for the degree program and in the major field is required for graduation.

Students expecting to receive the B.S.B.A. degree must qualify for advanced standing as a BPA student and do so prior to the deadline for application for degree candidacy as published in the General Catalog. Any course work that might be applicable to the upper-division professional core or major requirements taken while enrolled in other colleges or at other universities is subject to acceptance by the BPA College for degree certification purposes.

Minimum Requirements for the B.S.B.A. Degree

I. BASIC SKILLS AND PROFICIENCIES

A. Communications
   - Engl. 101 or 103H 3 units
   - Engl. 102 or 104H 3 units
   - Upper-Division Writing Proficiency Examination* Comm. 412 3 units

B. Mathematics and Quantitative Methods
   - Math. 119** 3 units
   - Math. 123** 3 units
   - M.I.S. 275 3 units

C. Language of Commerce/Pre-Professional Course Work
   - M.I.S. 111 3 units
   - Acct. 200 3 units
   - Acct. 210 3 units
   - "Principles of Economics"*** 6 units

II. STUDY AREAS

A. Biological and Physical Sciences
   Two semesters selected from astronomy, atmospheric sciences, chemistry, ecology and evolutionary biology, geography (103a, 103b, 104a, and 104b only), geosciences, hydrology and water resources, microbiology, molecular and cellular biology or physics (6-8 units)

B. Social and Behavioral Sciences
   Twelve units selected from options list available in BPA Undergraduate Programs Office (12 units)

C. Western and Non-Western Civilizations
   Six units of western and 3 units of non-western civilization course options selected from the relevant lists in the BPA Undergraduate Programs Office (9 units)

D. International and Multicultural Experience
   Fulfilled by two semesters of the same foreign language OR by two courses in international affairs selected from the relevant options list in the BPA Undergraduate Programs Office (6-8 units)

E. Arts, Literature and Ethics
   Fulfilled by selecting one of two options:
   (1) If "ethics" has been selected within the Social and Behavioral Sciences Study Area, then one 3-unit course in art and one 3-unit course in literature are to be chosen from the relevant list in the BPA Undergraduate Programs Office, or
   (2) If "ethics" is not selected elsewhere, then one 3-unit course in ethics and either one such course in art or literature are to be chosen from the list cited in option(1). (6 units)

III. PROFESSIONAL CORE COURSES

All candidates for the degree must complete this set of professional courses. These are normally taken in the junior year except for the capstone business policy course which should be completed in the student's last year:
   - Econ. 330; Fin. 311; M.A.P. 305 and 320; and M.I.S. 373; Mktg. 361; and a business policy option**** which varies with a major (21 units)
IV. MAJOR FIELDS
A major field of at least 15 units is to be selected. Some majors have up to 6 units of required supplemental course work. See individual major listings for details. (15-21 units)

V. FREE ELECTIVES
TOTAL REQUIRED FOR GRADUATION (7-17 units)
Minimum Out-of-College Unit Requirement 125 units
Minimum Upper-Division Unit Requirement 54

TOTAL REQUIRED FOR GRADUATION 57

*Students earning an "unsatisfactory" result on the exam normally will be required to complete additional writing course work as specified by the college.
**The math readiness exam, used to determine math placement, is required. College algebra or the equivalent is prerequisite for Math. 119 and 123.
***Information on the course work required is available from the BPA Undergraduate Programs Office.
****Writing emphasis course. The writing proficiency exam is a prerequisite.

B.S.B.A. Advanced Standing Eligibility Requirements

All students seeking the B.S.B.A. degree must qualify for advanced standing as a BPA student. To do so, the following lower-division requirements must be met: Engl. 101 or 103, 102 or 104; Math. 119, 123; M.I.S. 111, 275; Acct. 200, 210; 6 units of designated "economic principles"; 6 to 8 units of biological and physical sciences; sufficient general education study area, lower-division pre-major and elective units to attain the minimum 56 required by the policy.

MAJOR FIELDS AVAILABLE

Students should declare one of the major fields of business administration upon enrollment. Any subsequent change in major is accomplished by completing a change-of-major form available in BPA 108.

The major consists of 15 units. Some majors also require supplemental or pre-major course work. Additional units beyond the requirements are optional to the student. To graduate the student must have a grade-point average of 2.000 or better in courses undertaken in the major field. This average is computed on all courses attempted that may be used in the major, but does not include any pre-major courses or any course taken for the business policy option. BPA students are not allowed credit for more than one policy course in their degree program. Students electing a second major field may choose any policy course option listed under either of the respective major descriptions.

Students may transfer no more than 9 units of credit toward the major from other colleges or universities and must earn at least 6 units of University of Arizona residence credits in the major in the BPA College.

The requirements for each major field in business administration are given below.

Accounting

This major prepares students for diversified careers in the independent practice of public accounting, in controllership for business and government, and in general accounting management. All students planning to major in accounting must complete M.I.S. 121 before beginning the major. Accounting majors must complete Acct. 310 and 471 or M.I.S. 471 to fulfill the business policy requirement. Credit is given for Acct. 461 or Acct. 471, but not for both. Acct./M.I.S. double majors planning to take Acct. 461 should take M.I.S. 471 for the policy requirement.

(a) All accounting majors must complete: Acct. 300a-300b.
(b) An additional 9 units (three courses) must be selected from the following: Acct. 320, 401, 410, 422, 431,* 461, 472.

*P; 300b; 405 or M.I.S. 375.

Some states require a five-year program to be eligible to sit for the Uniform C.P.A. Examination; for this and other career reasons, a five-year program leading to the Master of Accounting degree (see Graduate Catalog) may be necessary to achieve a student's objectives. Information concerning the legal requirements for taking the Uniform C.P.A. Examination may be
obtained by writing the state board of accountancy in the capital city of the appropriate state. In Arizona the address is 3110 N. 19th Ave., 140, Phoenix, AZ 85015.

Business Economics

This major is designed for those who wish to concentrate in economic analysis and to prepare themselves for such professional work in business firms, governmental agencies, private research, or consulting firms; or to enter college teaching following graduate study. Business economics majors must take Econ. 361 and M.I.S. 375 prior to beginning major courses, and Geog. 471, M.A.P. 471, M.I.S. 471, or Mktg. 471 to fulfill the business policy requirement.

The major consists of 15 units of economics, including Econ. 332, to be selected from the 300- and 400-level courses offered by the Department of Economics.

Finance

This major offers undergraduate preparation for careers or graduate work in corporate financial management, investment analysis, security brokerage, and investment or commercial banking. Finance majors must take Acct. 320 and M.I.S. 375 prior to beginning major courses, and Fin. 471 or M.A.P. 471 to fulfill the business policy requirement.

(a) All students in this major will complete Fin. 412, 421, and 431.
(b) Six additional units (two courses) will also be chosen from the following: Acct. 300b, 401; Econ. 332, 422, 442, Fin. 361, 362, 422; A.Ec. 313; M.A.P. 426.

General Business Administration

This major gives the student a broad knowledge of the principal areas of business administration. It prepares the graduate for a variety of careers (including intensive graduate study in business), and aims to educate generalists rather than specialists. It may not be combined with any of the other business major options. General business administration majors must take M.A.P. 471 to fulfill the business-policy requirement.

The major consists of 15 units. Students will select one 3-unit 300- or 400-level course from each of five of the following seven areas: (1) accounting; (2) economics; (3) finance and real estate; (4) geography and regional development (305, 371, 379, 453, 456 or 461 only); (5) management and policy; (6) management information systems; and (7) marketing (364 and 366 may not be selected).

Management Information Systems

This major is designed for students with interest in establishing careers in the analysis, design, implementation, use and management of computerized information systems in an organizational environment.

All students planning to major in management information systems must complete M.I.S. 121 before beginning the major. M.I.S. majors must take M.I.S. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete M.I.S. 301, 307, 341 and 441.
(b) An additional three units (one course) must be selected from the following: M.I.S. 331, 421, 422, 451, and 461.

Materials describing career paths, recommended major courses, and suggested options for upper-division nonbusiness electives are available in the M.I.S. office.

Marketing

The major offers undergraduate preparation for careers both in business and in nonprofit organizations. Attention is given to understanding the changing wants of customers and the public; the development of products and services, pricing, distribution, promotion, planning, execution and control of marketing programs; and maintenance of satisfactory relationships with customers and the public. Marketing majors must complete M.I.S. 375 prior to beginning major courses, and Mktg. 471 to fulfill the business-policy requirement.
(a) All students in the major will complete Mktg. 440 and 450. (Mktg. 361, a prerequisite to all 400-level marketing courses, should be taken in the first semester of the junior year; Mktg. 440 and 450 must be completed prior to taking Mktg. 471. (b) Nine additional units (three courses) are to be selected from 400-level marketing courses. (At least one of these three courses must be taken prior to taking Mktg 471.)

Operations Management

This major offers preparation for management careers in manufacturing and service operations. Emphasis is placed on operation and control of inventory systems, materials management, plant and project scheduling, and service design. Both quantitative and computer based techniques are used for specific applications in these areas.

The major is also useful for those who wish to understand more about the functioning of the production system of any organization. All students planning to major in operations management must complete M.I.S. 121 or 122 before beginning the major. Operations management major must take M.A.P. 471 to fulfill the business policy requirement.

(a) All students in the major will complete M.I.S. 473a-473b.
(b) Nine additional units (three courses) will be completed from the following: M.I.S. 301, 331, 421, 474, 476, 477; S.I.E. 405, 462.

Personnel Management

This major is concerned with the recruiting, development, compensation, and utilization of human resources, and with the creation of constructive human relationships within modern organizations. Prospective majors are strongly urged to choose elective courses in psychology and sociology. Psyc. 101 should be elected in the freshman or sophomore years. Personnel management majors must complete M.A.P. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete M.A.P. 330 and 430.
(b) Nine additional units (three courses) must be selected from the following: Coun. 401, Econ. 382, 383, 386, Psyc. 450, M.A.P. 411, 413, 444, 479, 480.

Real Estate

This major, by providing a broad basic understanding of the legal, economic, social, and civic aspects of real property, prepares the student for a career in both the real estate profession and related industries. Real estate majors must take Acct. 320 and Fin. 261 before beginning major courses, and Geog. 471, M.A.P. 471 or Fin. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete Fin. 361, 362, 461.
(b) Six additional units (two courses) must be selected from the following: Econ. 435, 436; Fin. 251, 463, 465; Geog. 379; M.A.P. 426; Ping. 485.

PRESCHRED CURRICULUM FOR BACHELOR OF SCIENCE IN PUBLIC ADMINISTRATION DEGREE

The undergraduate curriculum in public administration seeks to provide the student with a broad general education as well as preparing one for imaginative and responsible citizenship and leadership roles in the public sector of society. The broad general education foundation includes course work in communications, mathematics and quantitative methods, the language of commerce, the social and behavioral sciences, the natural sciences, western and non-western civilizations, values, and international multicultural experience. The professional portion of the program includes course work in management, policy and public sector administration.

The B.S.P.A. degree requires a minimum of 125 units including all of the areas and requirements detailed below. A minimum of 54 units must be completed in course work offered by departments outside the BPA College. Additionally, a minimum of 57 units must be completed in upper-division courses numbered 300 or higher. A grade-point average of at least 2.0000 on all work undertaken for the degree program and in the major field is required for graduation.
Students expecting to receive the B.S.P.A. degree must qualify for Advanced Standing as a BPA student and do so prior to the deadline for application for degree candidacy as published in the General Catalog. Any course work that might be applicable to the upper-division professional core or major requirements which is taken while enrolled in other colleges or at other universities is subject to acceptance by the BPA College for degree certification purposes.

Minimum Requirements for the B.S.P.A. Degree

### I. BASIC SKILLS AND PROFICIENCIES

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<tr>
<th>Units</th>
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<tbody>
<tr>
<td>A. Communications</td>
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<tr>
<td>Engl. 101 or 103H</td>
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<tr>
<td>Engl. 102 or 104H</td>
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<tr>
<td>Upper-Division Writing Proficiency Examination*</td>
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<tr>
<td>Comm. 412</td>
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<tr>
<td>B. Mathematics and Quantitative Methods</td>
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<tr>
<td>Math. 119 **</td>
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<tr>
<td>Math. 123 **</td>
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<tr>
<td>M.A.P. 204***</td>
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<tr>
<td>M.I.S. 275</td>
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<tr>
<td>C. Language of Commerce/Pre-Professional Course Work</td>
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<tr>
<td>M.A.P. 100</td>
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<td>M.I.S. 111</td>
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<tr>
<td>Acct. 200</td>
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<tr>
<td>Acct. 272</td>
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<tr>
<td>“Principles of Economics”†</td>
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### II. STUDY AREAS

<table>
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<tbody>
<tr>
<td>A. Biological and Physical Sciences</td>
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<td>Two semesters selected from astronomy, atmospheric sciences, chemistry, ecology and evolutionary biology, geography (103a, 103b, 104a, and 104b only), geosciences, hydrology and water resources, microbiology, molecular and cellular biology or physics (6-8 units)</td>
</tr>
<tr>
<td>B. Social and Behavioral Sciences</td>
</tr>
<tr>
<td>Twelve units selected from options list available in BPA Undergraduate Programs Office (12 units)</td>
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<tr>
<td>C. Western and Non-Western Civilizations</td>
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<tr>
<td>Six units of western (6) and three units of non-western (3) civilization course options selected from the relevant lists in the BPA Undergraduate Programs Office (9 units)</td>
</tr>
<tr>
<td>D. International and Multicultural Experience</td>
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<tr>
<td>Fulfilled by two semesters of the same foreign language OR by two courses in international affairs selected from the relevant options list in the BPA Undergraduate Programs Office (6-8 units)</td>
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<tr>
<td>E. Arts, Literature and Ethics</td>
</tr>
<tr>
<td>Fulfilled by selecting one of two options:</td>
</tr>
<tr>
<td>(1) If “ethics” has been selected within the Social and Behavioral Sciences Study Area, then one 3-unit course in art and one 3-unit course in literature are to be chosen from the relevant list in the BPA Undergraduate Programs Office, or</td>
</tr>
<tr>
<td>(2) If “ethics” is not selected elsewhere, then one 3-unit course in ethics and either one such course in art or literature are to be chosen from the list cited in option (1). (6 units)</td>
</tr>
</tbody>
</table>

### III. PROFESSIONAL CORE COURSES

All candidates for the degree must complete this set of professional courses. They are normally taken in the junior year with the exception of M.A.P. 472 which should be taken in the student’s last year:

- M.A.P. 305 and 410a; M.I.S. 373; Econ. 435†; Pol. 474; and M.A.P. 472††

### IV. MAJOR FIELDS

A major field of 21 units is to be selected. This is comprised of 12 units of restricted options in the selected major area plus 9 units chosen from among one of three management emphasis areas.
V. FREE ELECTIVES

TOTAL REQUIRED FOR GRADUATION

- Minimum Out-of-College Unit Requirement: 54 units
- Minimum Upper-Division Unit Requirement: 57 units

*Students earning an "unsatisfactory" result on the exam normally will be required to complete additional writing course work as specified by the college.

**The math readiness exam, used to determine math placement, is required. College algebra or the equivalent is prerequisite for Math. 119 and 123.

**To be completed prior to M.I.S. 275.

†Information on the total required course work in economics is available from the BPA Undergraduate Programs Office.

††Writing Emphasis course. The writing proficiency exam is a prerequisite.

B.S.P.A. Advanced Standing Eligibility Requirements

All students seeking the B.S.P.A. degree must qualify for Advanced Standing as a BPA student. To do so, the following lower-division requirements must be met: Engl. 101 or 103, 102 or 104; Math. 119, 123; M.I.S. 111, 275; M.A.P. 100, 204; Acct. 200, 272; 6 units of designated "economic principles"; 6 to 8 units of biological and physical sciences; sufficient general education study area and elective units to attain the minimum 56 required by the policy.

MAJOR FIELDS AVAILABLE

Students should declare one of the major fields in public administration upon enrollment. Any subsequent change of major is accomplished by completing a change-of-major form available in BPA 108.

The major consists of 21 units. Twelve units are selected from a set of restricted options in the major field with an additional 9 units chosen from the options in a selected management emphasis area. Additional units beyond these requirements are optional to the student. To graduate the student must have a grade-point average of 2.0000 or better in all courses applicable to the major.

Students may transfer no more than 9 units of credit toward the major from other colleges or universities and must earn at least 12 units of University of Arizona residence credits in the major in the BPA College.

The requirements for each major field in public administration are given below.

Public Management

This major, which should be selected by all B.S.P.A. students except those with firm preferences for other specific fields, prepares students for administrative positions in government and quasi-public agencies. Graduates of the program may choose to enter policy areas of government, defense, manpower, transportation, housing, environment, energy, education, and other fields through entry-level positions in a variety of areas including program analysis, research and evaluation, budgeting and finance, personnel, and public information. The public management major also prepares students for graduate study in law, in specialized planning and administrative fields, or in public policy and administration.

(a) All students in this major will complete 12 units from M.A.P. 330, 401, 413; M.I.S. 475, 478.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below. Some public management major required courses overlap with courses in the management emphasis areas. If this occurs, students selecting these courses cannot use them to fulfill the management emphasis area requirement. Substitutions must be approved by the student's major advisor.

Criminal Justice Administration

This major prepares students for operational and administrative responsibilities in courts, corrections and police work, as well as for graduate study in law or in the administration of justice.

(a) All students in this major will complete M.A.P. 331, 332 and two of the following: M.A.P. 337, 431, 436.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.

Health Services Administration

This major is appropriate for students desiring careers in the planning and implementation of national, state, or local health policies, programs, and services. Positions may involve hospital administration, as well as the management of public or volunteer health agencies and medical care services. Long-term care administration, with special reference to the aged, is offered as part of this major. Students in health services administration may also prepare for graduate study in health and allied professions.

(a) All students in this major will complete 12 units from M.A.P. 354, 454, 455, 456; Econ. 487.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.

Human Services Administration

This major prepares students to exercise operational skills and administrative responsibility in human service agencies, institutions, and organizations. In developing management skills in the human service policy area, this major is effective preparation for entry-level positions and for graduate study in such fields as social work, social planning, and human services administration.

(a) All students in this major will complete 12 units from M.A.P. 348, 360, 454, 463, 466.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.

Public Recreation Administration

At the time of catalog printing this major was undergoing modification. For current information, contact the Undergraduate Programs Office, BPA 108.

Management Emphasis Areas

To complete any of the majors identified above, except public recreation administration, the student must also complete the requirements of one of the management emphasis areas described below. Options available in the management emphasis areas are operations management, human resources management, and policy analysis and strategic planning.

OPERATIONS MANAGEMENT - All students choosing this management emphasis area will complete:

(a) M.I.S. 476, 478.
(b) Three units of course work selected from M.I.S. 474, 479. Three units of other course work may be substituted with approval of the student's major advisor.

HUMAN RESOURCES MANAGEMENT - All students choosing this management emphasis area will complete:

(a) M.A.P. 330, 430.
(b) Three units of course work selected from M.A.P. 411, 413, 444, 480; Econ. 382, 383, 386; Coun. 401; Psyc. 450.; M.I.S. 479.

POLICY ANALYSIS AND STRATEGIC PLANNING - All students choosing this management emphasis area will complete:

(a) M.A.P. 401, 405.
(b) Three units of course work selected from M.A.P. 410b; Econ. 436; Pol. 406, 407, 480; Mktg. 470.

ENTREPRENEURIAL STUDIES PROGRAM

Sponsored by the Karl Eller Center for the Study of the Private Market Economy, the entrepreneurial studies program is for seniors in the College of Business and Public Administr-
tion and M.B.A. students. The program prepares students for careers as leaders in venture capital and investment banking activities, as managers of innovative corporate endeavors, and as independent entrepreneurs.

The program will provide students with the conceptual and analytical framework for conceiving, planning and initiating innovative business ventures. In particular, the program aims to impart an understanding of the nature of entrepreneurship, as well as the conditions necessary for its success.

OTHER COLLEGE PROGRAMS

The Board of Advisors—A group of leading executives from Arizona and other states serves as the Board of Advisors to the College of Business and Public Administration, assisting in the development of resources, providing a communication link between the college and management community, reviewing the goals and objectives of the college, and advising and assisting the dean in the resolution of important policy issues. An important dimension of the board's activities centers around member interaction with the students and faculty of the college.

The Business Partners—Believing that it exists within the total context of the private and public organizational sectors, the college maintains a Business Partners Program in which the institution and the business community provide one another with resources. Among the services supplied to business and industry is assistance in the recruitment of graduates.

The College Alumni Council—The College of Business and Public Administration is one of several within the University which has organized its own Alumni Council. The council assists in obtaining wide recognition of its accomplishments by sponsoring public events at which faculty expertise is made available to the larger community.

The Division of Economic and Business Research (DEBR)—One of the major public services of the college, the division specializes in applied research (as differentiated from scholarly research undertaken by departmental faculty) into economic matters affecting the state of Arizona. The division publishes statistical material as well as the Arizona Review and Arizona's Economy, which contain articles of general interest about the state's changing economy.

The Department of Executive Programs—The Department of Executive Programs utilizes college faculty, as well as experts from across the country, in the presentation of conferences, programs and seminars for executives. The Executive Development Conference, a semi-annual nine-day program, attracts top executives from throughout the U.S. and several foreign countries.

Distinguished Lectures—Throughout the academic year, leaders in American business and public management are brought to the college to speak to students and faculty. The MBA Student Association sponsors an Executive Lecture Series. Other lectures are presented periodically when exceptional executive talent is available.

Career Guidance—in addition to the services offered by the University of Arizona Placement Office, the College of Business and Public Administration provides career assistance to its students. At career forums throughout the year, students learn more about the kinds of career opportunities available in a variety of business and public fields. Executives also serve as guest speakers in classes and at special programs sponsored by BPA student organizations.

STUDENT INVOLVEMENT

The college encourages student participation in the numerous professional clubs, organizations and honorary societies associated within the various fields with business and public administration.

The BPA student council is a college-wide service organization which serves as a liaison between students, faculty, administration and other student organizations. The council sponsors and participates in a variety of college activities and programs.

The honoraries and professional organizations affiliated with the college include Alpha Kappa Psi, a professional business fraternity; Alpha Mu Alpha, a national marketing honorary; American Marketing Association, a professional marketing organization student chapter; Beta
Alpha Psi, a national accounting honorary; Beta Gamma Sigma, a national scholastic honor society; Delta Sigma Pi, an international business fraternity; Management Information Systems Association, a professional information systems organization; Phi Chi Theta, a college professional fraternity; Pi Alpha Alpha, the National Honor Society for Public Affairs and Administration; Public Administration Student's Association; University of Arizona Personnel Administration Association, a student chapter of the American Society for Personnel Administration; Economics Club; and Finance Club.

Outstanding student accomplishments are recognized each year through the presentation of a number of awards and honors.
College of Education

The College of Education is committed to the preparation of qualified individuals in fields of instruction in elementary, secondary, special, and postsecondary education, bilingual education, reading, and rehabilitation. Further, the college prepares individuals in the supervision and administration of elementary and secondary schools, special education schools and facilities, community colleges, and universities. The college is composed of the divisions of Educational Foundations and Administration; Language, Reading and Culture; Special Education and Rehabilitation; and Teaching and Teacher Education. The college also administers the Center for the Study of Higher Education, the Arizona Center for Educational Research and Development, and the Arizona Center for Evaluation and Measurement.

ACADEMIC DIVISIONS

In 1985, the College of Education began a process of reorganization in which two academic units, Counseling and Guidance and the Graduate Library School, were transferred into more appropriate colleges and the remaining departments were dissolved and realigned within four divisions. The new administrative structure more closely reflects the direction of academic planning currently under way within the college.

The Division of Educational Foundations and Administration houses three programs: educational administration, educational psychology, and higher education. Educational administration is concerned with preparing administrators for a variety of positions in the elementary and secondary schools. Educational psychology examines psychological processes in educational settings, emphasizing learning and development, testing and measurement, and school psychology. Higher education focuses on the development and dissemination of knowledge about postsecondary education, including universities and colleges, regional and state agencies, the federal government, and various policy-making organizations. The division offers graduate degree programs in educational administration, educational psychology, foundations of education, and higher education.

The Division of Language, Reading, and Culture brings together faculty members concerned with research, scholarship, and teaching related to the use of language in school and society. The faculty is specifically concerned with reading, composition, and bilingual and multicultural education. The division offers graduate degree programs in reading and in bilingual/bicultural education.

The Division of Special Education and Rehabilitation focuses upon all exceptional persons, the gifted as well as the handicapped. The division has three missions: (1) to add to the status of knowledge about exceptional persons through research, (2) to prepare professional personnel to serve the exceptional population, and (3) to provide technical assistance to local, state, and federal agencies. The division offers academic degree programs in special education and rehabilitation.

The Division of Teaching and Teacher Education offers programs directed toward the pre-service preparation of elementary and secondary school teachers, the continuing in-service education of certified members of the teaching profession, and advanced graduate training of professional educators. The division offers academic degree programs in early childhood, elementary, and secondary education and in educational media.

PROGRAM REQUIREMENTS

At the time the catalog was being edited, many programs in the College of Education were undergoing revision. All current or prospective students should check with the Office of Student Services in the college or consult the appropriate division for information on current degree requirements.
DEGREES, MAJORS, AND MINORS

DEGREES—The College of Education offers academic programs leading to the Bachelor of Arts in Education, Bachelor of Science in Education, Master of Arts, Master of Science, Master of Education, Master of Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy.

GRADUATE MAJORS—The Doctor of Philosophy degree is available with majors in educational administration, educational psychology, elementary education, foundations of education, higher education, reading, rehabilitation, secondary education, and special education. The Doctor of Education degree is available with majors in educational administration, educational psychology, elementary education, foundations of education, higher education, reading, rehabilitation, secondary education, and special education. The Educational Specialist degree is offered with majors in educational administration, educational media, educational psychology, elementary education, reading, secondary education, and special education. At the master's level, majors are offered in bilingual/bicultural education, educational administration, educational media, educational psychology, elementary education, foundations of education, higher education, reading, rehabilitation, secondary education, and special education. In addition, teaching majors for master's level degrees may be selected from over 24 departments outside the College of Education. Not all majors listed above are available for all master's degrees. Consult the appropriate division for details on specific master's level majors.

For further information on requirements for graduate degree programs in education, please see the Graduate Catalog.

UNDERGRADUATE MAJORS—At the undergraduate level, students select either a major administered within the College of Education or a subject area teaching major administered through another academic department. Majors within the College of Education are available in rehabilitation, early childhood education, and elementary education. For information on course requirements for these majors, students should consult an advisor in the appropriate division of the college. Teaching majors are defined as the secondary school academic subject area in which the student plans to teach. These majors are administered through the relevant academic departments in cooperation with the College of Education, which is responsible for providing the necessary professional education course work. Subject area course requirements for prospective teachers will be found under the appropriate academic department in the Departments and Courses of Instruction section of this catalog. For information on the professional education requirements, consult an advisor in the Division of Teaching and Teacher Education.

The Bachelor of Science in Education degree is awarded for a major in rehabilitation and for teaching majors in mathematics, physical education, or any one of the physical sciences. The Bachelor of Arts in Education degree is awarded for majors in early childhood education, elementary education, or any teaching major area other than mathematics, physical education, or one of the physical sciences. See "Majors and Minors for Secondary School Teaching" for a list of available teaching majors.

A student who wishes to pursue a degree in education without obtaining a teaching certificate may enroll in a special noncertification track within any one of the secondary school subject area majors (see Noncertification Track within "Majors in Secondary Education" in Undergraduate Programs below).

UNDERGRADUATE MINORS—Most teaching majors will require a teaching minor in a second field of specialization. Course requirements for these teaching minors will be listed under the relevant academic department in the Departments and Courses of Instruction section of this catalog. Four particular teaching majors are sufficiently comprehensive as to require no additional minor subject (see "Majors Requiring No Minor").

Students who major in elementary education are required to choose a subject matter minor. The minor should be selected and planned with the assistance of an advisor in the Division of Teaching and Teacher Education. Majors in early childhood education and in rehabilitation will also require a minor field.

Two nonteaching minors are available in the areas of rehabilitation and special education. These minors can be combined with education or teaching majors or can be selected by
persons who wish to explore these fields as an adjunct to majors outside the College of Education.

**SELECTION OF MAJORS AND MINORS**— Majors and minors should be selected in consultation with a College of Education advisor as early in the undergraduate career as possible, and no later than the junior year. Major subjects may be changed at the beginning of any semester. However, if a change of major or minor field is made late in the program, an additional semester or more may be necessary to complete the required course work.

Teaching majors and minors should be selected from the following lists of subjects commonly taught in high schools in most states. With the exception of the four majors that require no minors, all subject areas available as teaching majors may also be chosen as teaching minors; additional subject areas are available as minors only.

### Majors and Minors for Secondary School Teaching

#### Majors Requiring a Minor

The following teaching majors are also available as teaching minors.

<table>
<thead>
<tr>
<th>Major</th>
<th>Minors Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Journalism</td>
</tr>
<tr>
<td>Communication</td>
<td>Latin</td>
</tr>
<tr>
<td>Earth Science</td>
<td>Mathematics</td>
</tr>
<tr>
<td>English</td>
<td>Physical Education</td>
</tr>
<tr>
<td>French</td>
<td>(secondary emphasis)</td>
</tr>
<tr>
<td>General Biology</td>
<td>Physics</td>
</tr>
<tr>
<td>Geography</td>
<td>Political Science</td>
</tr>
<tr>
<td>German</td>
<td>Russian</td>
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<tr>
<td>History</td>
<td>Spanish</td>
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<tr>
<td><strong>Minors Only</strong></td>
<td></td>
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<tr>
<td>Anthropology</td>
<td>Italian</td>
</tr>
<tr>
<td>Athletic Coaching</td>
<td>Oriental Studies</td>
</tr>
<tr>
<td>Bilingual/Bicultural Education</td>
<td>Portuguese</td>
</tr>
<tr>
<td>Chemistry/Physics</td>
<td>Psychology</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Media Arts</td>
</tr>
<tr>
<td>Economics</td>
<td>Sociology</td>
</tr>
</tbody>
</table>

#### Majors Requiring No Minor

Extended English—For information, see the Department of English section in this catalog.

Physical Education—(K-12 emphasis) - For information, see the Department of Exercise and Sport Sciences section in this catalog.

Language Arts-Social Studies—A 50-unit combination of language arts and social studies intended for junior high/middle school teaching. For information, see an advisor in the Division of Teaching and Teacher Education.

Social Studies—A 50-unit combination of social studies intended for secondary school teaching. For information, see an advisor in the Division of Teaching and Teacher Education.

### Teaching Majors for Degrees Outside the College of Education

Three academic units outside the College of Education offer programs for training teachers in their particular disciplines. These majors will earn degrees specific to those units, rather than College of Education degrees. A major in art education, for example, offered by the College of Arts and Sciences, Faculty of Fine Arts, will earn a Bachelor of Fine Arts degree; similarly, a major in agricultural education, offered by the College of Agriculture, will earn a Bachelor of Science in Agriculture degree.

Note that the major in early childhood education is available for either the Bachelor of Arts in Education degree through the College of Education, or the Bachelor of Science in Family
and Consumer Resources degree through the College of Agriculture. For information on either major, consult the appropriate advisor in the Division of Teaching and Teacher Education or the School of Family and Consumer Resources.

The following teaching majors and degrees are available outside the College of Education.

Agricultural Education  
(B.S. in Ag.)

Art Education (B.F.A.)  
Drama Education (B.F.A.)  
Early Childhood Education  
(B.S. in F.C.R.)

Health Education (B.S. in H.S.)

Home Economics Education  
(B.S. in F.C.R.)

Home Economics Extension Education  
(B.S. in F.C.R.)

Music Education (B.M.)  

College of Agriculture

College of Arts and Sciences

College of Agriculture

School of Health-Related Professions

College of Agriculture

College of Agriculture

Business Education—The University offers no formal major in business education. However, students with an interest in teaching business and office subjects can do so through a program developed in cooperation between the College of Education and the College of Business and Public Administration. As candidates for the Bachelor of Science in Business Administration degree (B.S.B.A.) with a major in general business administration, these students will satisfy the requirements for a teaching certificate through the College of Education while completing the requirements for the business major. Because of the nature of the course requirements, students considering this program are encouraged to consult an advisor in the College of Business and Public Administration early in their academic careers.

ADMISSION REQUIREMENTS

Formal admission to the College of Education is required of all undergraduate students who wish to pursue a major for a College of Education degree as well as for most students who wish to enroll in restricted professional education courses for the purposes of earning a teaching certificate. To be admitted, applicants must meet the following requirements:

1. Completion of 56 units of credit applicable to a baccalaureate degree.
2. Cumulative grade-point average of 2.5000 or better. (This also applies to transfer students' work taken at other institutions.)
3. Passing scores on all three portions of the Pre-Professional Skills Test (PPST). (This third requirement applies to students who plan a career in teaching, that is, students in all undergraduate majors except rehabilitation.)

Students normally apply for admission to the College of Education at the beginning of their junior year, having completed their first two years of study in the College of Arts and Sciences as pre-education majors. However, students are encouraged to consult the pre-education advisor in the Office of Student Services in the College of Education as soon as they begin considering education as a career goal in order to plan their lower-division course work most effectively (see Academic Advising).

Admission to the College of Education is also required for post-baccalaureate students, although their application requirements will differ from those listed above for undergraduates (see Post-Baccalaureate Program).

REstricted Enrollment in Professional Education Courses

Most professional education courses (also referred to as "methods" courses) are closed to undergraduate students who have not met the following requirements:

1. Completion of 56 units of credit applicable to a baccalaureate degree,
2. A cumulative grade point average of 2.5000 or better, and
3. Passing scores on all three portions of the Pre-Professional Skills Test (PPST).

This enrollment restriction applies to all degree-seeking undergraduates, whether or not they are majoring in the College of Education. The restriction involves a variety of courses in several divisions of the College of Education as well as certain education-related courses in other colleges. A list of restricted courses is available in the Office of Student Services in the College of Education.

A student planning to select a major for an undergraduate education degree is also required to be formally admitted to the College of Education prior to enrolling in these courses. Such a student should consult the pre-education advisor in the Office of Student Services to make the necessary arrangements.

Students majoring outside the College of Education (see “Teaching Majors for Degrees Outside the College of Education”) are required to meet the same three requirements listed above. Such students must obtain cards of admittance (“red cards”) from the Office of Student Services prior to registering for these courses, indicating that the requirements have been met. Information regarding the PPST, including advisement and remediation, may be obtained from the Office of Student Services.

Post-baccalaureate students working toward teacher certification are not required to take the PPST, but they do need to be formally admitted to the College of Education prior to taking professional education courses. The requirements for their admission, however, will differ from those listed for undergraduates. The pre-education advisor in the Office of Student Services is available to help these persons complete the necessary procedures (see Post-Baccalaureate Program).

Graduate students must also meet certain requirements prior to taking professional education courses. These students should check with the Office of Student Services prior to enrolling to learn how the restrictions apply to them.

IMPORTANT: Students who enroll in professional education courses without meeting eligibility requirements will be dropped from the classes. If, through student or administrative oversight, an ineligible student completes a restricted course, Arizona law and Board of Regents policy expressly prohibits the use of the course toward meeting teacher certification requirements. It is therefore essential that prospective enrollees confirm their eligibility with the pre-education advisor in the Office of Student Services prior to registering for a restricted course.

Any student who is not admitted to the College of Education and who is considering taking an education course should check with the pre-education advisor in the Office of Student Services to determine his or her eligibility.

**POST-BACCALAUREATE PROGRAM**

Persons who have previously earned a bachelor's degree and are interested in obtaining a state teaching certificate may apply for admission to the College of Education's Post-Baccalaureate Program. To be considered, the applicant must have earned the undergraduate degree at a regionally accredited institution, with an overall grade-point average of 2.5000 or better.

Those interested in the program should begin by consulting the pre-education advisor in the Office of Student Services in the College of Education. The advisors will work with them throughout the admission procedures, which will include preliminary enrollment as an unclassified undergraduate pre-education major in the College of Arts and Sciences and a subsequent evaluation of the student's record by an appropriate faculty advisor, either in the Division of Teaching and Teacher Education or in a relevant academic department. When these steps have been successfully completed, the student will be admitted to the College of Education and become eligible to register for professional education courses (see Restricted Enrollment in Professional Education Courses).

Students in the program will be required to pass the basic skills portion of the Arizona Teacher Proficiency Examination (ATPE) before they can begin their student teaching, and they will need to pass the professional knowledge portion of the examination prior to their certification. Students can expect to spend from two to four full-time semesters in the Post-Baccalaureate Program, depending upon the type of certificate desired (elementary or secondary) and the content of their undergraduate program.

Further information is available in the Office of Student Services.
ACADEMIC ADVISING

Any student enrolled in the University who is considering a career in education may consult an advisor in the Office of Student Services in the College of Education. The advisor will assist the student in making a decision regarding education as a career field and in selecting an appropriate field of specialization. Though students will remain enrolled in the College of Arts and Sciences for the first two years of their undergraduate study, their course selection during this period is very important. For this reason, a pre-education advisor in the Office of Student Services is available to students to work with them in planning and completing the necessary course work. Upon formal admission to the College of Education (see Admission Requirements), students will be assigned an advisor in the division appropriate to their chosen major.

DEAN’S HONOR LISTS

The college honors high academic achievement in a semester through the Dean's Honor List. Students who attain a grade-point average of 3.500 or better based on 12 units with letter grades (excluding pass/fail or “S” grades) will earn Honorable Mention; students meeting the same grade-point requirement for 15 units will be eligible for the Dean's List; and those with a 4.000 grade-point average for 15 units will earn the Dean's List with Distinction. The honor lists are posted on the college bulletin board at the close of each semester. All honor students receive a certificate of recognition and the honor is noted on the student's transcript. For specific information on the several Dean's List categories and other academic honors, see the Academic Honors and Awards section of the catalog.

UNDERGRADUATE PROGRAMS

The faculty and administration of the College of Education are dedicated to the continuing development and improvement of their undergraduate preprofessional programs. The following undergraduate programs are currently being offered within the divisions of Special Education and Rehabilitation and of Teaching and Teacher Education.

Major in Early Childhood Education

Early childhood education is the appropriate major for students in the College of Education or the School of Family and Consumer Resources who intend to pursue teaching careers at the preschool, kindergarten, or primary grade levels. Since the teacher education programs are undergoing revision, students should check with the Division of Teaching and Teacher Education for course requirements for the major leading to the Bachelor of Arts in Education degree.

Major in Elementary Education

Students who wish to prepare for teaching careers in grades kindergarten through sixth grade should select a major in elementary education. Since the teacher education programs are undergoing revision, students should check with the Division of Teaching and Teacher Education for course requirements for the major leading to the Bachelor of Arts in Education degree.

Dual Program in Bilingual and Elementary Education—This course of study is intended for students who plan to teach in classrooms operating bilingual curricula in English and Spanish.

Major in Secondary Education

College of Education students planning to teach at the secondary school level must complete the requirements for a teaching major or a teaching major and minor from among the subjects and fields listed under Majors and Minors for Secondary School Teaching in the preceding section.

Though these students will not transfer to the College of Education until their junior year, they should take T.T.E. 225, Introduction to Teaching, in their freshman or sophomore years. Students are encouraged to contact an advisor in the Office of Student Services during their lower-division years concerning selection of appropriate teaching majors and minors.
Since the teacher education programs are undergoing revision, students should check with the Division of Teaching and Teacher Education for current degree requirements.

*Noncertification Track*—For students who wish to work in educational services outside the formal classroom setting, the College of Education provides a noncertification track within each of the secondary school subject area majors. Depending upon the subject area chosen, the student will earn either a Bachelor of Science in Education or a Bachelor of Arts in Education degree. This option is available for students interested in seeking education-related positions in business, government, the military, social services, adult education, and industry.

**Major in Rehabilitation**

The major in rehabilitation will prepare students for work in positions in various service areas, including rehabilitation, social, and education programs. Since the program in rehabilitation is undergoing revision, students should check with the Division of Special Education and Rehabilitation for current degree requirements.

**Minor in Rehabilitation**

A nonteaching minor in rehabilitation is available at the undergraduate level. Since the program in rehabilitation is undergoing revision, students should check with the Division of Special Education and Rehabilitation for current degree requirements.

**Minor in Special Education**

A nonteaching minor in special education is available at the undergraduate level. Since the program in special education is undergoing revision, students should check with the Division of Special Education and Rehabilitation for current degree requirements.

**LONDON SEMESTER**

The London Semester, sponsored by the Division of Teaching and Teacher Education, is offered as an educational option to encourage students toward the development of a comprehensive view of global education. This program of foreign study presents opportunities for personal development through experiencing the culture, educational system, and language of the United Kingdom. The academic focus upon global education seeks to cultivate in students a perspective of the world which emphasizes the interconnection among cultures, species, and the planet.

Though designed for students within the College of Education, students majoring in other areas are also invited to apply. Prior to admission to the program, students must consult with the academic advisor for the London Semester in the Division of Teaching and Teacher Education in order to review their academic progress and to determine their eligibility for the program.

**CERTIFICATION FOR COMMUNITY COLLEGE TEACHING**

The College of Education cooperates with departments in other colleges of the University in the preparation of students who are candidates for community college teaching certificates. The Arizona Board of Directors for Community Colleges has established the following standards for academic certification.

The minimum requirements for an Arizona Community College Regular Certificate, valid for six years, shall be:

1. A master's or higher earned degree with at least 24 semester hours of upper-division and/or graduate credit in the field to be taught, or
2. A bachelor's degree in a specific area with at least three years of directly related occupational experience and skill in the field to be taught, or
3. An associate's degree or at least 64 semester hours and, in addition, at least five years of directly related occupational experience in the field to be taught.
In addition, applicants must have completed an approved course on the subject of the community college offered at one of the Arizona universities or by a community college district. Provisional, special, and honorary Arizona community college certificates are available with varying requirements and periods of validity. The Center for the Study of Higher Education in the College of Education will assist individuals seeking application information on these certificates. The above standards are subject to modification by the Arizona State Board of Directors of Community Colleges.

RESEARCH CENTERS AND PUBLIC SERVICE

Research centers and public services operating within the College of Education greatly enhance the academic programs and research capabilities of the college. Basic and applied research is conducted in all contexts and at all levels of professional education. Professional services are available to clientele ranging from individuals to such institutions as school districts; public and private postsecondary institutions; local, state, and federal agencies; health service-related agencies; correctional institutions; Indian tribal governments; and business and industry. A description of the nature and function of these centers and other services is provided below.

Arizona Center for Educational Evaluation and Measurement

The Arizona Center for Educational Evaluation and Measurement initiates and conducts multidisciplinary research on such topics as nondiscriminatory psychological assessment; assessment of development competencies, sequencing of instruction, cognitive skills in children; and evaluation of school effectiveness. The center maintains state-of-the-art research technology, prepares graduate students in research methodology; and provides technical assistance to public and private agencies regarding testing, student services, curriculum development, and systems for program evaluation.

Arizona Center for Educational Research and Development

The Arizona Center for Educational Research and Development initiates and conducts research and development programs in such areas as early childhood education, teaching and learning, language and literacy, cultural diversity and learning, and education of exceptional children. The center provides faculty and graduate students with the following support services: grant proposal development; weekly notices of funding sources; computer allocations for research and instruction; funding for small projects; and budget review and negotiation assistance.

Center for the Study of Higher Education

The Center for the Study of Higher Education conducts research studies and provides related service activities to meet state and institutional needs, as well as those of regional, national, and international governmental units and other organizations. It develops and disseminates information about higher education policy and operation and facilitates the research of faculty members and students. Special research and service projects are provided through university funds and outside support.

University Rehabilitation Services

The rehabilitation program provides an excellent setting for interdisciplinary research and demonstration projects. Such projects are directed by faculty members for various university departments. Research is encouraged in all aspects of rehabilitation. A variety of services is available through the Division of Special Education and Rehabilitation including comprehensive vocational and psychological evaluation which provides disabled and handicapped individuals with realistic vocational goals. The rehabilitation staff is trained in the practical application of rehabilitation techniques and provides consultative services to rehabilitation agencies.
Engineering education is preparation for a professional career. While most graduates embark on careers in engineering practice, men and women with engineering majors find the baccalaureate program excellent preparation for other fields as diverse as law, medicine, business and government. An engineering education develops analytical and quantitative thinking, a critical but optimistic approach to problems, and the habit of self-directed future learning. Graduates make a transition successfully to a wide variety of different careers. The graduate has a thorough understanding of how materials, energy, and information can be adapted to humanity's needs and desires. This is developed through the study of physical science, mathematics, engineering science, humanities, social science and practice.

**PROFESSIONAL FIELDS OF STUDY**

The college offers four-year curricula leading to the degrees of Bachelor of Science in:

- Aerospace Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Energy Engineering
- Engineering Mathematics
- Engineering Physics
- Geological Engineering
- Hydrology
- Industrial Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Mining Engineering
- Nuclear Engineering
- Systems Engineering

The entering student is asked to designate a field of interest from among those listed above. Since a high degree of commonality exists among the various fields in the first year, it is often possible for a student to transfer from one field to another after the first year with only minor realignment of the study program.

**OPTIONS**

**BIOMEDICAL ENGINEERING OPTION**—Biomedical engineering can be defined as a multi-discipline in which physical scientists and engineers interact with life scientists and physicians to solve problems ranging from basic investigations to applications in clinics and the health care delivery system. The Departments of Aerospace and Mechanical Engineering, Chemical Engineering, Electrical and Computer Engineering, Nuclear and Energy Engineering, and Systems and Industrial Engineering have biomedical options available as undergraduate technical electives, graduate minor programs and research. A university committee coordinates the option. See Biomedical Engineering for further details.

**CLINICAL ENGINEERING OPTION**—This option is offered in conjunction with the Master of Science degree through the Department of Electrical and Computer Engineering and Aerospace and Mechanical Engineering. For information regarding the option, please see the Graduate Catalog. At the undergraduate level, students can select several of the medically-oriented courses such as those concerning medical instrumentation, clinical engineering, physiology, and health care management in order to obtain an understanding of engineering in medicine and biology while earning a Bachelor of Science degree.

**COMPUTER SOFTWARE ENGINEERING OPTION**—This option deals with the analysis and design of systems in which computer programs play an important role. The computer software engineer performs the systems analysis which determines the computer programs to be developed, participates in the structured design of the programs, manages the programming effort and oversees the testing, debugging, installation and documentation of the programs. The Department of Systems and Industrial Engineering offers this option through the undergraduate degree program in systems engineering by structuring the choice of technical electives. Contact the department for further details.
MANUFACTURING SYSTEMS ENGINEERING OPTION—The modern manufacturing systems engineer designs, installs, implements, improves and manages computer integrated manufacturing systems. This option prepares students in the areas of organizing, scheduling, and managing the total manufacturing system from product design through fabrication, distribution and consumer services. The Department of Systems and Industrial Engineering offers this option through the undergraduate degree program in industrial engineering by structuring the choice of technical electives. Contact the department for further details.

PREMEDICAL OPTION—An engineering degree can provide a valuable background for physicians who will utilize the modern technological advances being implemented in the practice of medicine or who will participate in medical research. All departments in the college offer a premedical option. Electives which satisfy admission requirements for medical school are selected by the student and departmental advisor.

ACCREDITATION

The Accreditation Board for Engineering and Technology (ABET) is the official agency for accrediting undergraduate engineering curricula. Schools are visited periodically by teams of outstanding engineers selected by ABET. A complete evaluation is made of curricula, faculty qualifications, laboratory and library facilities, grading standards, and many other considerations. Thus, when the major undergraduate curricula of an engineering college are accredited by ABET, the student is assured that high standards are maintained.

COLLEGE OF ENGINEERING AND MINES FRESHMAN HONORS PROGRAM

This program recognizes the abilities and achievements of high school graduates and offers a variety of special challenges and resources to encourage the full development of academic and interpersonal skills. Eligibility is based on academic excellence, creativity, curiosity, maturity and motivation. The program is open to high school seniors who have applied for admission to the College of Engineering and Mines and who meet one of the following criteria:

a) A Flinn Scholar or National Merit Scholar.
b) Among the top 5% of his or her graduating class.
c) An ACT composite score of at least 29 (or SAT of 1300).

Applications and inquiries should be directed to: Dr. J.S. DeNatale, College of Engineering and Mines, University of Arizona, Tucson, Arizona 85721.

COLLEGE ENTRANCE REQUIREMENTS

Entering freshmen will meet those requirements outlined in the Admission to the University section of this catalog. Notice that in the section titled "Admission to Particular Colleges and Schools", College of Engineering and Mines entrance requirements differ from the general university requirements. Also, students transferring from other colleges or universities are required to present a cumulative grade-point average of 2.500 or better for all previous college work.

ADVANCED STANDING

Students must have been granted advanced standing to enroll in 300- or 400-level courses in the College of Engineering and Mines. To qualify for permanent advanced standing, students must meet the following criteria:

1. Completion of a minimum of 56 credit hours, including all required courses listed in the freshman and sophomore years of the curriculum of the student's major department. At least 15 units of required courses must have been completed at the University of Arizona. In addition, all admission deficiencies must have been removed.
2. A University of Arizona cumulative grade-point average of not less than the minimum set by the major department, but in no case below 2.0000.
3. Completion of the Upper-Division Writing-Proficiency Examination.
Students otherwise qualified and lacking no more than three required lower-division courses may be granted provisional advanced standing. If these courses are not completed during the next semester they are offered, advanced standing will be revoked until such time as they are completed.

Students otherwise qualified, but lacking completion of the Upper-Division Writing-Proficiency Examination, may be granted provisional advanced standing. If the examination is not completed during the following semester, advanced standing will be revoked until it is completed.

Transfer students who do not meet the 15-unit requirement set forth above, but meet all other requirements, will be granted provisional advanced standing until such time as they have completed a minimum of 15 units of required courses at the University of Arizona. At that time advanced standing will become permanent if the student's grade-point average at the University of Arizona meets the departmental requirement; if it does not, advanced standing will be revoked.

Application forms are available at the Office of the Dean of the College of Engineering and Mines (Room 134, Geology Building) and at all departmental offices in the college.

Students wishing to enroll in 300- or 400-level engineering courses, who are registered in colleges other than the College of Engineering and Mines, will normally be expected to have completed all course prerequisites and have fulfilled the above criteria relative to their own majors. Such students will be allowed to register for one advanced-standing course each semester without special permission. Those wishing to register for more than one advanced-standing course must apply at the dean's office for special permission.

HUMANITIES AND SOCIAL SCIENCE ELECTIVES

The humanities are the branches of knowledge concerned with the culture and values of mankind and the social sciences are studies of individual relationships in and to society. Humanities and Social Science (HSS) studies assist in meeting the objectives of a liberal education and in meeting the objectives of the engineering profession. In the interests of making engineers fully aware of their social responsibilities and better able to consider related factors in the decision-making processes, HSS course work is required as an integral part of the engineering program. Courses are acceptable only if a substantial amount of material relating to cultural values is involved as contrasted to routine exercises to enhance a student's performance. Further, this course work must include courses at an advanced level rather than a selection of unrelated introductory courses.

The college's specific HSS requirement and a list of approved courses are available in all departmental offices and in Geology 134. Deviation from this list requires approval of a college petition.

COLLEGE OF ENGINEERING AND MINES SCHOLARSHIPS

A limited number of scholarships are recommended each year by departments within the College of Engineering and Mines. Students interested in applying for these scholarships should contact their departmental offices for information. It is usually best to do this prior to March 1. All scholarships require the submission of an application to the Office of Student Financial Aid (203 Administration Building) and many require the demonstration of need as defined by that office. Scholarships are not available in the dean's office.

GRADUATE STUDY

The Master of Science (M.S.) degree is offered with majors in aerospace engineering, agricultural engineering, chemical engineering, civil engineering, electrical engineering, engineering mechanics, geological engineering, hydrology, industrial engineering, materials science and engineering, mechanical engineering, mineral economics, mining engineering, nuclear engineering, systems engineering and water resources administration. The Doctor of Philosophy (Ph.D.) degree is offered with majors in aerospace engineering, chemical engineering, civil engineering, electrical engineering, engineering mechanics, geological engineering, hydrology, irrigation engineering, materials science and engineering, mechanical engineering, mineral economics, mining engineering, nuclear engineering, systems engineering and water resources administration. Complete details of both graduate programs are set forth in the Graduate Catalog.
Brief discussions of each subject area as well as the particular curriculum for each will be found under the section headings which follow.

**BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING**
*(ABET Accredited)*

Aerospace engineering is concerned primarily with solving the problems of flight, and places special emphasis on the design and operation of all types of aircraft, rockets, satellites, and spacecraft. In recent years, aerospace engineers have become involved in the design of deep-submergence vehicles, modern surface ships, air cushion vehicles, and ground transportation systems.

Equipment supporting aerospace engineering studies includes digital computers with interactive graphics; internal combustion engines and a gas turbine; microcomputers and microprocessors; nonlinear control systems; production and tooling shop; low and high-speed wind tunnels; refrigeration and heat transfer loops; and instrumentation of a wide variety.

**Required Curriculum**

### FRESHMAN YEAR

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The 9 units of technical electives are selected, in consultation with an advisor, from upper-division offerings in engineering or other scientific technical fields.
BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING  
(ABET Accredited)

Agricultural engineers work directly in the design, construction, and management of power units, machines, water distribution and disposal systems, buildings, and processing equipment for the production of plants and animals. They develop systems for production, processing, packaging, transportation, and distribution of food and other agricultural products. The curriculum develops the student's background in the biological sciences. Computer applications to engineering problems in agriculture are stressed.

Required Curriculum

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*A.En. 120a-120b and 121a-121b are offered in alternate years and are taken in the freshman or sophomore years. In the same way, 410, 412, 415, and 423 are taken in the junior or senior year.

**With the approval of a faculty advisor, technical electives are chosen to form a coherent program of study in an area such as water resource development, irrigation, livestock housing, feed or food processing, energy or agricultural machinery.

***Agricultural science electives will include one course each from the plant, soil, and animal science areas.
COLLEGE OF ENGINEERING AND MINES

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING
(ABET Accredited)

Chemical engineering is a profession which provides society with materials and energy. It deals with how chemicals are brought together to react, separated and purified, mixed, heated, contained and transported. Computers are used as an integral part of making the processes economical and safe.

Required Curriculum

FRESHMAN YEAR

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*15 units of humanities and social science electives; 11 units of technical electives from appropriate fields of engineering, science or business; 3 units of C.E.; 3 of M.S.E.; and 6 of E.C.E., as approved by a departmental advisor.

**A field trip is made in mid-January and is a required part of Ch.E. 304.
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(ABET Accredited)

Civil engineering is primarily concerned with the larger elements of both the natural and man-made environment. The civil engineer designs, constructs, and operates the physical facilities necessary for such tasks as reducing air and water pollution, planning and building new communities, and providing water, power, and transportation systems. Students may elect to take a concentrated series of courses in structural engineering, geotechnical engineering, transportation engineering, hydraulic engineering, or environmental engineering. Fully equipped laboratories for instruction and research are available.

Required Curriculum*

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* Modification of this program may be permitted, but requires the approval of the student's advisor and department head.

**Elective courses are grouped as follows: humanistic and social science (12 units from the approved list of the College of Engineering and Mines) and technical (21 units). To meet the technical elective requirement, students must fulfill one of the following 12- or 15-unit option sequences. Required courses in the given sequence are indicated by *. Environmental engineering: C.E. 371*, 423*, 424, 477, 479*, N.E.E. 467; geotechnical engineering: C.E. 423*, 440*, (C.E. 402 or G.En. 427)*, 441*; hydraulic/water resources: 371*, 422*, 423*, 424*; structural engineering: C.E. 336*, 432a*, 432b*, (402 or 440)*; transportation and highway engineering: C.E. 361*, 452*, 462*, (C.E. 463 or 468)*; general civil engineering: C.E. 336*, 361*, 371*, 423*, 440*. Listings of all acceptable technical electives are available from advisors. Selection of all electives should be made with advisor's approval.
BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

The computer engineering program prepares students to work in the dynamic and rapidly expanding field of digital technology. Computer engineers design computers and computer systems, apply computers as components in larger systems, and apply digital techniques to solving a broad range of engineering problems. The curriculum includes a strong electrical engineering component, made up of almost all the required courses in the electrical engineering curriculum. To this base it adds extensive course work in both the hardware and software aspects of computers and digital systems. The program is strengthened by the availability of extensive laboratory and computing facilities.

Required Curriculum

**FRESHMAN YEAR**

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<th>Subject</th>
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**SOPHOMORE YEAR**

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<td>Phys. 121</td>
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**JUNIOR YEAR**

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**SENIOR YEAR**

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*The 12 units of technical electives will normally be 400-level courses in the Department of Electrical and Computer Engineering, and must be approved by the student's faculty advisor.*
BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING  
(ABET Accredited)

Due to the rapid pace of modern technology, the goal of the electrical engineering undergraduate curriculum is to educate immediately productive electrical engineers who are also qualified to pursue further educational opportunities. Consequently, the program emphasizes basic scientific knowledge, modern design techniques, and laboratory experiences that pinpoint design limitations.

The presence in the department of the Computer Science Research Laboratory, the Computer-Aided Design Laboratory, and the Microelectronics Laboratory, as well as research in fields, physical and plasma electronics, lightning processes, pattern recognition, simulation, modern control theory, and other specialties, maintains a modern viewpoint in the undergraduate program.

Required Curriculum

FRESHMAN YEAR

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<tr>
<th>First Semester</th>
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<th>Second Semester</th>
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SOPHOMORE YEAR

| Math. 223       | 4     | Math. 254       | 3     |
| Phys. 116       | 4     | Phys. 121       | 3     |
| S.I.E. 270      | 2     | Engr. Sci. Elective | 3 |
| E.C.E. 220a     | 3     | E.C.E. 220b     | 3     |
| E.C.E. 271a     | 3     | E.C.E. 271b     | 3     |
| Total           | 16    | Total           | 15    |

JUNIOR YEAR

| E.C.E. 301      | 3     | E.C.E. 302      | 3     |
| E.C.E. 321a     | 3     | E.C.E. 321b     | 3     |
| E.C.E. 351a     | 3     | E.C.E. 351b     | 3     |
| Math. 322       | 3     | E.C.E. 381      | 3     |
| Hum. & Soc. Sci. Elective | 3 | Total           | 15    |

SENIOR YEAR

| E.C.E. 494a     | 3     | E.C.E. 495a     | 1     |
| Total           | 18    | Total           | 16    |


**The 24 units of technical electives are to be chosen by the student in consultation with a faculty advisor, from a list of approved technical electives that may be obtained at the departmental office. Not less than 15 credits must be in E.C.E.
BACHELOR OF SCIENCE IN ENERGY ENGINEERING

The energy engineering program at the University of Arizona is intended to bring a broad perspective to the problems of energy generation and usage. The need exists for engineers familiar with many facets of energy-related engineering to participate in decisions involving considerations of economics, environmental impact, available resources, conservation, and the options for generation and distribution of electricity. The program of study is intended to prepare the student to make decisions or advise those who do in these areas. Such individuals must have a strong background characteristic of all engineering graduates, including basic mathematics, physics, and chemistry. A basic preparation in conventional economic principles and applied engineering economics is also required.

**Required Curriculum**

### FRESHMAN YEAR

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<tr>
<th>Subject</th>
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<td>Chem. 103b</td>
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### SOPHOMORE YEAR

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<td>Phys. 121</td>
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<td>C.E. 214</td>
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### JUNIOR YEAR

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### SENIOR YEAR

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<td>A.M.E. 442</td>
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*Econ. 210 plus 13 elective units.

**Tech. electives include 12 units to be selected from areas of specialization for a total of 130 units for graduation.
**BACHELOR OF SCIENCE IN ENGINEERING MATHEMATICS**

The engineering mathematics curriculum is designed to give the student a deep understanding of mathematics to complement specific interests in engineering. Graduates of this curriculum working in industry may use their proficiency in analysis, statistics, computer science or numerical analysis to develop techniques needed to obtain meaningful solutions to engineering problems for which there is no standard solution. The program can be tailored to give each individual the desired concentration in particular areas of mathematics and engineering, the goal being breadth with selective depth. The engineering mathematics curriculum gives an excellent background for graduate work in applied mathematics and computer science as well as various areas in engineering.

**Required Curriculum**

**FRESHMAN YEAR**

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<th>Subject</th>
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<td>Chem. 103b</td>
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**SOPHOMORE YEAR**

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**JUNIOR YEAR**

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*Humanities and social science electives: 17 units to be chosen from a list approved by the college. Technical electives: 23 units to be chosen in consultation with an adviser.

**Those students interested in using technical electives to emphasize computer science should include C.Sc. 115, 227 and 237 their first three semesters.**
BACHELOR OF SCIENCE IN ENGINEERING PHYSICS

The engineering physics curriculum stresses basic scientific and engineering principles in order to prepare the student to solve engineering problems which involve either several areas of knowledge or basic new scientific developments. Modern complex devices and systems often involve several fields such as optics, mechanics, electronics, solid state, and nuclear radiation.

This curriculum helps bridge the gap between science and engineering. To reduce a scientific development to a practical application requires both physical understanding and engineering skill. The engineering physics curriculum prepares the student for graduate work in physics and engineering.

Technical electives should be upper-division units carefully chosen in conference with the advisor to make a coherent program.

Required Curriculum

FRESHMAN YEAR

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SOPHOMORE YEAR

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<td>C.E. 214</td>
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SENIOR YEAR

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BACHELOR OF SCIENCE IN GEOLOGICAL ENGINEERING
(ABET Accredited)

Geological engineering entails the application of geological science to the design of engineering structures. The geological engineer is an environmentalist trained to recognize and understand the significance of geological conditions and their influence on engineering designs. Graduates spend much of their time on location throughout the world working on the earth's surface and underground. Projects requiring geological engineering expertise range from domestic toxic waste reclamation to foreign dam investigations.

Required Curriculum

FRESHMAN YEAR

<table>
<thead>
<tr>
<th>Subject</th>
<th>First Semester</th>
<th></th>
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SOPHOMORE YEAR

| Subject                      |  | Subject                      |  |
|------------------------------|  |------------------------------|  |
| Math. 223                    | 4  | Math. 254                    | 3  |
| Phys. 116                    | 4  | Phys. 121                    | 3  |
| C.E. 110                     | 3  | S.I.E. 265                   | 3  |
| S.I.E. 17OR,L                | 3  | C.E. 214                     | 3  |
| Geos. 109                    | 4  | Geos. 221                    | 4  |
| Total                        | 18 | Total                        | 16 |

JUNIOR YEAR

| Subject                      |  | Subject                      |  |
|------------------------------|  |------------------------------|  |
| G.En. 422                    | 4  | G.En. 407                    | 3  |
| C.E. 217                     | 3  | G.En. 470                    | 3  |
| Geos. 302                    | 3  | C.E. 321                     | 3  |
| Geos. 450                    | 4  | C.E. 340                     | 4  |
| Total                        | 17 | Total                        | 16 |

SUMMER SESSION

| Subject                      |  | Subject                      |  |
|------------------------------|  |------------------------------|  |
| G.En. 416                    | 3  |                            |    |
| Geos. 412                    | 3  |                            |    |

SENIOR YEAR

| Subject                      |  | Subject                      |  |
|------------------------------|  |------------------------------|  |
| G.En. 402                    | 4  | G.En. 424                    | 3  |
| G.En. 427                    | 4  | G.En. 425                    | 3  |
| Geos. 435                    | 3  | Mn.E. 447                    | 2 or 3 |
| Technical Elective           | 3  | Technical Elective           | 6  |
| Total                        | 18 | Total                        | 17 or 18 |
BACHELOR OF SCIENCE IN HYDROLOGY

Hydrology, the science of water, deals with the origin, distribution, and the physical, chemical and biological properties of the waters of the Earth. It has application to flood control, water supply, recreation, structure (bridges, dams, etc) design, pollution control, and other water management concerns. The hydrology curriculum is designed to give the student a basic knowledge of hydrology and allied subjects. Flexibility is offered through the selection of electives so that a program of study can be developed which best fits the student's needs.

Graduates with the degree of Bachelor of Science in Hydrology obtain professional positions in the fields of hydrology and water resources. Because hydrology is an applied science, instruction is augmented at all levels with field trips in Arizona, a state which contains a great diversity of natural features and climatic zones, making it a superb outdoor laboratory. The five-week summer field course provides direct experience with hydrologic measurements, testing, and data gathering at a number of locations in Arizona. The field course ends with students applying these techniques, on location to solve a local water resource problem.

Required Curriculum

FRESHMAN YEAR

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SUMMER SESSION

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*Electives to be chosen in humanities, social science, language, and fine arts.
**Technical and other electives (may not be prerequisite or equivalent to required courses).
BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING  
(ABET Accredited)

Industrial engineering focuses on the design and implementation of integrated systems of people, materials, machines, energy and information. After first specifying system objectives, industrial engineers combine technical knowledge and skill from the physical, engineering and social sciences to design, evaluate and monitor system performance. Industrial engineers practice in both administrative and production segments of manufacturing and service organizations. A special option in manufacturing systems engineering may also be chosen.

Required Curriculum

### FRESHMAN YEAR

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*Hum. and soc. sci. electives must be chosen from a list approved by the College of Engineering and Mines. Selection of these electives is made in consultation with the student's faculty advisor.

**Technical electives and math. electives must be chosen from lists of 300- or 400- level courses available in the department office and must be approved by the student's faculty advisor. In the manufacturing systems engineering option, the three senior technical electives are selected from manufacturing oriented courses such as S.I.E. 455 and S.I.E. 465. Since S.I.E. 350 is a prerequisite for S.I.E. 455, the former should be taken rather than C.E. 217.
BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND ENGINEERING

Materials science and engineering has come into its own as a field of endeavor during the past 25 years. The field covers the properties and behavior of metals, ceramics, glasses, polymers, semiconductors and composites. Students study material properties and processes and how they are related to the internal structure of various materials.

Equipment available includes optical and electron microscopes, X-ray diffraction equipment, non-destructive testing equipment, and extensive physical testing equipment which allows the student to explore the characteristics of materials.

Required Curriculum

**FRESHMAN YEAR**

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*May be replaced by M.S.E. 331R for students specializing in primary materials processing.


††Students specializing in primary materials processing may take M.S.E. 401R, 401L, 410L, 420L, 423, 426.

Students specializing in materials technology must take M.S.E. 424, 430b, 430L, 450R, 452, 474.

**Students specializing in electronic materials must take: M.S.E. 424, 430b, 430L, 434, 450R, 450L, 457, 474.

Note: Ch.E. 470 Fundamentals of Polymeric Materials is recommended for students specializing in materials technology and electronic materials. Other technical electives must be chosen in consultation with the student's advisor.
Mechanical engineering is a broad discipline which covers the fields of solid and fluid mechanics, thermodynamics, and engineering design. Basic studies are devoted to machine dynamics, fluid flow, energy and heat power, mechanical properties of materials, and instrumentation. Students can specialize in a wide variety of topics, which include power systems, thermal sciences, automatic controls, reliability and quality assurance, and mechanical design.

Equipment supporting mechanical engineering studies includes digital computers with interactive graphics; internal combustion engines and a gas turbine; microcomputers and microprocessors; nonlinear control systems; production and tooling shop; low- and high-speed wind tunnels; refrigeration and heat transfer loops; and instrumentation of a wide variety.

Required Curriculum

FRESHMAN YEAR

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JUNIOR YEAR

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SENIOR YEAR

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*Elective courses are chosen by the student in consultation with a faculty advisor. The 30 units of electives must contain 15 in the humanities and social sciences. The remaining 15 units are technical electives, which are to be selected from engineering and science courses. At least 12 units must be at the 400-level, with 9 of these in A.M.E. (exclusive of independent study, which can at most total 3 units). Moreover, 3 of these units must be taken from a selected list of courses having a design emphasis.
BACHELOR OF SCIENCE IN MINING ENGINEERING
(ABET Accredited)

Mining engineering is that branch of engineering responsible for planning, developing and operating mining and other underground facilities. Mining engineers acquire an intimate understanding of the unique environment presented underground; they learn how rock behaves when excavated, how to plan and supervise mines and how to excavate, transport and process minerals and coal.

Graduates with a Bachelor of Science degree in mining engineering find employment in the fields of design and operation of underground and surface mines, management of mines, heavy construction projects and tunneling and underground chamber projects, heavy equipment development and finance.

Required Curriculum

FRESHMAN YEAR

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<tr>
<th>Course</th>
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<tbody>
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<tr>
<td>Eng. 101</td>
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<td>Chem. 103a</td>
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SOPHOMORE YEAR

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<td>Geos. 109</td>
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JUNIOR YEAR

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<td>M.S.E. 401R,L</td>
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SENIOR YEAR

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</table>
BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING  
(ABET Accredited)

Nuclear engineering is concerned with the release, control, and utilization of all forms of energy resulting from nuclear reactions. This branch of engineering is deeply rooted in the physical sciences and mathematics and requires a broad-based interdisciplinary education.

The applications of nuclear energy are many, ranging from commercial nuclear power systems to the use of radioisotopes in science, industry and medicine.

The four-year curriculum gives the student a broad base in engineering science and mathematics. The first two years are similar to those for other engineering disciplines. The remaining two years are devoted to areas of particular interest to the nuclear engineer. With an understanding of fundamental concepts, the student is prepared to cope with future advancements in the field.

Facilities available for laboratory experiments and research include: TRIGA nuclear reactor for operating the steady state or pulsed mode; 2 MeV Position Ion Van de Graaff Accelerator operating in steady state, pulsed, or modulated source mode to produce charged particles and neutrons; 1.25 MeV Radiation Dynamics Electron Accelerator operating as a source of electrons or brehmsstrahlung; 500 curie Gamma Ray Irradiator serving a source for materials and biological specimen irradiations. Also available is a wide variety of laboratories including those needed for radioactive material counting, radiochemical processing, nuclear materials and related equipment for evaluating performance and modification of materials in radiation fields.

Required Curriculum

| FRESHMAN YEAR |  |
|  |  |  |  |  |
| Subject | First Semester | Units | Subject | Second Semester | Units |
| Math. 124/125a | . | 5/3 | Math. 125b | . | 3 |
| Engl. 101 | . | 3 | Engl. 102 | . | 3 |
| Chem. 103a | . | 3 | Chem. 103b | . | 3 |
| Chem. 104a | . | 1 | Chem. 104b | . | 1 |
| Elective* | . | 2 | Phys. 110 | . | 4 |
| Hum. & Soc. Sci. Elective* | . | 3 | S.I.E. 170R,L | . | 3 |
| N.E.E. 103a | . | 1 | N.E.E. 103b | . | 1 |
| Total | . | 18/16 | Total | . | 18 |

| SOPHOMORE YEAR |  |
|  |  |  |  |  |
| Math. 223 | . | 4 | Math. 254 | . | 3 |
| Phys. 116 | . | 4 | Phys. 121 | . | 3 |
| Econ. 210 | . | 3 | C.E. 214 | . | 3 |
| S.I.E. 270 | . | 2 | Hum. & Soc. Sci. Electives* | . | 4 |
| N.E.E. 211 | . | 2 | N.E.E. 221 | . | 3 |
| N.E.E. 231 | . | 3 | Total | . | 16 |
| Total | . | 16 |  |

| JUNIOR YEAR |  |
|  |  |  |  |  |
| N.E.E. 343 | . | 4 | N.E.E. 348 | . | 3 |
| Phys. 330 | . | 3 | N.E.E. 369 | . | 3 |
| E.C.E. 207 | . | 3 | A.M.E. 331a | . | 3 |
| A.M.E. 340a | . | 3 | M.S.E. 331R | . | 3 |
| Tech. Elective* | . | 3 | M.S.E. 331L | . | 1 |
| Total | . | 16 | Hum. & Soc. Sci. Elective* | . | 3 |
| Total | . | 16 |  |

| SENIOR YEAR |  |
|  |  |  |  |  |
| N.E.E. 420** | . | 3 | N.E.E. 410 | . | 3 |
| N.E.E. 430 | . | 3 | N.E.E. 435 | . | 3 |
| N.E.E. 441 | . | 3 | Hum. & Soc. Sci. Elective* | . | 3 |
| N.E.E. 454 | . | 3 | Tech. Electives* | . | 6 |
| A.M.E. 442 | . | 3 | Total | . | 17 |

*Elective courses are chosen by the student in consultation with a faculty advisor.
**Offered both semesters
BACHELOR OF SCIENCE IN SYSTEMS ENGINEERING  
(ABET Accredited)

Systems engineering is concerned with the design, modeling and analysis of technological systems that employ people and machines, software and hardware, material and energy for such purposes as communication, health care, transportation or manufacturing. The curriculum provides students with design viewpoints and methodologies that emphasize system integration, and with subject matter and tools for modeling and analysis especially appropriate for large complex systems, e.g., optimization, probability and statistics, system theory, decision analysis and simulation. At every level, the curriculum encourages fluency in the use of computers. A special option in software engineering may also be chosen.

Required Curriculum

### FRESHMAN YEAR

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### SOPHOMORE YEAR

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<td>S.I.E. 442</td>
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*Six course substitutions as indicated within the parentheses are required for the software systems engineering option, beginning in the sophomore year.

**Hum. and soc. sci. electives must be chosen from a list approved by the College of Engineering and Mines. Selection of these electives is made in consultation with the student's faculty advisor.

***Technical electives and math. electives must be chosen from lists of 300- or 400-level courses available in the department office and must be approved by the student's faculty advisor.
TWO-YEAR TRANSFER PROGRAM

Those students unable to choose a field upon entrance to the college, as well as those enrolled in community college pre-engineering transfer programs, are advised to follow the two-year curriculum listed below:

FRESHMAN YEAR

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<th>Subject</th>
<th>First Semester</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>Math. 124/125a</td>
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<td>Math. 125b</td>
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SOPHOMORE YEAR

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<td>Total</td>
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Upon satisfactory completion, this curriculum will transfer into the college's degree programs with a minimum loss of credit. Students transferring into specific degree programs before completion of this two-year program should see their new advisors to determine how the courses will transfer. Listed below are the advanced standing deficiencies that will remain when these courses are transferred into one of the Bachelor of Science degree programs listed on the previous pages. Selective courses should be chosen from this list to minimize deficiencies.

Degree:

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<td>Agricultural Engr. Ag. or Bio. Sci. (3); A.M.E. 232, 340a; E.C.E. 207</td>
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<tr>
<td>Chemical Engr. Ch.E. 102, 201, 202, 203; Chem. 241a, 241b, 243a, 243b, 323, 325</td>
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<tr>
<td>Civil Engr. A.M.E. 232; C.E. 151, 217; E.C.E. 207; Geos. 101a, 102a; S.I.E. 265</td>
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<tr>
<td>Computer Engr. C.Sc. 115, 227; E.C.E. 220a, 220b, 271a, 271b; Math. 243</td>
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<td>Electrical Engr. E.C.E. 220a, 220b, 271a, 271b</td>
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<tr>
<td>Energy Engr. E.C.E. 220a; M.S.E. 224; N.E.E. 203, 211</td>
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<td>Engr. Mathematics C.E. 217; E.C.E. 207; Math. 215</td>
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<td>Engr. Physics C.E. 217; E.C.E. 207</td>
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<td>Geological Engr. Geos. 101a, 102a, 109, 221; S.I.E. 265</td>
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<td>Hydrology Atmo. 171; Geos. 101a, 102a, 221; Hydr. 150, 296a; P.I.S. 100</td>
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<tr>
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<td>Mat. Sci. &amp; Engr. Chem. 322, 323; M.S.E. 224, 240</td>
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<tr>
<td>Mechanical Engr. A.M.E. 232; E.C.E. 207</td>
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<tr>
<td>Mining Engr. C.E. 217, 151; Geos. 101a, 109; Mn.E. 120, 220</td>
</tr>
<tr>
<td>Nuclear Engr. N.E.E. 211, 221, 231</td>
</tr>
<tr>
<td>Systems Engr. E.C.E. 207; S.I.E. 250</td>
</tr>
</tbody>
</table>

Courses not credited toward degree completion:

| S.I.E. 270 |
| C.E. 110 |
| Chem. 104b; Phys. 121; S.I.E. 270 |
| Chem. 103b; 104b; S.I.E. 170 |
| Chem. 104b |

| E.C.E. 207; S.I.E. 258 |
| Chem. 104b |
| Chem. 104b |

| Chem. 104b |
COOPERATIVE EDUCATION PROGRAM

The Cooperative Education Program provides students with an opportunity to supplement their academic studies with periods of career-related work experience prior to graduation. Co-op is a full-time, paid semester of work experience away from formal studies. Co-op students who carefully plan their academic schedules will be able to participate and still graduate in 4-1/2 to 5 years.

Participants must have finished the freshman year and one full-time semester at the University of Arizona. A minimum grade-point average of 2.000 is needed to register for the program, but many employers require considerably higher grade-point averages. Information regarding the co-op program is available through the Career and Placement Services Office.

SUMMER CAREER ORIENTED EMPLOYMENT PROGRAM

This program is designed to help students find career-related work experience during the summer months. Information regarding the program is available through the Career and Placement Services Office.

INTERNERSHIP PROGRAM

Students who want to work part-time in a career-related position while attending the University should explore local opportunities available through the Internship Program. Information regarding this program is available through the Career and Placement Services Office.

MINERAL ENGINEERING STUDENT EXCHANGE PROGRAM

Arizona has a compact with seven other western states to support undergraduate studies in mineral engineering through the Western Interstate Commission for Higher Education (WICHE). Thus, if a student who is a resident of the states of Alaska, Idaho, Montana, New Mexico, Nevada, Utah, or Wyoming desires to pursue studies in mining engineering, materials science and engineering, or geological engineering at the University of Arizona, and the desired curriculum is not offered in the home state, then that student is eligible to attend the University of Arizona without paying nonresident tuition, which otherwise would normally be assessed. Write to the dean of the College of Engineering and Mines for more information.

STUDENT PROFESSIONAL AND HONORARY SOCIETIES

The following professional organizations have active student chapters sponsored by the college and coordinated by the Engineers' Council. Students are encouraged to participate in these organizations during all four years of enrollment. Contact departmental or college offices for information.

Scholastic Honorary Societies
- Alpha Epsilon (Agricultural engineering students)
- Tau Beta Pi (All engineering students)

Professional Organizations
- American Nuclear Society
- American Society of Agricultural Engineers
- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Society for Metals
- American Institute of Aeronautics and Astronautics
- American Institute of Chemical Engineers
- American Water Resources Association
- Association of Engineering Geologists
- Association for Computing Machinery
- Institute of Electrical and Electronic Engineers
- Institute of Industrial Engineers
- Society of Automotive Engineers
- Society of Mining Engineers (AIME)
- Society of Reliability Engineers
- Student Energy Society
- The Metallurgical Society (AIME)
- Theta Tau

Other Engineering Student Organizations
- American Indian Science and Engineering Society
- Society of Hispanic Professional Engineers
- Society of Women Engineers
- American Indian Science and Engineering Society
- Society of Hispanic Professional Engineers
- Society of Women Engineers
- Theta Tau
College of Law

The University of Arizona College of Law is a member of the Association of American Law Schools and an approved law school of the American Bar Association. A rigorous course of professional education prepares students for service to the community in the private and public practice of law. To qualify for membership in the legal profession, a student must possess a broad educational experience and significant intellectual capacity, and must successfully negotiate a difficult course of study during which he or she is expected to master the principles of the law and of the legal system and to acquire professional techniques of lawyers.

Application forms and additional information pertaining to the program, as well as a College of Law Catalog, may be obtained from the College of Law.

ADMISSION PROCESS

Applicants are initially evaluated according to personal statements, references and a formula which combines the candidate's undergraduate grade-point average and score on the LSAT. Many admittees are selected from the pool of applicants based primarily upon the quality of their academic performance and LSAT score.

The balance of the entering class will be chosen by the vote of the Admissions Committee from a group of qualified candidates whose backgrounds and academic records indicate a good chance to succeed in law studies and to make a significant contribution to the legal educational process, the legal profession and the community. Diversity is essential to a vital educational process and a dynamic legal profession. Although weight is given to academic records and test scores, the committee looks to other factors that not only affect the diversity objective in a positive manner but also may render grades and test scores less important as indicators of intellectual strength. Among those factors are colleges attended, course of study, grade trends, significant or extracurricular activities, unique educational or occupational experience, involvement in community affairs, participation in prelaw school programs (e.g., CLEO), race and ethnicity, economic or cultural background, and any other factors that may justifiably be relied upon in appraising the qualifications of applicants for success in law school and contribution to the legal profession. In making the selections, consideration is given to the individual characteristics of each applicant.

APPLICATION PROCEDURE

First-year students are admitted only in the fall semester. Offers of admission can be deferred until subsequent years at the discretion of the assistant dean. Applicants are encouraged to submit their applications as early as possible in the Fall Semester. All application materials, including the LSDAS report, must be delivered to the Admissions Office or postmarked no later than March 1.

1. To complete an application, a candidate for admission must submit:
   A. A Law School Application Matching Form (see item 3).
   B. A completed law school application (including personal statement).
   C. A Domicile Affidavit.
   D. Two references.
   E. Nonresidents only: a nonrefundable $10 application fee. (Only checks or money orders, payable to the University of Arizona, are acceptable.)

2. All candidates must take the Law School Admission Test (LSAT), which is given at centers in the United States several times a year. Information about the test can be obtained by writing Law School Admission Services (LSAS), Box 200-R, Newtown, PA 18940, or by contacting
the nearest law school or prelaw advisor. In order to meet the March 1 deadline for complete applications, candidates must take the test no later than the December administration. Scores for the March test will not be considered for applicants to the entering class.

An applicant may take the LSAT more than once; however, the scores will be averaged for use in the initial evaluation formula.

3. All applicants must register for a Law School Data Assembly Service Report. LSDAS reports are produced only for candidates who submit directly to all law colleges a Law School Application Matching Form with their application for admission. The matching forms are included with the LSAT/LSDAS registration materials found in Law School Admission Bulletins. To preserve a candidate's right to privacy, LSAS does not release LSDAS reports to any school that does not supply them with an Application Matching Form.

It is important to recognize that considerable lead time is required for the LSDAS process. To ensure timely completion of applications, candidates should register with LSDAS and submit transcripts from each undergraduate institution attended to LSDAS prior to January 1. Students must provide to LSDAS transcripts of any course work completed after the initial submission to LSDAS. It is wise to keep receipts for transcripts and LSDAS services as evidence of compliance with deadlines.

Graduate transcripts should also be sent to LSDAS. Graduate grades will not be analyzed on the report but the transcripts will be attached to the back of the report.

TRANSFER STUDENTS—Students who have done well at other law schools may be permitted to transfer to the University of Arizona in either the fall or the spring semester of their second year of law school. A transfer applicant must send the following items to the Admissions Office, University of Arizona College of Law, Tucson, Arizona 85721, prior to December 1 for application to the spring semester, and prior to July 15 for application to the fall semester.

1. Completed application for transfer admission.
2. Domicile Affidavit.
3. An LSDAS report showing entire undergraduate career and the LSAT score.
4. A letter from the dean of the law school currently being attended stating that the candidate is presently in good standing and eligible to continue studies at that institution.
5. Transcripts of at least one full year (three quarters or two semesters) of law work. First-year students may not transfer in midyear.

If these minimum requirements are met, applicants will be judged as to whether a transfer would be in the best interest of the student and of the college. Third-year students will not be considered for transfer but may apply as transient or visiting students. No student who has been disqualified or placed on probation at another law school, or who has failed to maintain at least a “C” average for all law work attempted, will be allowed to transfer to the College of Law. Transfer students will not receive credit for work done at a law school which is not a member of the Association of American Law Schools or approved by the American Bar Association.

NONDEGREE STUDENTS

Special Students. A limited number of students without the qualifications required of candidates for the law degree may, at the discretion of the faculty, be allowed to audit a course or courses as special students. Applicants must have experience and educational background which indicate a strong probability that they will be successful in law study. They must also demonstrate some special need for legal training.

Students from Other Colleges. With the written approval of their advisers, graduate students may register for courses in the College of Law. Students desiring to do so will be required to obtain the prior approval of the instructor and of the Executive Committee of the College of Law.

Special students and students from other colleges studying at the College of Law are not degree candidates, nor are they eligible for the Arizona bar examination. Law courses may not be used by part-time students as credit toward a law degree in the event that such students are subsequently admitted as degree candidates.
College of Medicine

The College of Medicine offers a professional program leading to the M.D. degree and graduate programs leading to the Ph.D. degree in certain of the medical sciences. A combined M.D./Ph.D. program in which the two degrees are awarded concurrently is also available. Candidates for the Ph.D. degree are enrolled in the Graduate College of the University. For information beyond that summarized below, one should request a catalog from the Admissions Office, College of Medicine, University of Arizona, Tucson, Arizona 85724.

PREMEDICAL REQUIREMENTS—Applicants must meet the minimum requirement of 90 semester hours, including 30 hours at the upper-division level, in an accredited college or university. Successful completion of the following specific course work is required: two semesters or three quarters each of inorganic chemistry, organic chemistry, physics, general biology or zoology and English. Students should demonstrate the ability to handle scientific material effectively, irrespective of their majors.

MEDICAL COLLEGE ADMISSION TEST—All applicants must take the new Medical College Admission Test and arrange to have scores forwarded to this college. The test should be taken in the year preceding that in which the student hopes to enter medical school, or at the latest, within two years of application. For applications write: MCAT—The American College Testing Program, P.O. Box 414, Iowa City, Iowa 52243.

APPLICATION TO THE FIRST-YEAR CLASS—The College of Medicine is a participating member in the American Medical College Application Service (AMCAS). Each student need submit only one application if applying just to AMCAS schools. Requests for application material may be obtained from the Admissions Office of the College of Medicine. The application period is June 1 to November 1 of the year preceding that in which the applicant hopes to enter medical school. Those to be considered are requested to appear for a personal interview. Further details of the application procedure may be found in the College of Medicine Catalog.

SELECTION FACTORS—The College of Medicine follows the recommended acceptance procedures of the Association of American Medical Colleges. Acceptance is based upon an assessment of the applicant's intellectual and personal traits. In evaluating candidates, the Admissions Committee considers ability and scholarship as indicated by the candidate's entire academic record, the results of various aptitude and achievement tests, letters of recommendation, and the personal interview. Consideration is given only to residents of Arizona and to highly qualified residents of Alaska, Montana, and Wyoming who are certified and funded by the Western Interstate Commission for Higher Education (WICHE). Applicants from states other than these cannot be considered.

ADMISSION OF TRANSFER STUDENTS—Applications are accepted for transfer into the clinical years of the College of Medicine curriculum only from Arizona residents and WICHE certified and funded residents from Alaska, Montana and Wyoming. Please see the College of Medicine Catalog for further information.

ACADEMIC POLICY AND CURRICULUM—All medical students are graded on an Honors-Pass-Fail basis. Students who are enrolled in other colleges of the University and who are taking College of Medicine courses will be graded by the same system as the rest of the University. The curriculum of the College of Medicine is based upon a four-year program. For information concerning the pace of academic work, please consult the College of Medicine Catalog.
College of Nursing

Professional nursing is a service which helps people achieve and maintain optimum health. It is demanding but rewarding. Rapid social changes require professional nurses to have a body of knowledge in pace with scientific advances which they apply to effective nursing care. They must possess problem-solving ability and discriminative judgment in recognizing the health needs of patients, their families, and the community, and in utilizing appropriate nursing intervention. The practice of nursing changes as continuously as the practice of medicine and related disciplines. Clinical nursing is based upon the natural and behavioral sciences, and students are encouraged to draw upon scientific principles from related courses to include psychological and social as well as physical care in their applied nursing courses.

The college is accredited by the National League for Nursing and approved by the Arizona State Board of Nursing. Upon recommendation of the faculty, the graduates will be admitted to the licensing examination administered by the state board. Information regarding licensure may be obtained from the office of the associate dean of the baccalaureate program.

DEGREES

The degrees offered are the Bachelor of Science in Nursing, the Master of Science, the Nursing Specialist, and the Doctor of Philosophy. For information regarding graduate study, please see the Graduate Catalog.

The program which leads to the B.S. in Nursing prepares the graduate to begin practice as a professional nurse, and to undertake graduate study in nursing. The curriculum is composed of two years of preclinical courses, which are taken in the College of Arts and Sciences, followed by the clinical major. After having completed the preclinical phase of the program, students are admitted selectively to the College of Nursing to begin the nursing major in fall or spring. A minimum of 33 units of the nursing major must be university-credit course work.

Nursing students are preparing for a profession which is exacting and in which they must take responsibility for the lives and well-being of others. Applicants must be in good physical and mental health; otherwise, they may be denied admission or, once admitted, recommended for withdrawal.

REQUIREMENTS

Any entering freshman who meets university admission requirements as described in the Admission to the University section of this catalog may be admitted to the College of Arts and Sciences for the prenursing portion of the program.

Transfer students must meet the same university admission requirements. They may complete all freshman and sophomore courses as listed in the nursing program at another college or university, or may present a combination of transfer and University of Arizona courses for consideration for admission to the nursing major.

There is a selection process before any student can be accepted into the College of Nursing for the upper-division nursing courses. For acceptance into the nursing major, students must have completed the prescribed freshman and sophomore courses, attained a grade-point average of 2.5000 on all courses taken in the freshman and sophomore years, and have removed any high school deficiencies. All transfer students must have a minimum 2.5000 average on all freshman and sophomore courses on both University of Arizona and transfer credits for consideration for admission to the college.

Students are required to take the University of Arizona Writing-Proficiency Examination before starting their classes in the College of Nursing. Students who have an unsatisfactory rating on the examination will be required to complete remedial work acceptable to the College of Nursing.

All students entering the College of Nursing are required to have basic computer knowledge, obtained in high school, computer store, university courses, or self-taught.

Since enrollment in the college is limited, completion of freshman and sophomore courses by entering freshmen or transfer students with the required grade-point average does not assure the student of admission to the major. Once admitted to the major, the student must be full time, attending five consecutive semesters. During these semesters the student must be enrolled for all required courses.
Students seeking acceptance to the College of Nursing for fall semester need to file the special application form, to be obtained directly from the college, by February 1 of the sophomore year and can expect to hear of their status by April 1. Students planning to enter the college in a spring semester must file this application by August 1 of the previous year and can expect to hear by October 1 regarding acceptance. Students not admitted must reapply for admission as the college does not maintain a waiting list.

In addition to these requirements, registered nurses from diploma or associate degree schools of nursing must hold a current, valid license to practice nursing. For these applicants acceptance of transfer credits and the establishment of credit by examination will be considered on an individual basis. (See also Special Examination for Credit section of this catalog.)

Since clinical laboratories are in a variety of community settings, all students in the clinical nursing courses are required to provide their own cars for transportation to the areas where they are assigned for patient-care experience.

A candidate for the degree of B.S. in Nursing must fulfill the requirements both in number and kind of units as outlined in the catalog under which the student has chosen to graduate. The graduation average must be 2.0000 or better, with an average of 2.0000 or better for all work undertaken in the major field at the University of Arizona (See also Graduation Requirements section of this catalog.)

**GRADING POLICY FOR NURSING COURSES**—The grade of “D” is unacceptable for courses in the nursing major inasmuch as it does not reflect acceptable performance. Students who do not complete a required course(s) with a grade of “C” or better, are not eligible to progress in the professional nursing major. The student will be permitted to repeat the course for credit contingent on space available.

**HONORS**

The college participates in the Honors Program.

**REQUIRED CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN NURSING***

**FRESHMAN YEAR**

<table>
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<tr>
<th>Subject</th>
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**SOPHOMORE YEAR**

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**Humanities (6 units): All students in prenursing are required to complete either: (A) two semesters of Humanities (250a-250b-250c); or (B) no fewer than 6 units of course work from the following groups: courses in literature, courses in history, courses in philosophy. A list of courses acceptable under option B is available in the College of Nursing. The humanities survey (250a-250b) constitutes a single, 8-unit sequence, but a student may elect only part of the sequence.

***There may be an additional prerequisite for Ecol. 159aR, 159bR.

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**HONORS**

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***There may be an additional prerequisite for Ecol.159aR, 159bR.
JUNIOR-SENIOR YEARS

Five consecutive semesters beginning either fall or spring.

FIRST SEMESTER — N.F.S. 310 (3); Nurs. 353 (6), 354 (3), 359 (3)
Total units—15

SECOND SEMESTER—Pcol. 472 (3); Nurs 363 (11); Nurs. elective (3)
Total units—17

THIRD SEMESTER —Nurs. 373a (6), 373b (5), 375 (3), 379 (2)
Total units—16

FOURTH SEMESTER—Nurs. 381 (6), 382 (6), 388 (2), 389 (2)
Total units—16

FIFTH SEMESTER—Nurs. 387a (8), 387b (8)
Total units—16

Total Minimum Units Required for Graduation—140-143
College of Pharmacy

An important objective of the College of Pharmacy is to educate qualified students to become pharmacists who are committed to providing the highest quality of pharmaceutical and related health care services. These services are mainly concerned with optimizing the therapeutic effects and minimizing the adverse effects of drugs, and require the knowledge and skills of a drug specialist. The practice of pharmacy requires great sensitivity to the health care needs of people and demands a high standard of moral and professional integrity.

The pharmacy curriculum, which includes scientific, professional, and general education courses, is designed to develop pharmacists who are professionally competent and academically well-rounded. The professional program in the College of Pharmacy is fully accredited by the American Council on Pharmaceutical Education.

ACADEMIC PROGRAMS

The professional degree offered by the College of Pharmacy is the Doctor of Pharmacy (Pharm.D.). The program for this degree is based upon six years of college work (two years of prepharmacy and four years in the College of Pharmacy), as outlined below.

The college also offers graduate studies leading to the Master of Science degree in pharmacology, toxicology, and pharmacy and the Doctor of Philosophy degree in pharmaceutical sciences, pharmacology and toxicology, and pharmacy. For information on the specific programs in the departments of Pharmaceutical Sciences, Pharmacology and Toxicology, and Pharmacy Practice, consult the respective departmental headings elsewhere in this catalog.

ADMISSION REQUIREMENTS FOR THE DOCTOR OF PHARMACY PROGRAM

Admission to the Doctor of Pharmacy program requires completion of courses as specified in the prepharmacy curriculum below. Students in the prepharmacy program at the University of Arizona are enrolled in the College of Arts and Sciences. Equivalent courses completed at other colleges or universities may be accepted in fulfillment of the prepharmacy course requirements.

Candidates are admitted into the professional pharmacy program only in the fall semester. Evaluation for admission to the college requires the following application items: (1) a completed University of Arizona application form, (2) official transcripts of all completed university or college courses, (3) a listing of remaining prepharmacy courses that must be completed before entering the College of Pharmacy, (4) a completed student profile questionnaire, (5) three completed recommendation forms, (6) the results of the Pharmacy College Admission Test (PCAT), and (7) an interview. It is recommended that the PCAT be taken in November, but no later than February. All application materials, including application form and transcripts, should be sent directly to the College of Pharmacy. Students who seek admission to the College of Pharmacy are urged to initiate the application process in October of the year preceding admission and have all application materials submitted as soon as possible, but no later than by the end of February. Applicants will be informed of their admission status by late March or early April.

Application forms for admission to the University are available from the Office of Admissions, University of Arizona, Tucson, AZ 85721. Profile questionnaire and recommendation forms are available from the College of Pharmacy. Application forms for the PCAT may be obtained from Psychological Corporation, 555 Academic Ct., San Antonio, TX 78204 or from the College of Pharmacy.
COLLEGE SCHOLASTIC REQUIREMENTS

Students in the Pharm.D. program are required to register for and complete a minimum of 14 units each semester. The cumulative university grade-point average and the cumulative professional grade-point average are considered for the determination of scholastic standing in the College of Pharmacy. A student is placed on academic probation if either grade-point average falls below 2.000 at the end of a semester or summer session. A student who is on probation may be disqualified at the end of the next semester if either grade-point average is below 2.000. A student who has been disqualified for at least a semester and who requests readmission to the pharmacy program, must petition the College of Pharmacy. The readmitted student is automatically placed on scholastic probation and is subject to any additional conditions that may be imposed by the faculty. It should be noted under “Academic Probation and Disqualification,” of the Academic Guidelines section of this catalog that, “Any later disqualification will be considered permanent disqualification.”

INTERNSHIP REQUIREMENTS

After enrolling in the College of Pharmacy, a student may register as an intern with the Arizona State Board of Pharmacy, 5060 N. 19th Avenue, Suite 101, Phoenix, AZ 85015. Inquiries concerning registration as a pharmacy intern and internship regulations should be addressed to the Secretary of the Board of Pharmacy.

FINANCIAL ASSISTANCE

Both undergraduate and graduate students in the College of Pharmacy are eligible for financial assistance through the scholarship and loan funds described in the Scholarships and Financial Aids section of this catalog.

REQUIRED CURRICULUM LEADING TO THE DEGREE OF DOCTOR OF PHARMACY

FIRST PREPHARMACY YEAR

<table>
<thead>
<tr>
<th>Subject</th>
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SECOND PREPHARMACY YEAR

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<td>Soc. Sci. Elec.*</td>
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*Lower-division social science elective—6 units of introductory courses from the following areas: anth., psych., soc., pol., comm., hist.

**Humanities 250a or 6 units from humanities options, as listed in general education requirements under College of Arts and Sciences, in this catalog.
### FIRST PROFESSIONAL YEAR

<table>
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### SUMMER SESSION

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### FOURTH PROFESSIONAL YEAR

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*6 units of upper-division general electives.
**15 units of practicum electives.
ELECTIVES

Students are required to complete the specified number of lower-division social science and humanities electives during prepharmacy studies. Subsequently, students are required to complete 6 units of upper-division general electives during the professional years. These 6 units may be selected from 300 and 400 level courses in the following departments:

Accounting  Management Information Systems
Anthropology  Marketing
Biochemistry  Molecular and Cellular Biology
Chemistry  Nutrition and Food Science
Communication  Pharmaceutical Sciences
Computer Science  Pharmacology and Toxicology
Ecology and Evolutionary Biology  Pharmacy Practice
Economics  Psychology
Finance  Sociology
Health Related Professions  Statistics
Management and Policy

Additionally, students are required to complete 15 units of practicum electives, selected from Ph.Pr. 803a-d, Ph.Pr. 810a-i, or Ph.Pr. 815a-I during the final professional year.

THE ARIZONA POISON AND DRUG INFORMATION CENTER,
THE RUTH E. GOLDMING CLINICAL PHARMACOKINETICS LABORATORY,
AND THE JEFFREY M. GOLDMING CLINICAL RESEARCH UNIT

The Arizona Poison and Drug Information Center, the Ruth E. Golding Clinical Pharmacokinetics Laboratory, and the Jeffrey M. Golding Clinical Research Unit are operated by the College of Pharmacy. For a description of their activities, consult the General University Information section of this catalog.
THE NATURE OF GRADUATE WORK—The status of graduate students is different from that of undergraduates. Satisfying degree requirements should not be the primary aim of graduate students. Graduate education provides an opportunity to increase knowledge, to broaden understanding and to develop research capabilities. Consequently, a student's academic achievements should reflect a personal commitment to the discipline and to scholarly standards.

ADMISSION—Admission to the Graduate College is open to qualified applicants who hold the bachelor's degree from the University of Arizona or from a college or university which grants degrees recognized by the University of Arizona. Degrees that are recognized should be based on programs of study that meet or exceed the general education requirements for comparable degree majors at the University of Arizona. A degree cannot ordinarily be recognized if it is based on any of the following types of credits:

1. Credits awarded by postsecondary institutions in the United States that lack candidate status or accreditation by a regional accreditation association.
2. Credits awarded by postsecondary institutions for life experience unless validated by the institution awarding the credits through the use of standardized (such as CLEP) or comprehensive examinations.
3. Credits awarded by postsecondary institutions for courses taken at noncollegiate institutions (e.g., governmental agencies, corporations, industrial firms, etc.).
4. Credits awarded by postsecondary institutions for noncredit courses, workshops, and seminars offered by other postsecondary institutions as part of continuing education programs.

In general, degrees that are recognized should be based on a unit of credit comparable to that defined by the Arizona Board of Regents (26 May 1979) for institutions under its jurisdiction. A minimum of 45 hours of work by each student is required for each unit of credit. An hour of work is the equivalent of 50 minutes of class time (often called a "contact hour") or 60 minutes of independent study work. For lecture-discussion courses, this requirement equates to at least 15 contact hours and a minimum of 30 hours of work outside of the classroom for each unit of credit. Even though the values of 15 and 30 may vary for different modes of instruction, the minimum total of 45 hours of work for each unit of credit is a constant. Admission is granted only after approval of an applicant's previous academic record by the Dean of the Graduate College and the head of the academic unit in which the greater portion of major academic work will be completed.

GRADE-POINT AVERAGE—Applicants who apply for admission to the Graduate College are evaluated on the individual merits of their academic achievements and individual scholarly potential to complete graduate level course work and curriculum requirements. Ordinarily, a minimum cumulative grade-point average of 3.0 over the last 60 units of course work is required for admission to the Graduate College. Applicants should consult the academic unit to which they are applying regarding that unit's grade-point average expectations. Prospective students who do not meet this standard may enroll as non-degree students and complete 12 consecutive units of 500-level (or higher) course work with a grade-point average of a least 3.25 in order to establish eligibility for seeking admission to the graduate degree program of their choice.

GRADUATE RECORD EXAMINATIONS—Normally applicants must submit scores on the Graduate Record Examination in order to complete the admission process. Scores on the aptitude test of the Graduate Record Examinations are used to supplement other evidence of preparation for graduate work. Such scores are only one component of the credentials used to make admission decisions, and they are evaluated in the context of the complete record in the application folder of each applicant. No formal minimum scores on standardized examinations are required for admission to the Graduate College. A number of departments, however, have specific requirements with regard to the Graduate Record Examinations, the Graduate Management Admissions Test, or other examinations. Some may require applicants to take the advanced GRE in
the appropriate discipline. Academic departments and departmental headnotes in the Graduate Catalog should be consulted for further information. It is important that the examination is taken as early as possible in the academic year. Applications for the examinations, which are administered locally as well as in other centers, should be sent, together with the examination fee, to Graduate Record Examinations, Educational Testing Service, Box 1502, Berkeley, CA 94701; or Box 955, Princeton, NJ 08541.

REGULAR GRADUATE STATUS—Students who meet the admission requirements outlined above may be admitted to regular graduate status to undertake work leading to an advanced degree.

ADMISSION WITH DEFICIENCIES—An additional number of undergraduate courses may be required when previous work has not approximated the general requirements for the corresponding bachelor's degree at the University of Arizona or the special requirements for the field in which the candidate proposes to specialize. With departmental approval, a limited number of course deficiencies may be satisfied after admission to a graduate program; however, this work will not receive graduate credit.

GRADUATE NONDEGREE STATUS—Individuals holding a bachelor's degree, or its equivalent, from a college or university which grants degrees recognized by the University of Arizona may attend graduate-level courses without being admitted to a graduate degree program. Such students may enroll in graduate-level course work as their qualifications and performance permit; however, no more than 6 units earned while in this status may later be requested to be applied toward an advanced degree awarded at the University.

ADMISSION OF FOREIGN STUDENTS—Nonimmigrants should request graduate application forms from the Graduate Student Admissions Office and departmental requirements and materials from the major department. All foreign student applications, with the required credentials, should reach the Graduate Student Admissions Office before March 1 for summer and fall terms and September 1 for the spring term. Some graduates of foreign institutions may be admitted initially as International Special Students for a period of enrollment limited to two academic terms with the understanding that they may be required to undertake some work without graduate credit in order to make up deficiencies in preparation. In any event, no commitment can be made regarding the time required to complete a course of study.

The University requires all applicants whose native language is other than English to take the Test of English as a Foreign Language (TOEFL) unless they have completed at least two academic years of full-time study or received a bachelor's or higher degree at a post-secondary academic institution in which English is the spoken tongue and medium of instruction. Results of the TOEFL are valid for two years, and scores will be sent to the University of Arizona, when requested by the applicant, from TOEFL, Box 899-TR, Princeton, NJ 08540, U.S.A. The scores for this examination must be received before the student's application is complete. New students who are required to take the TOEFL test and whose scores are below 550 are required to take a locally administered English test and to enroll for any further English courses which may be recommended. Students whose native language is not English and who wish to be considered for a teaching assistantship should also submit scores on the Test of Spoken English (TSE) that is also administered by the Educational Testing Service of Princeton, NJ 08540.

For those prospective students who lack college-level English proficiency, the Center for English as a Second Language (CESL) offers full-time English language training on campus. The full semester or summer term sessions carry no college credit, but satisfactory completion of CESL training meets the University's English proficiency requirement for admission. Request further information from the Center for English as a Second Language, Room 104 CESL Building, University of Arizona, Tucson, AZ 85721.

Students on nonimmigrant visas must certify that they possess adequate financial resources to support themselves while in residence at the University of Arizona. If sponsorship is through an organization or government agency, the sponsor must inform the Graduate Student Admissions Office, in advance, what the terms of support will be. Financial guarantees must be dated and addressed to the University of Arizona. If the University is to bill for tuition and fees, billing must be through an embassy or an agent in the United States. In addition, students on nonimmigrant visas are required by the University to have student accident and sickness insurance coverage for each term of enrollment. The cost of this insurance is included in the amount
of financial guarantee required. Students may be exempted from the University of Arizona insurance plan only when their government or sponsoring agency has submitted accident and insurance plans acceptable to the University of Arizona. Additional information and costs of this coverage will be sent to those foreign students who are accepted for admission.

APPLICATION FOR ADMISSION—Application for admission to the Graduate College must be made on forms furnished by the Graduate College. Completed application forms must arrive before supporting transcripts come or processing will be seriously delayed. An applicant from another institution should request that two sets of completed official transcripts of all undergraduate and graduate work done and degrees received be sent directly by the institution at which the work was done to the Dean of Graduate College of the University of Arizona. Both the application and the transcripts should be on file four to six months prior to registration. Applicants whose records are not in English are required to provide a certified translation of those records. Applicants should also contact the department of their intended major to obtain departmental application materials and requirements. Students who have been admitted to the Graduate College but who were not enrolled during the previous regular semester must reapply for admission.

MAJOR FIELDS FOR SPECIALIST DEGREES

- educational administration
- educational media
- educational psychology
- elementary education
- microbiology
- nursing
- reading
- secondary education
- special education

ADVANCED DEGREES OFFERED

Full descriptions of programs and requirements for each of the following degrees may be found in the Graduate Catalog. A number of departments offer work leading to more than one degree, and a great many specializations are available within the degrees listed.

- Master of Accounting (M.Ac.)
- Master of Agricultural Education (M.Ag.Ed.)
- Master of Architecture (M.Arch.)
- Master of Arts (M.A.)
- Master of Business Administration (M.B.A.)
- Master of Education (M.Ed.)
- Master of Fine Arts (M.F.A.)
- Master of Home Economics Education (M.H.E.Ed.)
- Master of Landscape Architecture (M.L.Arch.)
- Master of Library Science (M.L.S.)
- Master of Music (M.M.)
- Master of Public Administration (M.P.A.)
- Master of Science (M.S.)
- Master of Teaching (M.T.)

- Educational Specialist (Ed.S.)
- Nursing Specialist (N.S.)
- Specialist in Microbiology (Sp.M.)
- Doctor of Education (Ed.D.)
- Doctor of Musical Arts (A.Mus.D.)
- Doctor of Philosophy (Ph.D.)
General Divisions of the University

DEPARTMENT OF EXERCISE AND SPORT SCIENCES

The Department of Exercise and Sport Sciences offers course work in exercise and sport sciences and physical education leading to bachelors' degrees. Minor programs are available in physical education and in athletic coaching. The latter minor is designed for individuals who wish to coach interscholastic sports at the secondary school level while teaching in a field other than physical education. Refer to the Departments and Courses of Instruction section of this catalog for the specific details concerning each of these programs.

Master of Arts and Master of Science degrees are available with a major in exercise and sport sciences. A minor in exercise and sport sciences is available for Ph.D. and Ed.D. students with majors in other disciplines. For information regarding graduate programs, please consult the Graduate Catalog.

The department offers a broad elective program in physical activity course work which focuses on physical fitness and skill development. Students may choose from among more than 40 courses. Provision is made for those students with physical handicaps to participate in an adapted physical activity program which has many diverse offerings.

ATHLETIC PROGRAMS

INTRAMURAL AND RECREATIONAL SPORTS PROGRAM—Campus Recreation is a newly created unit within the Student Affairs division. In the near future it will include a new student funded recreation center. It currently incorporates the intramural programs active in Bear Down Gym and on Bear Down field, club spots, open recreation, and the Park Student Center weight room and exercise program. Both organized and informal programs of activity intended for students, faculty, and staff are sponsored by the department throughout the year. The intramural program includes competitive sports activities in 26 sports for men, 25 sports for women and 8 sports on a coed recreational basis. Women and men are encouraged to join residence halls, sororities, fraternities, or independent teams or register independently in this active program. Informal recreation can be arranged by scheduling the appropriate facility for specific hours of recreational use. Gymnasia, handball-racquetball, and tennis courts, swimming pools, weight room and field space are available for individual participation in recreational pursuits. The information regarding the program of Intramural and Recreational Sports can be obtained by calling the Recreational Office in Bear Down Gym.

INTERCOLLEGIATE ATHLETICS—The Intercollegiate Athletics Department at the University of Arizona conducts a challenging program in 8 sports for men and 9 for women: baseball (M), basketball (M/W), cross country (M/W), football (M), golf (M/W), gymnastics (W), softball (W), swimming and diving (M/W), tennis (M/W), track and field (M/W), and volleyball (W). The University is a member of the NCAA, and both the men's and women's programs are conducted under NCAA rules and participate in NCAA championships.

The University of Arizona is a member of the Pacific-10 Conference. In addition to the men's and women's teams from the University of Arizona, the conference includes Arizona State University, University of California at Berkeley, University of California at Los Angeles, University of Oregon, Oregon State University, Stanford University, University of Southern California, University of Washington, and Washington State University.

The President of the University appoints an advisory committee on intercollegiate athletics, which consists of the Director of Athletics, the faculty representative to the NCAA, members of the faculty, alumni members, and students.

OFFICE OF INTERDISCIPLINARY PROGRAMS

One of the major problems facing higher education is the initiation and development of effective interdisciplinary programs of education and research. The traditional disciplinary struc-
tume of the University is being altered in diverse ways, some involving informal cooperation of interested faculty, others resulting in creation of centers, institutes and other organized units. The University of Arizona has responded to these needs by creating a number of interdisciplinary units: the Office of Arid Lands Studies, the Environmental Research Laboratory, the Optical Sciences Center, the Institute for Atmospheric Physics and others.

The Office in Interdisciplinary Programs was established as an agency responsible for furthering the development of new activities. The Coordinator of Interdisciplinary Programs works with the Dean of the Graduate College and the Vice President for Research in fostering both educational and research projects.

SCHOOL OF HEALTH-RELATED PROFESSIONS

The School of Health-Related Professions provides educational opportunities for students in the health-related professions. Close liaison exists with related colleges as a recognition of the interdisciplinary nature of the health field and an attempt to utilize valuable resources throughout the University.

DEGREES—The School offers the Bachelor of Science in Health Sciences degree with majors in health education, medical technology, and occupational safety and health, as well as a Master of Education with a major in health education.

ADMISSION—Students seeking admission to programs in the School of Health-Related Professions should contact the Office of Academic Services in the College of Arts and Sciences, Modern Language 347, or faculty advisors for the programs of health education or medical technology at the School of Health-Related Professions, 1435 N. Fremont.

SCHOOL OF MILITARY SCIENCE, NAVAL SCIENCE AND MILITARY AEROSPACE STUDIES

The Reserve Officer Training Corps (ROTC) has been an integral part of the University of Arizona since 1917. The School of Military Science, Naval Science and Military Aerospace Studies consists of three separate departments, the Department of Military Science (Army), Department of Naval Science (Navy and Marine Corps), and the Department of Military Aerospace Studies (Air Force), under the administrative control of the military coordinator, a civilian member of the University staff designated by the President of the University.

General objectives of the course of instruction are to furnish leaders suitable for commissioning as officers in the U.S. Army, U.S. Navy, U.S. Marine Corps, and U.S. Air Force. Outstanding Army ROTC students who are designated Distinguished Military Students are eligible to apply for appointment as officers in the Regular Army. All graduating students in the Naval and Air Force ROTC programs go on active duty. Intermediate objectives of the ROTC programs are to develop self-discipline; integrity; a sense of responsibility; an appreciation of the role of a participating citizen in the national defense; and the capacities for thoughtful and decisive leadership.

Department of Military Science

Army ROTC (Reserve Officers' Training Corps) is a program which offers college students the opportunity to graduate as officers and serve in the U.S. Army, the Army National Guard, or the U.S. Army Reserve. Army ROTC has been an integral part of the University of Arizona since 1917.

Army ROTC enhances a student's education by providing unique leadership and management training, along with practical experience. It helps a student develop many of the qualities basic to success in the Army, or in a civilian career. ROTC gives each college student a valuable opportunity to build for the future by earning a college degree and an officer's commission at the same time.

PROGRAMS—The School of Military Science offers a regular four-year program and a special two-year program.
The four-year program is divided into two parts called the Basic Course and the Advanced Course. The Basic Course is usually taken during the first two years of college and covers such subjects as management principles, national defense, military history and leadership development. In addition, a variety of outside social and professional enrichment activities are available. All necessary ROTC textbooks, uniforms, and other essential materials for the Basic Course are furnished to the students at no cost. The student participating in the Basic Course is under no military obligation. After completing the Basic Course, students who have the desire and have demonstrated the potential to become an officer and who have met the physical and scholastic standards are eligible to enroll in the Advanced Course.

The Advanced Course is usually taken during the final two years of college. It includes instruction in organization and management, tactics, ethics and professionalism and further leadership development. All necessary textbooks and uniforms in the Advanced Course are also furnished to students at no cost. During the summer between their junior and senior years of college, Advanced Course cadets attend a paid six-week training session at Fort Lewis, Washington, called ROTC Advanced Camp. Advanced Camp gives cadets the chance to practice what they've learned in the classroom, and introduces them to Army life at an active Army post. Advanced Course cadets receive a monthly subsistence allowance of $100.00 during their ROTC training.

The two-year program is designed for junior and community college graduates, students at four-year colleges who did not take ROTC during their first two years of school, students entering a two-year postgraduate course of study, and high school students planning to attend military junior colleges. To enter the two-year program, students must first attend a fully-paid six-week Basic Camp, normally held during the summer between their sophomore and junior years of college. Students going to a military junior college will attend camp the summer following high school graduation. At Basic Camp, students learn to challenge themselves physically and mentally, and to build their confidence and self-esteem. After successful completion of Basic Camp, students who meet all the necessary enrollment requirements may enroll in the Advanced Course of ROTC study. Students with prior military service may qualify for the Advanced Program without having to attend Basic Camp.

MILITARY SERVICE CREDIT—Credit toward graduation received for active military service (see "Credit for Military Service" in the Admission to the University section of this catalog) can be used in lieu of lower-division (Basic Course) ROTC units in the four-year program.

LOWER-DIVISION CREDIT—Three units of credit are given for each semester completed of the Basic Course (total, four semesters).

UPPER-DIVISION CREDIT—Three units of credit are given for each semester completed of the Advanced Course (total, four semesters). Advanced Course ROTC cadets are required to sign a contract with the government to continue in ROTC until the completion of ROTC training.

FINANCIAL ASSISTANCE—Subsistence pay of $100.00 per month, tax-free, for a maximum of 20 months during the Advanced Course is paid to upper-division ROTC cadets. Additionally, students receive pay for summer camp and travel pay to and from ROTC Advanced Camp.

Army ROTC scholarships are offered for four, three and two years and are awarded on a competitive basis to the most outstanding students who apply. Four-year scholarships are awarded to students who will be entering college as a freshman. Three- and two-year scholarships are awarded to students already enrolled in college and to Army enlisted personnel on active duty. Students who attend the Basic Camp of the two-year program may compete for two-year scholarships while at camp.

Each scholarship pays for college tuition and required educational fees, and provides a specified amount for textbooks, supplies and equipment. Each scholarship also includes a subsistence allowance of up to $1,000 for every year the scholarship is in effect.

Department of Naval Science

The mission of the Naval Reserve Officers Training Corps Unit is to develop midshipmen morally, mentally, and physically and to imbue them with the highest ideals of duty, honor, and loyalty in order to commission college graduates as naval officers who possess a basic profes-
sional background, are motivated toward careers in the naval service, and have a potential for future development in mind and character so as to assume the highest responsibilities of command, citizenship, and government.

PROGRAMS—The NROTC program offers a four-year college program and a two-year college program. All programs lead to service as a commissioned officer in the Navy or Marine Corps. Applicants for the four-year college program may be made to the NROTC unit at any time. Applicants for the two-year college program may be made to the NROTC unit during the fall semester or early part of the spring semester of the sophomore year. Applicants are selected on the basis of demonstrated academic performance and expressed motivations.

FINANCIAL AID—The NROTC program offers four, three-and-a-half, three, two-and-a-half, and two-year scholarships. Students in the NROTC scholarship program receive tuition and scholastic fees, textbooks, uniforms and $100.00 per month for a maximum of 40 months. Students in the NROTC college program receive Naval Science textbooks and uniforms while they are in the program and $100.00 per month subsistence allowance during their junior and senior years.

Applications for the NROTC four-year scholarship program must be made to the Navy by December 1 for entry into the program the following fall semester. Applicants must compete nationally on the basis of ACT or SAT scores. High school and college academic performance weighs heavily on an applicant's selection. Applications for the NROTC two-year scholarship must be made to the Navy during the early part of the year for entry into the program in June. Applicants must be college sophomores and selection is based primarily on the student's academic performance.

Further information concerning the program may be obtained from high school and college counselors, recruiting stations, and the NROTC unit at the University of Arizona.

COURSES OF INSTRUCTION—Students in the NROTC scholarship program are encouraged to pursue majors in the engineering and hard science (mathematics, chemistry, and physics) fields of study to meet the technological requirements of today's growing Navy. Other fields of study are permitted with the approval of the Professor of Naval Science. There are no restrictions placed upon college program students or Marine Corps option students as to their academic majors.

While enrolled in the NROTC program the student will complete the following courses of study in addition to their academic major requirements.

FIRST YEAR
Naval Science 101 Introduction to Naval Science
Naval Science 102 Naval Ship Systems I

SECOND YEAR
Naval Science 201 Naval Ship Systems II
Naval Science 202 Seapower and Maritime Affairs

THIRD YEAR
Naval Science 301 Navigation and Naval Operations I
Naval Science 302 Navigation and Naval Operations II

FOURTH YEAR
Naval Science 401 Leadership and Management I *
Naval Science 402 Leadership and Management II

* Management 305 may be substituted for this course.

Course descriptions may be found under Naval Science in the departmental section of this catalog. Marine Corps option students will take Naval Science 310—Evolution of Warfare; Naval Science 410 —Amphibious Warfare; and two elective courses (elective courses must be approved by the Professor of Naval Science) during their third and fourth years vice the above schedule.

All NROTC students attend Naval Science laboratory once a week. In addition, the NROTC scholarship students must take certain additional courses depending on major. Information concerning these additional courses may be obtained at the Department of Naval Science.
Department of Military Aerospace Studies

The Department of Military Aerospace Studies (Air Force ROTC) provides unique opportunities to students interested in entering the military profession as Air Force officers. Today's Air Force is a highly technologically advanced branch of the military forces. Whether a student's interest lies in flying the most advanced aircraft in the world or in the development of state-of-the-art technology, the Air Force can offer exciting and challenging opportunities to those who qualify. Graduates go on active duty in career fields where they can immediately apply their university education. Additionally, they assume advanced leadership and management responsibilities not normally found in civilian entry level positions. Although a bachelor's degree is the minimum requirement, students working toward higher degrees can also join the program and receive a commission in the U.S. Air Force.

PROGRAMS—Air Force ROTC offers both a two- and four-year program. The four-year program consists of the General Military Course—four semesters of lower-division aerospace studies classes; and the Professional Officer Course—four semesters of upper-division aerospace studies classes. The first four semesters carry no military obligation, giving students the opportunity to look at the military profession and the Air Force before making a commitment. Since the first four semesters have no prerequisites, they are open to any student interested in exploring Air Force opportunities. The two-year program consists of the Professional Officer Course. Students must have at least a junior standing to enter the two-year program, and should apply during the fall or early spring of their sophomore year of study. Seniors and graduate students wishing to enter the two-year program must have or be willing to spend two years in ROTC as full-time students. All ROTC students attend a weekly one-hour leadership laboratory providing "hands-on" experience in the art and science of leading people.

FINANCIAL AID—Every student accepted into the Professional Officer Course receives a $100.00 per month, tax-free subsistence allowance during the academic year. Scholarships are also available. Air Force ROTC offers four, three-and-a-half, three, two-and-a-half, and two-year scholarships. Students must apply for four-year scholarships as seniors in high school. Subsequent to high school, students must be enrolled in an Air Force ROTC class to apply. A student enrolled in any lower-division Air Force ROTC class may qualify for a scholarship. Scholarships pay tuition and fees, the cost of books, plus a $100.00 per month, tax-free subsistence allowance. Scholarships are awarded based on the student's achievement, not financial need, and do not extend the active duty commitment.

CREDIT—Lower-division Air Force ROTC classes carry two units of credit each semester. Upper division classes carry three units each semester. People with prior military service and people accepted into the two-year program may receive credit for the lower-division Air Force ROTC courses.

For more information, please contact the Department of Aerospace Studies.

DIVISION OF CONTINUING EDUCATION

The Division of Continuing Education is responsible for educational and community services as an outreach function of the University of Arizona. In cooperation with all academic colleges and departments of the University, specific courses and programs are developed to meet the ever-changing needs of people in the Tucson area and southern Arizona. Learning opportunities include a variety of credit and noncredit programs.

Credit Programs

UNIVERSITY EXTENSION—University Extension serves the needs of the individuals who find it difficult or impossible to take regularly scheduled classes on campus. The Sierra Vista/Fort Huachuca Program Center is open five days a week. Both graduate and undergraduate courses are offered off-campus and all courses receive regular university credit. In all cases, admission to the Graduate College is required to receive graduate credit.

INDEPENDENT STUDY THROUGH CORRESPONDENCE—Correspondence courses are designed to parallel, as nearly as possible, the same courses offered on campus. Neither age of
the student nor place of residence is a deterring factor to the successful completion of an independent study program. All lessons and examinations are mailed to the instructor who grades and returns the lessons to the students. Tucson area students take examinations in the Independent Study Through Correspondence Office on campus. Students residing outside of the Tucson area take examinations in their local community under the auspices of an approved proctor. Regularly enrolled on-campus students may register for correspondence courses with the approval of the college dean. For information on restrictions governing the use of correspondence study to fulfill graduation requirements, see “Correspondence Study” and “University Credit Requirement” under the Graduate Requirements section of this catalog.

Noncredit Programs

UNIVERSITY CONFERENCE DEPARTMENT—Working with colleges, departments and faculty, the conference department assists in planning regional, national and international conferences, short courses and seminars.

ELDERHOSTEL—Continuing Education is the state coordinating office for Arizona Elderhostel. Arizona Elderhostel is part of the national Elderhostel network offering special low-cost academic programs for older adults.

OFFICE OF INTERNATIONAL PROGRAMS

The Office of International Programs serves as a campus-wide support and coordinating unit for all international activities of the University of Arizona. Numerous international development activities are coordinated through this office. These include active projects in Africa, the Middle East, and Latin America.

The office serves as a campus clearinghouse for information on international programs, studies, and projects, to students, faculty, and the general public. The office also provides special services, by contractual arrangement, with sponsors of international students for which fees are charged.

Study Abroad programs coordinated from this office include summer and semester programs in Rio de Janeiro, Brazil; London, England; Florence, Italy; Segovia, Spain; and in France, Germany, Japan, and Taiwan. The University also operates a major summer program in Guadalajara, Mexico. Numerous international academic programs include formal faculty exchanges between the University and institutions in France, Austria, Britain, and Mexico.

The Peace Corps Office, which counsels and processes Peace Corps and U.N. Volunteer Program applicants, is part of the Office of International Programs.

OFFICE OF THE SUMMER SESSION

Summer session is an integral part of the academic structure of the University and consists of a three-week presession and two five-week terms. Courses offered are of the same character as those held during the regular academic year, with similar standards of academic achievement required. Over 700 courses are available during the summer terms. The summer program is coordinated by the Office of Summer Session, with departmental academic programs determined by academic deans.

ADMISSION—Summer session enrollment is open to all regularly admitted students of the University. It is also open to students admitted at the undergraduate level for the summer session only.

For further information, please see the Summer Session Schedule of Classes, which is published each January.

Winter Session

A three-week winter session, consisting of a limited number of courses and coordinated by the Office of Summer Session, is held during the break between the fall and spring terms. Students are able to earn up to 3 units of credit.
Departments and Courses of Instruction
Course Offerings

CURRICULAR CHANGE—Course listings in the following departmental sections are subject to change. Curriculum changes approved during the first year of the catalog’s biennium are listed in the Supplement to the University of Arizona Catalog, published approximately one year after publication of the biennial catalog. A copy of this publication is available upon request from the University Curriculum Office, Administration Building, Room 412a.

CLASS SCHEDULES—Because the catalog designation of semesters of offering is subject to change, students should consult the Schedule of Classes for curricular planning of a particular term. Schedules for fall and spring classes are available at the Information Desk of Registrar Data Processing, Administration Building, Room 210, in April and October, respectively. The Summer Session Schedule of Classes is available in January at the Administration Building, Room 210. For a complete statement of the student’s responsibility in maintaining acquaintance with current university requirements, see the copyright page of this catalog.

PREREQUISITES—A student registering for a course must meet the prerequisites or otherwise satisfy the instructor of his or her preparation to take the course. Prerequisites can be waived only at the discretion of the instructor or department involved.

CANCELLATION OF COURSES—The University reserves the right to cancel courses not elected by an adequate number of students.

Course Numbering System

CLASSIFICATION OF COURSES — The number by which a course is designated indicates the level of the course. Courses numbered:

100-299 inclusive: Lower-division courses primarily for freshmen and sophomores.

100-199: Primarily introductory and beginning courses.


300-499 inclusive: Upper-division courses primarily for juniors and seniors.

300-399: Advanced-intermediate-level courses. Not available for graduate credit.

400-499: Advanced-level courses. Acceptable for graduate credit with the prior approval of the Graduate College, except 400-level individual studies courses (491, 493, 494 or 499, with or without subscripts).

500-599 inclusive: Graduate courses. Open to exceptionally well-qualified seniors with the prior written approval of the course instructor and the Graduate College.

600-699 inclusive: Graduate courses. Not open to undergraduate students.

700-799 inclusive: Graduate courses limited to doctoral students.

800-899 inclusive: Courses limited to students working toward degrees offered by the College of Medicine or the College of Pharmacy. Not available for credit toward other degrees.

SEMESTER COURSES (SINGLE NUMBERS)—A course designated by a single number (as Econ. 248) is one semester in length.

YEAR COURSES (DOUBLE NUMBERS)—A course designated by a double number (as Pol. 233a-233b) is continued through two successive semesters, the work of the first semester being prerequisite to that of the second unless otherwise indicated in the statement of prerequisites. Credit is awarded for the first half of the course except in a few instances when credit in the first half is contingent upon completion of the second half.

COURSE DESCRIPTION EXPLANATION

The standard course description includes a variety of symbols indicative of essential information. The following is a standard course description with the individual symbols explained in the order in which they appear in that description.

SAMPLE COURSE LISTING:

406. Social Structure in Modern Societies (3) [Rpt.] GC I 1988-89 GRD Critical review of modern theory and research on social structure and social organization in modern societies. 2R, 3L. P, 6 units of sociology or CR. (Identical with Hist. 406) Smith

406. — Course number.

Social Structure in Modern Societies — Course title.

(3) — Number of units.
[Rpt.] — May be repeated for credit. A restriction regarding the number of times a course may be repeated for credit (beyond the student's first enrollment) or the total number of units of credit permitted for a course may be designated. [Rpt./2] indicates that the course may be repeated for credit twice, for a maximum of three enrollments in the course; [Rpt./6 units] means that the course may be repeated until the student has received a total of 6 units of credit. It is the student's responsibility to ensure that course content is not duplicated.

GC — Graduate credit available. (Used as an identifier for 400-level courses only.)
I — Semester offered. I indicates fall semester; II, spring; S, summer.
1988-89 — Year in which course is offered. If no year designation is given, the course is offered each year.
GRD/CDT — GRD and CDT indicate that the course is available by examination. GRD indicates that the course is available by examination for a grade and credit, and CDT indicates that the course is available by examination for credit only. These options are not available for graduate credit.

Critical review...societies. — Course description.

2R, 3L — Class structure. R, L, and S indicate "recitation," "laboratory," and "studio." 2R, 3L indicates that the class meets two hours of recitation and three hours of laboratory per week (based upon 15 weeks). For courses consisting of lecture and recitation periods only, the number of class hours per week is the same as the unit value and is not specified in the course description.

P — Prerequisites. Identifies courses or other experiences which must be completed prior to enrolling in the course listed.

CR — Concurrent registration. Identifies courses which must be taken during the same term as the course listed.

(Identical with Hist. 406) — Crosslisting. Identifies other departments which give credit for the same course. The course description is shown in the course list of the "home" department with instructional responsibility for the course. If no course description appears, consult the crosslisted department.

Smith — Professor in charge.

Note: Not all of the above information may be noted in any individual course.
UNIVERSITY-WIDE "HOUSE-NUMBERED" COURSES

Most University of Arizona courses use a combination of lectures, discussions and laboratories as their basic teaching format. University-wide "house-numbered" courses identify alternative teaching formats which emphasize student participation, typically in small group or individual settings. Small-group courses are identified by numbers ending in 95, 96 or 97. The area of study for such courses is indicated through a subscript and subtitle. Individual-studies courses are those with numbers ending in 91, 93, 94, 98* and 99, as well as all 900-level courses. Under their generic numbers and titles, and without subscripts, they are available for use by all departments at the course-number levels appropriate to the departments' academic programs. Individual studies courses at the 400-level are not available for graduate credit.

*See the Honors Program under the Departments and Courses of Instruction section of this catalog for a description of 498H.

Small-Group Courses

195, 295, 395, 495, 595, 695, 795. Colloquium (Credit varies) The exchange of scholarly information and/or secondary research, usually in a small group setting. Instruction often includes lectures by several different persons. Research projects may or may not be required of course registrants.

GRADES AVAILABLE: (195, 295, 395, 495) - A, B, C, D, E, I, P/F, S/P.* W.
(495 GC, 595, 695, 795) - A, B, C, D, E, I, S/P.* W.

196, 296, 396, 496. Proseminar and 596, 696, 796. Seminar (Credit varies) The development and exchange of scholarly information, usually in a small group setting. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.

GRADES AVAILABLE: (196, 296, 396, 496) - A, B, C, D, E, I, P/F, S/P.* W.
(496 GC, 596, 696, 796) - A, B, C, D, E, I, S/P, W.

197, 297, 397, 497, 597, 697, 797. Workshop (Credit varies) The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles.

GRADES AVAILABLE: (197, 297, 397, 497) - A, B, C, D, E, I, P/F, W.
(497 GC, 597, 697, 797) - A, B, C, D, E, I, W.

*Special (i.e., S,P,C,D,E) or regular grades may be used as departmental policy dictates; however, in any single course offering, all registrants must be graded by the same system.

Individual Studies

191, 291, 391, 491, 591, 691, 791. Preceptorship (Credit varies.) Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.

GRADES AVAILABLE: S/P, C, D, E, I, W.

193, 293, 393, 493, 593, 693, 793. Internship (Credit varies) Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

GRADES AVAILABLE: S/P, C, D, E, I, W.

493I, 593I. Legislative Internship [493I(12), 593I(9)] [I] Working experience at the Arizona State Legislature; responsibilities draw upon student's area of major expertise and include preparing written and oral reports, summarizing legislative proposals, and providing information to legislators and legislative committees. Participating programs include but are not limited to: architecture, economics, English, geography and regional development, history, hydrology, journalism, management, management information systems, marketing, political science, psychology, public administration, secondary education, sociology, statistics, and urban planning. Students in other programs are eligible and should consult the department head or, in the case of the College of Law, the dean, for appropriate arrangements.

GRADES AVAILABLE: A, B, C, D, E, I, W.
194, 294, 394, 494, 594, 694, 794. Practicum (Credit varies) The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation. 
*GRADES AVAILABLE: S/P, C, D, E, I, W.*

199, 299, 399, 499, 599, 699, 799.* Independent Study (Credit varies) Qualified students working on an individual basis with professors who have agreed to supervise such work. 
*GRADES AVAILABLE: S/P, C, D, E, I, W.*

900. Research (Credit varies) Individual research, not related to thesis or dissertation preparation, by graduate students. 
*GRADES AVAILABLE: S/P, C, D, E, K, W.*

908. Case Studies (Credit varies) Individual study of a particular case, or report thereof. 
*GRADES AVAILABLE: S/P, E, K, W.*

909. Master's Report (Credit varies) Individual study or special project or formal report thereof submitted in lieu of thesis for certain master's degrees. 
*GRADES AVAILABLE: S/P, E, K, W.*

910. Thesis (Credit varies) Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department. 
*GRADES AVAILABLE: S/P, E, K, W.*

920. Dissertation (1 to 9) Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing). 
*GRADES AVAILABLE: S/P, E, K, W.*

925. Graduate Recitals (1 to 9) For graduate students in music performance. 
*GRADES AVAILABLE: S/P, E, K, W.*

930.** Supplementary Registration (1 to 9) For students who have completed all course requirements for their advanced degree programs. May be used concurrently with other enrollments to bring to total number of units to the required minimum. 
*GRADES AVAILABLE: K.*

*Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.

**Graduate students who have completed the course requirements of their programs and will be taking examinations or completing courses or projects initiated at an earlier date should register for supplementary registration. Students completing requirements for advanced degrees must be registered during the semester or summer term in which requirements are completed, or during the previous semester or term if requirements are completed during an intersession. Students who have previously enrolled for all the regular courses required for their degrees may register for supplementary registration (course number 930, one to nine units). All graduate students using university facilities or faculty time must register for 930 if not registered for anything else. Credit received for this course is in addition to the units required for the advanced degree.

**ACADEMIC DEPARTMENTS AND COMMITTEES**

Permanent courses offered by the University of Arizona are listed on the following pages by department or committee in alphabetical order. For location of departmental office, see “College and Department Locations” at the end of this catalog.
ACCOUNTING

Professors Russell M. Barefield, Head, William B. Barrett, Dan S. Dhaliwal, William L. Felix, Jr., Dee L. Kleespie
Associate Professor William S. Waller
Assistant Professors Joseph Fisher, Marcia S. Niles, Graeme W. Rankine, William K. Salatka, Jeffrey W. Schatzberg, S. Mark Young
Lecturer Joan W. Norvelle, Associate Head

The accounting program prepares students for careers such as the independent practice of public accounting, controllership, and general accounting management. Graduate work in accounting is offered for those who wish more background for the positions described above and for those who wish to teach in colleges and universities. In many instances, a five-year program leading to a Master of Accounting degree will be desirable to achieve a student's objectives. (See the Graduate Catalog.)

Students who desire the Bachelor of Science in Business Administration with a major in accounting will follow the program of studies shown in the College of Business and Public Administration section of the catalog.

The department offers graduate instruction leading to the Master of Accounting degree and participates in the programs leading to the Master of Business Administration and Doctor of Philosophy degrees with a major in business administration. For admission and degree requirements, please see the Graduate Catalog.

200. Introduction to Financial Accounting (3) I II CDT Concepts involved in accounting for assets, liabilities, and owners' equity; financial statements.


300a-300b.* Intermediate Accounting (3-3) Theory and methodology involved in contemporary accounting for assets, liabilities, stockholders' equity, net income, and funds; analysis and interpretation of financial statements. Credit allowed for this course or 553a-553b, but not for both. P, 210. Both 300a and 300b are offered each semester.

310.* Cost and Managerial Accounting (3) I II Concepts and analytical procedures necessary in the generation of accounting data for management planning and control. P, 210, Econ. 201a-201b or Econ. 300, M.A.P. 275, Math. 123.

401.* Advanced Accounting I (3) GC III Theory and methodology involved in the preparation of consolidated financial statements and in accounting for partnerships. P, 300b or CR.

402.* Financial Accounting Standards (3) GC II In-depth coverage of selected authoritative pronouncements and other special topics in financial accounting. P, 300b.

405.* Foundations of Accounting and Auditing Theory (3) GC II Theoretical frameworks and analytical tools appropriate to the development and implementation of accounting and auditing theories. P, 310, M.A.P. 275.

410.* Advanced Cost Accounting (3) GC II Theoretical issues of process and standard costing, performance measurement, differential cost analysis, and other selected topics. P, 310, 405.

420.* Advanced Business Law (3) GC II GRD (Identical with M.A.P. 420).

422.* Advanced Federal Taxation (3) GC I II Introduction to advanced topics: taxation of corporations and stockholders' transactions in stocks; taxation of partnerships and fiduciaries; gift and estate taxation. P, 320, 401.

431.* Principles of Auditing (3) GC I II The opinion formulation process of the professional auditor; the auditor's reports, professional standards, internal and operational auditing. P, 300b, 405 or M.A.P. 375.

461.* Accounting Information Systems (3) GC I II The analysis, design and implementation of information systems, with special emphasis on accounting applications. P, 310 or 551, M.I.S. 121. Credit allowed for this course or 471 but not both. (Identical with M.I.S. 461)

471.* Policy Formation and Accounting Information Systems (3) I II Integrative course utilizing the case study approach and focusing on the financial impact of accounting, marketing and production strategies.
Open only to BPA majors. P, 310, 300b, Fin. 311, M.A.P. 305, Mktg. 361. Credit allowed for this course or 461 but not both. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

472. * Fund Accounting (3) GC II Budgetary and financial accounting, control, and reporting for governments and other not-for-profit organizations. P, 210, 272, or 550.  *
  * "Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

510. Principles of Profit Planning and Control (3) I The design and use of accounting information for managerial planning and control purposes. P, 310 or 551.


523a-523b. Estate Planning and Taxation (2-2) I II Advanced topics on gift and estate taxation; emphasis on the planning and structuring of financial activities to minimize the impact of income and wealth-transfer taxes. P, 422, M.A.P. 426 or CR.

526a-526b. Corporate Taxation (2-2) I II Advanced topics in the taxation of corporations and of stockholders' transactions in corporate shares. P, 401, 422.

527. Tax Aspects of Real Estate Transactions (2) II Gains and losses on sales and exchanges of property for tax purposes; capital and ordinary gains and losses, realization, transfer by gift or at death, use in trade or business, installment sales, and depreciation recapture provisions. P, 401, 422.

528. Taxation of Partnerships (2) II Concepts and principles of partnership income taxation and the uses of partnerships for tax planning. P, 401, 422.

531. Responsibilities of the Public Accountant (3) II A professional course for those who expect to pursue public accounting as a career. P, 431.

550. Financial Accounting Analysis (3) III Principles and procedures underlying basic financial accounting processes and their application in the preparation and analysis of financial statements. Advanced degree credit available for nonmajors only. Open only to students admitted to BPA graduate programs.

551. Managerial Use of Accounting Data (3) I II Case studies and text readings focused on utilization of accounting data in determining the possible results of alternative executive decision. Advanced degree credit available for nonmajors only. Open only to students admitted to BPA graduate programs. P, 550, Econ. 500a or CR, M.A.P. 552 or CR.

553a-553b. Financial Accounting (3-3) I II Theory and methodology of net income determination; accounting for assets, liabilities, and owners' equity. Credit allowed for this course or 300a-300b, but not for both. P, 210 or 551.

556. Tax Factors in Business Decisions (3) II Introduction to the federal taxation of income for all types of taxpayers and to the taxation of transfers of wealth, with emphasis on the effect of taxes on business decisions. Open only to students admitted to BPA graduate degree programs. Not open to accounting majors. Credit allowed for this course or 320, but not for both. P, 210 or 551.

567. Design and Control of Production Systems (3) III (Identical with M.I.S. 567)

569. Information and Financial Decision Support for Investment Planning (3) III Accounting and finance theory for investment planning and implementation. An MBA integrative course. Open only to students admitted to BPA graduate programs. P, 550, Fin. 511. (Identical with Fin. 569)

570. Management and Evaluation of Information Systems (3) I II (Identical with M.I.S. 570)


596. Seminar  
  a. Computers in Auditing (3) I II (Identical with M.I.S. 596a)


696. Seminar  
  a. Auditing (1 to 3) I II  
  b. Managerial Accounting (1 to 3) I II  
  c. Taxation (1 to 3) I II  
  d. Theory (1 to 3) I II  
  e. Behavioral (1 to 3) I II
The department offers the degrees of Bachelor of Science in Aerospace Engineering, Bachelor of Science in Mechanical Engineering, and Master of Science and Doctor of Philosophy with majors in aerospace engineering and mechanical engineering. (See the College of Engineering section of this catalog for specific undergraduate program requirements.)

132. Introduction to Engineering Design and Analysis I (3) I Participation in engineering projects involving analysis, construction, operation, testing, design. 2R, 3L. P, Math. 117e, Math. 118.

133. Introduction to Engineering Design and Analysis II (3) II Engineering problem solving; application of mathematical methods to engineering analysis and design. P, CR Math. 125b, Phys. 103a.

232. Dynamics (3) II Dynamics of particles and rigid bodies as applied to mechanical systems; introduction to mechanical vibrations. P, C.E. 214, CR Math. 254.


312. Introduction to Production Engineering (3) II Theory of economic material removal or forming; machine tool principles, potentials, and limitations; cutting tools, consideration of cost, and adaptability from manual to servo controls, design project. 2R, 3L. P, C.E. 214.


333. A.M.E. Instrumentation (3) II Basic principles of lab. practice and instrumentation. 2R, 3L. P, 331a, 340a, E.C.E. 208.

334. Dynamics of Machines (3) II Analysis of motions and forces in machines, design exercises. P, 332.


402. Product Engineering Design (3) II Economic production principles; design relationship of materials and production processes; tooling, quality control, and packaging; design project. 2R, 3L. CR 312.


406. Engineering Quality Control (3) GC I (Identical with S.I.E. 406)

408. Reliability Engineering (3) GC I Time-to-failure, failure-rate, and reliability determination for early, useful and wear-out lives; equipment reliability prediction; spare parts provisioning; reliability growth; reliability allocation. P, Math. 223, S.I.E. 320. (Identical with S.I.E. 408)

409. Engineering Design (3) II Role of design in engineering; strength design factors, stress analysis, application of Mohr's circle of stress and strain; deflection analysis and introduction to failure and fatigue theory. P, 232, C.E. 217.
DEPARTMENTS AND COURSES OF INSTRUCTION

410. Aerospace Design (3) I II Creative participation of student groups in the advanced design of a modern aerospace vehicle system. 2R, 3L. P, 409a, 461, CR 434.

413a-413b. Reliability and Quality Analysis (3-3) GC 413a: Probability theory and statistical models in reliability, life testing, and design; descriptive and mathematical statistics, basic graphical and analytical data analysis techniques. 413b: Monte Carlo methods in reliability analysis, polynomial curve fitting and linear models, Bayes estimation, decision analysis in engineering design, stochastic processes in design. P, Math. 223.

415. Mechanical Engineering Design (3) I II Engineering design process steps, idea generation techniques, optimal design of engineering systems, computer aided design, major design project. P, 409, 340b, CR 312.

416. Mechanical Engineering Design Implementation (3) I II Construction, testing and evaluation of prototype design; design iteration to arrive at final system configuration. 2R, 3L. P, 415. 415 and 416 must be taken in consecutive semesters.

417. Clinical Engineering (3) GC II (Identical with E.C.E. 417)

418. Physiology for Engineers (4) GC I (Identical with Psio. 418)

419. Physiology Laboratory (2) GC I (Identical with Psio. 419)


423. Probabilistic Mechanical Design (3) GC I Application of probability theory and statistics to mechanical and structural design; modern mechanical reliability methods; design philosophy. P, C.E. 217; CR 409.


430. Mechanical Vibrations (3) GC I Free and forced vibrations of simple mechanical systems; effects of sampling; introduction to multidegree of freedom systems. P, 232, Math. 254.


436. Finite Element Methods of Structural Analysis (3) GC I II Matrix algebra, computers, theory of elasticity, work and strain energy, energy theorems, the finite element, the assembled structure, programming aspects of the problem, general purpose programs, application to aerospace structures. P, 409.


438. Composite Materials (3) GC II Classification and characteristics of composite materials; mechanical behavior of composite materials, micro-and macro-mechanical behavior of laminae; mechanical behavior of laminates; mechanical behavior of short fiber composites. P, 310, C.E. 217.

442. Heat Transfer (3) GC I II Study of conduction, convection and radiation heat transfer, with applications to engineering problems. P, 331a, 340a.

445. Direct Energy Conversion (3) GC II (Identical with N.E.E. 445)


453. Air Conditioning Engineering (3) GC I Analysis and design of systems and components for control of temperature, humidity, air cleanliness and acoustics; applications to residential and commercial buildings. P, 340b, CR 331a. (Identical with N.E.E. 453)


455. Power Systems Laboratory (2) I II Lab. investigations involving thermal power systems and energy conversion devices. 3L. P, 340b, 333. Writing-Emphasis Course. P, Satisfaction of the upper-division writing proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).
458. Wind Energy Conversion Systems (3) GC I Aerodynamic theory of vertical and horizontal axis propellers and windmills; optimal design of blades and electrical components; lab. and field measurements of operating systems. 3R, 1L. Field trips. P, 331a, E.C.E. 208.

460. Aerodynamics (3) GC II Basic equations and their approximation; potential flow theory; fundamentals of airfoil and wing theory; axisymmetric flows; application to aerodynamics of wings and bodies. P, 361, 432.

461. Gasdynamics (3) GC II Thermodynamics review; equations for one-dimensional flow; wave propagation and acoustics; isentropic flow; shock waves; simple two-dimensional flows; friction and heat addition. P, 331a, 340a.

462. Aerodynamics Laboratory (1) I Low-speed and high-speed wind tunnel testing; aircraft flight tests. P, 333, 361, 461.

463. Dynamics of Space Flight (3) GC I Spacecraft dynamics; orbital and attitude maneuvers, lunar and interplanetary transfer, re-entry. P, 232.

466. Stability and Control of Aerospace Vehicles (3) GC I Static and dynamic stability of rigid and nonrigid vehicles; automatic control of aircraft, missiles and space craft. P, 361.

467. Solar Energy Engineering (3) GC I (Identical with N.E.E. 467)

469. Energy Engineering Laboratory (3) GC III (Identical with N.E.E. 469)

485. Biomechanical Engineering (3) GC II One subject covered yearly from: Biomechanical-solid mechanics (orthopedic, vascular, muscle, skin); feedback control (physiological systems); heat transfer, thermodynamics (temperature regulation exercise, hyperthermia, instrumentation). P, 310, 331b, 340b, CR 409.

495. Colloquium
  s. Senior Colloquium (1) I II

502. Advanced Finite Element Analysis (3) II (Identical with E.M. 502)

503. Modeling and System Identification in Dynamic Engineering Systems (3) I 1987-88 Principles of mathematical modeling of engineering problems; state and parameter identification techniques; lumped and distributed system; open loop (explicit) and closed loop (implicit) applications; frequency and time domain representation; deterministic and stochastic inputs. P, 310, CR 405.


505. Modern Control Theory (3) II 1988-89 Controllability and stability for linear and nonlinear systems, observer design, qualitative methods of optimal control and game theory applied to control system design. P, 405.

506. Advanced Quality Control and Reliability (3) II (Identical with S.I.E. 506)

508. Advanced Reliability Engineering(3) II Extension of 406; Complex systems reliability; maintainability engineering; reliability and availability of maintained systems; operational readiness; system effectiveness; maintainability demonstration. P, 408, S.I.E. 420. (Identical with S.I.E. 508)

510. Airplane and Helicopter Design (3) I Helicopter and airplane design and analysis; optimization of takeoff, climb, specific range, endurance; energy methods. P, 466.

512. Advanced Probabilistic Design (3) II Continuation of 423; advanced methods for mechanical and structural reliability analysis, system reliability analysis, random loading models, applications to fatigue, fracture, buckling, creep, etc. P, 423.

518. Reliability Testing (3) II Mean-time-between-failure and reliability confidence limits; sequential testing; sampling; accelerated, sudden-death, and suspended-items, non-parametric, and Bayesian testing. P, 408, S.I.E. 420. (Identical with S.I.E. 518)

520a-520b. Fundamentals of Fluid Mechanics (3-3) 520a: Fundamental equations of motions; surface tension; kinematics of vorticity; integral solutions; irrotational flows; simple viscous flows. P, 331b, CR 532a. 520b: Small-disturbance inviscid theory; low Reynolds number flow; vorticity dynamics; boundary layers. P, CR 532b.


Engineering Analysis (3-3) 532a: Mathematical models; operational techniques; functions of a complex variable; Fourier analysis. P, Math. 254. A.M.E. 532b: Linear analysis; ordinary and partial differential equations; methods of solution.


Finite Element Analysis in Nonlinear Solid Mechanics (3) I Finite element methods, including material nonlinearity (elastic, plastic, viscoelastic); geometric nonlinearity (finite deformations), numerical solution methods, and nonlinear programs. P, 436.

Advanced Structural Mechanics (3) II Advanced problems in structural analysis using the finite element method; analysis and optimization of complex systems; nonlinear and composite structures and material systems; application to other disciplines. P, 436. (Identical with E.M. 539)

Advanced Thermodynamics (3) I Reversible and irreversible macroscopic thermodynamics; selected engineering applications. P, 331a, 340a.

Convective Transport Phenomena (3) I Convective energy, mass and momentum transfer; internal and external flow; exact, approximate and numerical solutions; application to current problems. P, 442, CR 532a, computer programming ability.


Combustion Generated Air Pollution (3) II Pollutant formation in combustion processes and methods of control; diffusion models for atmospheric dispersion, including plume rise calculations. P, 331a, 340a. (Identical with Ch.E. 545)

Nature of Turbulent Shear Flow (3) II 1988-89 Physical phenomena in turbulent shear flows; experimental techniques; observations and physical consequences; prediction methods; recent advances. P, 520a-520b, 532b.

Aerodynamics of Propulsion (3) I 1987-88 Interior ballistics of rocket motors; ramjets, turbojets, turbofans; detonation wave theory; combustion chamber instability analysis; nozzle design. P, 461.

Combustion Gasdynamics (3) II 1987-88 Aerothermochemistry; fluid mechanics, thermodynamics, chemistry of propulsion and air pollution; reaction kinetics, combustion stability, detonation; singular perturbations in deflagration. P, 532a, 461.

Fluid Mechanics of Viscous Flows (3) I Behavior of viscous fluids over a range of Reynolds numbers; Navier-Stokes equations; boundary layer equations; slow flow; compressible boundary layers. P, 520b.

Compressible Aerodynamics (3) II Inviscid flow of compressible fluids; governing equations and their method of solution for subsonic, transonic, supersonic, and hypersonic flows. P, 532a, 461.

Advanced Solar Engineering (3) II (Identical with N.E.E. 567)


Hydrodynamic Stability (3) I Introduction to linear stability theory in fluid mechanics; the Orr-Sommerfeld equation, behavior of eigen solutions, stability limits, extensions to problems in two component systems. P, 520a-520b, 532a-532b.

Convective Stability (3) II 1987-88 Linear and nonlinear stability theory for thermally or chemically stratified flows; doubly-diffusive effects; analytical and numerical methods; materials processing and geophysical applications. P, 520a-520b, 532a-532b.

Advanced Computational Aerodynamics (3) I Governing equations for aerodynamic applications; iterative techniques for solving partial differential equations; grid generation and multi-grid techniques; applications to compressible viscous flows. P, 421, 520b, 532b.

Colloquium
a. Research Conference (1) I II

Seminar
g. Graduate Seminar (1) I II
AGRICULTURAL ECONOMICS

(See Nutritional Sciences)

AGRICULTURAL ECONOMICS

Professors Jimmye S. Hillman, Head, Robert C. Angus, A. Gordon Ball, Bartley P. Cardon, Robert S. Firch, Roger W. Fox, Maurice M. Kelso (Emeritus), Robert O. Kuehl, William B. Lord (Adjunct), William E. Martin
Associate Professors David L. Barkley, Dennis C. Cory, Eric A. Monke
Assistant Professors David K. Blough, Roger A. Dahlgran, Merle D. Faminow, Bonnie C. Saliba, Gary D. Thompson, Paul N. Wilson
Research Scientist Edwin H. Carpenter
Assistant Research Scientist Mark W. Langworthy
Extension Specialists Harry W. Ayer, Steven C. Blank, Russell L. Gum, James C. Wade

The department's program is designed to relate agricultural problems and issues in contemporary society to their underlying economic explanations. Through the choice of elective courses the major in agricultural economics may build programs in: agricultural business to prepare for careers in the management of farms, ranches and agribusiness firms; economic development for careers in rural area development and foreign agricultural development; resource economics for careers in the management of public resources of land and water; preparation for graduate study for careers in business, teaching and research.

The following degrees are offered: Bachelor of Science in Agriculture with a major in agricultural economics and Master of Science with a major in agricultural economics. The Doctor of Philosophy degree with a major in economics and an emphasis in agricultural economics is administered by the combined faculties of the departments of Economics and Agricultural Economics.

The major: A minimum of 19 units in upper-division agricultural economics courses including 339, 403, 404, 464, and 494. Additional required courses include Econ. 201 b, 300 or 361, 330 or 332, Math. 119 and 123, 3 units of accounting, and 3 units of computer applications.

The Minor: A minimum of 20 units of course work is required in agricultural economics. Introductory course work totaling 3 units, but not to exceed 9 units must be selected from 213, 215, 217, 231 or 242. For a specialization in the minor, a minimum of 12 upper division credits will be selected in consultation with a minor advisor. Students will be expected to have prerequisites and/or supporting courses that may be required for the courses in the minor.

Students in agricultural economics follow the agricultural business curriculum (see College of Agriculture) with the following additions: 6 units of basic agricultural courses (Group II); 3 units of physics, atmospheric sciences, geosciences (Group III); 4 units of biological or physical sciences electives (Group III); and 6 units of social sciences and humanities (Group IV). The business core is not required. Students who have majors in other departments and who choose an agricultural business curriculum will also be assigned an advisor in the Department of Agricultural Economics.

213. Introduction to Agricultural Marketing (3) II Basic economic principles and marketing methods for agricultural crops, livestock, and livestock products. Field trip. P, 3 units of economics Firch

215. Agricultural Business Management (3) I II Applying economic principles in decision making for the farm or ranch firm; analytical techniques and management control; problems in organization, management, and operation of an agricultural business. P, Econ. 201a Wilson/Thompson

217. Resource and Environmental Economics (3) I Relationship between man and use of natural resources and environmental systems, with emphasis on the economic implications of alternative environmental, energy and land-use policies. P, Econ.201a (Identical with Econ. 217) Cory

231. Agricultural Input Marketing and Sales (3) II Economics of agricultural input markets, agricultural input selling process, sales organization and management. P, Econ. 201a. Ball

242. World Food Economy (3) II World resources of agriculture; population and food supply; economics of hunger, world trade and agricultural policies. P, Econ. 201a. Monke.

313. Economics of Futures Markets (3) II Futures market participants, evolution, functions, performance, regulation, financial instruments, and options on futures contracts, with emphasis on hedging uses of
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the futures market for agricultural commodities. P, Econ. 201b. (Identical with Econ. 313 and Fin. 313) Firch


403. Marketing and Price Analysis (3) GC II Market functions, costs, price forecasting, and regulation in the movement of agricultural products. Advanced degree credit available for nonmajors only. P, 439, Econ. 300. Faminow

404. Production Economic Analysis (3) GC I Application of production economics principles and analytical techniques to the solution of agricultural economics problems. Advanced degree credit available for nonmajors only. P, Math. 117e, Econ. 00. Barkley/Thompson

412. Agricultural Economic Development in Latin America (3) GC II Review and analysis of economic growth and development in Latin America with special emphasis on the agricultural sector. P, Econ. 201a-201b. (Identical with Econ. 412 and Anth. 412). Fox

414. Rural Area Development (3) GC I Identification of current U.S. nonmetropolitan problems, economic principles useful in analyzing these problems, and possible program alternatives for rural area development. P, Econ. 201b or Geog. 305. (Identical with Geog. 414) Barkley

440. Forest Resource Economics (3) GC II (Identical with Ws.M. 440)

442. Transformation of Agrarian Societies in the Middle East (3) GC II (Identical with Or.S. 442).

450. Agricultural Finance (3) GC I Applying business principles to problems confronting farm-ranch and incorporated agribusiness firms in the acquisition, allocation, control and transfer of capital resources. P, 215, or Econ. 300 and 3 units of accounting Wilson

464. Agricultural Policy (3) GC II Economic analysis of the policy issues and proposals impacting on agriculture and rural America, with emphasis on the historical and continuing role of government in price and income policies. Advanced degree credit available for nonmajors only. Hillman

467. Population and Development in the Middle East (3) GC I (Identical with Or.S. 467)

470. Economics of Outdoor Recreation (3) GC II 1987-88 (Identical with N.R.R. 470)

471. Problems in Regional Development (3) GC I II (Identical with Geog. 471)

476. Natural Resource Economics (3) GC II Economic principles useful in analyzing natural resource problems and policies in the Southwest and nationwide. P, Econ. 201a-201b (Identical with Econ. 476, W.R.A. 476, and Ws.M. 476) Saliba


480. Forest Policy and Administration (3) GC II (Identical with Ws.M. 480)

500. Research Methodology in Agricultural Economics (3) II Study of the research process in agricultural economics as an efficient means for acquiring reliable knowledge for problem solutions. Martin

504. Production Economics (3) I Theory of the firm and industry; single and multiple products; risk and uncertainty. (Identical with Econ. 504) Barkley/Wilson

512. International Agricultural Economic Development (3) II The role of agriculture in economic growth and development, including economic policies related to agriculture, and to world trade in agricultural commodities. (Identical with Econ. 512) Fox/Monke

513. Agricultural Price and Marketing Analysis (3) II Market organization, efficiency, and functions in a dynamic economy. (Identical with Econ. 513) Monke

514. Cost-Benefit Analysis (3) II Theoretical bases and empirical techniques, with emphasis on LDCs. Consumer-producer surplus; social and private costs; macroeconomic distortions; non-market goods; uses in policy analysis. (Identical with Econ. 514 and M.A.P. 514). Monke


539. Statistical Methods (2) I II Concepts and methods of inferential statistics, including probability distributions, estimation and testing hypotheses for common statistical problems. 10-week course. P, Math 117e. (Identical with Gene. 539) Kuehl/Blough Note: A student should also take a third related unit, taught during the last five weeks of the semester and selected from among the following options: 539a, 539n, 539r, 539s.

539a. Analysis of Variance (1) I II P, 539. (Identical with Gene. 539)
539n. Nonparametric Methods (1) I P, 539. (Identical with Gene. 539)
539r. Regression Analysis (1) I II P, 539. (Identical with Gene. 539)
539s. Sample Surveys(1) II P, 539. (Identical with Gene. 539)
540. Design and Analysis of Experiments (3) II Statistical principles of research design for experimental
and observational studies; introduction to the linear statistical model for analysis of data from research
studies including techniques for complete block and incomplete block designs; factorial experiments;
covariates and polynomial response functions. P, 539a. Kuehl
576. Advanced Natural Resource Economics (3) I Advanced economic theory and analysis of
environmental and energy-related resource issues. P, Math. 123, Econ. 361. (Identical with Econ. 576,
577. Natural Resource Economics and Public Policy (3) II Advanced economic theory and evaluation
of land and water resource issues and public policies for graduate students in natural resource-related
disciplines. Topics include water quality, water allocation, public lands management, and valuation of
non-market resources. P, Econ. 361 or 476. (Identical with Econ. 577, W.R.A. 577, and Ws.M. 577)
Saliba

AGRICULTURAL EDUCATION

Professors Floyd G. McCormick, Head, Gordon J. Graham, Clinton O. Jacobs (Emeritus), Kenneth
S. Olson, Phillip R. Zurbrick
Associate Professor Christopher J. Kalangi
Assistant Professors David E. Cox, Glen M. Miller
Lecturer Timothy L. Koehnen

The programs of study in agricultural education prepare students for teaching careers at
secondary and community college levels; for positions in agricultural mechanics sales and
service; for careers in agricultural communications; and for positions in international agricultural
extension available in state, federal and international agencies, business and industry. These
positions require preparation in basic sciences, technical agriculture, knowledge of the principles
and techniques of the teaching-learning process, communication skills and the ability to work
with people.

The department offers the degree of Bachelor of Science in Agriculture with majors in
agricultural education, agricultural communications, and general agriculture. The degree is
available through the agriculture, agricultural science, or agricultural business curricula.

The department also offers programs of study leading to the degrees of Master of Science
and Master of Agricultural Education. A strong emphasis in international agricultural extension
is offered at the graduate level.

An Extension/Non-Formal Education option designed to supplement the student's major
is available to all students in the College of Agriculture. Students taking this option must take
A.Ed. 220; H.E.E. 428; A.Ed. 448; 493; and Agri. 496; plus two elective courses from the approved
list available from the student's advisor.

Any student who plans to become a teacher must be formally admitted to the Teacher
Education program prior to enrolling in professional education course work. Admission requires
the completion of a formal application to the Department of Agricultural Education as well as
successful completion of state prescribed tests. Contact an advisor for specific requirements.

Degree requirements: Students with a major in agricultural education will meet the minimum
requirements for the Bachelor of Science in Agriculture degree under the selected curriculum.
In addition, students will complete the following courses according to their area of emphasis: (1)
agricultural teaching: A.Ed. 100a-100b, 221; 301, 338a, 485, 389, 496a, 496b, 397a, 409; Ed.P.
311; S.W. 200; A.Ec. 213 or A.Ec. 215; An.S.134 or An.S. 430. (2) agricultural mechanics: A.Ed.
100a-100b, 221, 397a, 397b, 493; S.W. 450.

Students who do not plan to teach may meet department requirements by completing a
minimum of 18 credits in agricultural education and education. Students registering for 389 must
have a cumulative grade-point average of 2.000 or better and approval of the head of the department.

Students pursuing a degree of Bachelor of Science in Agriculture with a major in agricultural
communications will complete the following courses in addition to meeting the minimum
students pursuing a degree of Bachelor of Science in Agriculture with a major in general agriculture will complete a minimum of 37 units in courses in agriculture or related fields. A minimum of 6 units each must be completed in the four areas of animal science, plant science, agricultural social science, and soil science or agricultural engineering.

100a-100b. **Agricultural Mechanics** (3-3) GRD Principles and techniques in construction and maintenance. 100a: Utilizing wood, concrete masonry materials and electrical energy. 100b: Metal fabrication processes in agricultural occupations and production applications. 100a is not a prerequisite to 100b. (Identical with A.En. 100a-100b).

220. **Non-Formal Education** (3) I Characteristics and scope of non-formal education; types of programs; responsibilities of professionals; and career opportunities. Field trip. (Identical with H.E.E. 220)

221. **Introduction to Agricultural Education** (1) I Objectives, nature, and scope of vocational education in agriculture; types of programs; qualifications of personnel; career opportunities. McCormick

301. **Youth Leadership Development** (3) I Characteristics of effective advisers; leadership styles; strategies for the management and organization of youth groups in agriculture; practice in leadership development techniques. 2R, 2L. Cox

338a. **The Teaching of Agriculture** (4) II (Identical with T.T.E. 338a)

389. **Supervised Teaching in Agriculture** [1 to 8] [Rpt./I] III Observation and teaching vocational agriculture in the classroom and field under supervision. P, 338a or CR.

396H. **Honors Proseminar** (3) I

397. **Workshop**
   a. Applications in Agricultural Mechanics (3) I

409. **Principles of Vocational Education** (2) II (Identical with T.T.E. 409)

422. **Community Communications Media** (3) I Characteristics of balanced communications serving education and information programs; participating experience utilizing newspapers, radio, television, and newsletters. (Identical with Agri. 422) Graham

448. **Extension Program Planning and Evaluation** (3) GC II (Identical with H.E.E. 448)

485. **Methods in Teaching Agricultural Mechanics** (2) II Problems and procedures in teaching mechanics and operative skills; conducting demonstrations; providing space and teaching facilities. 1R, 3L. P, 338a and 409 or CR. Cox

496. **Proseminar**
   a. Instructional Materials Development (3) I Field trip. P, 389 or CR. Zurbrick
   b. Techniques in Teaching Agricultural Mechanics (1) I Open to majors only. P, student teacher placement.

497. **Workshop**
   a. Curriculum Development [1 to 3] [Rpt./3] GC I II
   b. Occupational Experience Program [1 to 3] [Rpt./3] GC I II
   c. Youth Leadership Development [1 to 3] [Rpt./3] GC I II
   d. Continuing Education in Agriculture [1 to 3] [Rpt./3] GC I II
   e. Program Planning and Evaluation [1 to 3] [Rpt./3] GC I II
   f. Instructional Realia (1) [Rpt./3 units] I 3L P, CR 396a.
   i. * Extension Communications (1 to 2) [Rpt./2] GC (Identical with H.E.E. 497i)
   m. * Human Motivation in Extension Programs (1 to 2) [Rpt./2] (Identical with H.E.E. 497m)
   n. * Youth Development through 4-H Programs (1 to 2) [Rpt./2] (Identical with H.E.E. 497n)
   r. * Public Relations in Extension (1 to 2) [Rpt./2] GC (Identical with H.E.E. 497r)

538. **Philosophy and Principles of Extension Education** (3) I Social and economic significance of extension education in domestic and international situations. P, 12 units of ag. or f.c.r. (Identical with H.E.E. 538)

539. **Extension Education Methods** (3) II Acquisition of competencies in the development and application of non-formal education methods used by change agents to diffuse practical information. P, 6 units of a.ed. or education. (Identical with H.E.E. 539)

540. **International Agricultural Extension Education** (3) I Identification and discussion of a number of critical factors peculiar to agricultural extension and rural development in developing countries. Working and living overseas; country studies.
542. **Education for Agricultural Entrepreneurship** (3) II Pedagogy of developing motivation, skills and knowledge needed to start small enterprises in agriculture. Field trips. P, 6 units of macro/microeconomics with emphasis upon management.

597. **Workshop**
- c. *Extension Credibility and Accountability (1 to 2) [Rpt./2] (Identical with H.E.E. 597c)
- d. *Extension Supervision and Administration (1 to 3) [Rpt./2] (Identical with H.E.E. 597d)
- g. *Microcomputers-Extension (1 to 2) [Rpt./2] (Identical with H.E.E. 597g)
- t. Principles of Extension Training (1 to 3) I (Identical with H.E.E. 597i)
- u. Evaluation in Extension Education (1 to 3) I (Identical with H.E.E. 597u)
- v. Volunteer Staff Development in Extension (3) I (Identical with H.E.E. 597v, which is home)
- w. Administration of Extension Programs (1 to 3) I (Identical with H.E.E. 597w)

*Offered only through the Cooperative Extension Service Winter School.

601. **Advanced Agricultural Education Methods** (3) [Rpt./3] I II Problems in organizing and conducting programs of instruction in vocational and extension education. P, eight units of a.ed. or education.

615. **Investigations and Studies in Agricultural Education** (3) I Study and analysis of research literature, methods, techniques and procedures for conducting investigations; selecting a problem and developing plans for a study. P, 9 units of a.ed. or education. Zurbrick

620. **Program Evaluation in Agricultural Education** (3) I Objective educational program evaluation procedures useful for strengthening and enhancing effectiveness of formal and nonformal programs in agricultural and vocational education. Field trips.

621. **Program Planning** (3) II Developing programs in agricultural teaching and extension; situation analysis, objectives, policies, content, procedures, and evaluative criteria. P, 6 units of a.ed. McCormick

622. **Adult Vocational Education** (3) II Organization, content, and techniques for conducting adult vocational education programs; characteristics of adult learners; issues affecting adult vocational education. P, bachelor’s degree and one year teaching experience.

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**AGRICULTURAL ENGINEERING**


Associate Professors M.D. Cannon (Emeritus), Wayne E. Coates, Dennis L. Larson

Assistant Professor Muluneh Yitayew

The degree of Bachelor of Science in Agricultural Engineering is available through the College of Engineering. The degree of Bachelor of Science in Agriculture with major in irrigation is available through the College of Agriculture. The department offers graduate work leading to a Master of Science degree in Agricultural Engineering and a Ph.D. degree in Irrigation Engineering.

The requirements for the B.S. in Agricultural Engineering are presented in the College of Engineering section of this catalog.

The major in irrigation includes the minimum college requirements as specified under the College of Agriculture section of this catalog. Required courses in the major include A.En. 250, 311a-311b, 406, 450, 451, 495a, Math. 117e, 118, 123 or 125a, M.I.S. 111; Phys. 102a-102b, 180a-180b, S.W. 200, 201.

The minor in irrigation: The department offers students the opportunity to minor in irrigation. Prerequisite to the minor is the completion of Math. 123, Phys. 102a-102b and S.W. 200 and 201. The minor requires at least 20 units of credit to include 12 units of upper-division course work. Core course requirements are A.En. 250, 406, 407, 450, and 451. Courses in soil management or plant production must be discussed with departmental academic advisor.

The College of Agriculture curriculum in agricultural business and options in turfgrass management and international agriculture are also available to students majoring in irrigation. Courses to be included in each option will be selected in consultation with the student’s advisor.

100a-100b. **Agricultural Mechanics** (3-3) (Identical with A.Ed. 100a-100b)

120a-120b. **Agricultural Engineering Problems** (1-1) 1988-89 Application of engineering principles to the solution of problems in agriculture. 120a is not prerequisite to 120b. Wiersma
121a-121b. **Agricultural Engineering Practices** (1-1) 1987-88 Function, operation, construction, maintenance and safety of agricultural machines and equipment. 121a is not prerequisite to 121b. 
*Wiersma*

250. **Water in Agriculture** (3) II GRD Importance of water in agriculture, agricultural water sources, uses, management and conservation; social, political, economic, and health issues. (Identical with S.W. 250)

311a-311b. **Power and Machinery Management in Irrigated Agriculture** (3-3) 1988-89. 311a. Principles of operation, utilization and management of tractors and irrigation power units. 311b. Selection, operation and management of farm machinery systems used in irrigated agriculture. 2R, 3L. P, Math. 117e, Math.118. *Coates*

406. **Applied Hydraulics** (3) GC I GRD Fundamentals of hydraulics applicable to the irrigation of agricultural lands, including fluid properties, hydrostatics, irrigation flow characteristics, open channel and pipeline applications, and measurement of flowing water. P, Math. 118, 123 or 125a, Phys. 102a. *Yitayew*


425. **Agricultural Engineering Design** (3) GC I Selected design problems in the fields of agricultural machinery, buildings, and irrigation. 1R, 6L. P, six units of agricultural engineering courses at the 400-level. Writing-Empphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Empphasis Courses" in the Academic Guidelines section of this catalog). *Larson*

450. **Irrigation Principles and Management** (2) GC I GRD Principles of operating farm irrigation systems, evaluation of systems, selection of systems, basic drainage principles, energy management, basic irrigation scheduling. P, 250 or a water related course, Math. 117e, S.W. 200; CR A.En. 451.


455. **Irrigation Engineering** (3) GC II Introduction to irrigation systems, irrigation water supply, and irrigation management; basic designs. P, C.E. 321. (Identical with C.E. 455)


463. **Energy from Biomass** (3) GC II Biomass energy sources; collection and processing methods; thermal, anaerobic digestion and fermentation conversion processes, energetic, economic and environmental issues. 2R, 3L. P, A.M.E. 340a. (Identical with N.E.E. 463) *Larson*

465. **Food Engineering** (3) GC II 1988-89 Fundamentals of fluid flow, materials handling, heat transfer, refrigeration, freezing and drying as applied to food processing. (Identical with N.F.S. 465)

494. **Practicum**
   a. **Agricultural Engineering Design** (3) I II P, 425

495. **Colloquium**
   a. Senior Report (1) I II S Writing-Empphasis Course for irrigation major. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Empphasis Courses" in the Academic Guidelines section of this catalog).

550. **Small Scale Water Management Systems** (3) I Design, construction, testing and operation of water management systems for small scale operators; water harvesting; runoff farming. Field trips. P, 6 units of hydrology, hydraulics, or irrigation.
551. Water Management for Small Scale Agriculture (3) S Evaluation, design, construction and maintenance of water harvesting, runoff farming and other small scale water management systems. Intended for professionals from developing countries. Daily field work. Field trips. Fee.


605. Soil-Water Dynamics (3) II 1988–89 (Identical with S.W. 605)


650. Advanced Irrigation Management (3) II 1987–88 Irrigation scheduling using Jensen-Haise and Penman equations for predicting evapotranspiration; determination of crop coefficients; production functions, economics, and energy considerations. P, 450 or 455 or S.W. 520.


657. Trickle Irrigation Analysis (3) II 1988–89 Analysis of design and operating criteria for trickle or drip irrigation systems, hydraulics of emitters and pipe systems. P, 456.

696. Seminar
   a. Soils, Water and Agricultural Engineering (1) [Rpt./1] I II (Identical with S.W. 696a) Wiersma

AGRICULTURE

Several courses offered within the College of Agriculture are applicable to broad subject matter areas. Therefore, they are offered by the college rather than by a specific department. Courses are taught by faculty within the college. For specific questions, see the Associate Dean and Director of Instruction.

220. Microcomputers in Agriculture (2) I II (Identical with P.L.S. 220)

422. Community Communications Media (3) I (Identical with A.Ed. 422)

450. Alternative Futures in Energy and Environment (3) I GC Energy and environment status and future alternatives; interaction of food-fiber production and natural resource use, with emphasis on student discussion of diverse views. Caldwell

AGRONOMY AND PLANT GENETICS
(See Plant Sciences)

AMERICAN INDIAN STUDIES

Committee on American Indian Studies

Professors Barbara Babcock (English), James W. Clarke (Political Science), Vine Deloria, Jr. (Political Science), Lawrence J. Evers (English), Jerrold Levy (Anthropology), N. Scott Momaday (English), James Officer (Anthropology), J. Jefferson Reid (Anthropology), Susan W. Steele (Linguistics), Robert K. Thomas

Associate Professors Courtney Cleland (Sociology), Thomas M. Holm (Political Science), Alice S. Paul (Elementary Education)

Assistant Professor Ofelia Zepeda (Linguistics), Director

Lecturer Emory Sekaquaptewa (Anthropology)
The minor in American Indian studies consists of at least 20 units selected by the student in consultation with the chairperson of the committee and approved by the student's major professor. The minor provides a wide range of instruction in the history, culture, lifeways, and contemporary problems of the native people of the New World. The Departments of Anthropology, Art, English, Linguistics, and Political Science, and Sociology and various departments in the College of Education contribute to this program, which provides American Indian students with basic information on their cultural heritage and its significance in the contemporary world. It also provides other students with a greater appreciation for the lifeways and value systems of American Indians. Prelaw students interested in legal problems of American Indians may combine prelaw and American Indian studies and American Indian policy courses in the Department of Political Science with the minor in American Indian studies.

A Master of Arts with a major in American Indian studies is also available. For admission and degree requirements, please see the Graduate Catalog. For information concerning the concentration in American Indian policy studies, see also the Department of Political Science.

102. Linguistics for Native American Communities (3) I S (Identical with Ling. 102)
203a-203b. Elementary Navajo Language (3-3) (Identical with Ling. 203a-203b)
205. Prehistoric Peoples of the Southwest(3) I II (Identical with Anth. 205)
206. Native Peoples of the Southwest(3) I II (Identical with Anth. 206)
210. Native Languages of North America(3) I (Identical with Ling. 210)
307a-307b. Elementary Papago Language(3-3) (Identical with Ling. 307a-307b)
334. Politics and the American Indians(3) II (Identical with Pol. 334)
396H. Honors Proseminar (3) I II
404. Sociology of the Southwest (3) GC I (Identical with Soc. 404)
415a-415b. Southwestern Indian Arts (3-3) GC (Identical with Anth. 415a-415b)
416. Contemporary Indian America (3) GC II 1987-88 (Identical with Anth. 416)
423. Peoples of Mexico (3) GC II (Identical with Anth. 423)
430. The Anthropology of Visual Art (3) GC II 1988-89 (Identical with Anth. 430)
445a-445b. Structure of a Non-Western Language (3-3) [Rpt./2] GC (Identical with Ling. 445a-445b)
449a-449b. Folklore (3-3) GC (Identical with Engl. 449a-449b)
461. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)
477a. Ethnic Literature (3) GC (Identical with Engl. 477a)
482. Hopi Language in Culture (3) GC II (Identical with Anth. 482)
484a-484b. Development of Federal Indian Policy (3-3) GC (Identical with Pol. 484a-484b)
487. Race and Public Policy (3) GC I (Identical with Pol. 487)
502a-502b. Dynamics of Indian Societies (3-3) Philosophies, institutions and characteristics of tribal life in North America. 502a: American Indian life-styles prior to European contact. 502b: Impact of European immigration on tribal groups of North America. (Identical with Anth. 502a-502b)
595. Colloquium
   a. Theory and Indian Studies (3) II P, 502a-502b or 484a-484b
596. Seminar
   h. American Indian Law and Policy (3) [Rpt./2] I II (Identical with Pol. 596h, which is home.)
   m. Studies in the Oral Tradition (3) [Rpt./9 units] I II (Identical with Engl. 596m, which is home)

ANATOMY

Professors Robert S. McCuskey, Head, Jay B. Angevine, Jr., Joseph T. Bagnara, Bryant Benson, Mac E. Hadley, Philip H. Krutzsch
Associate Professors David E. Blask, Mary J. C. Hendrix, Č. Ward Kischer, Albert V. LeBouton
Assistant Professor Christopher A. Leadem
Lecturers William D. Barber, Norman E. Koelling
The Department of Anatomy offers work leading to the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

399H. **Honors Independent Study** (1-3) II Opportunities in biomedical research. P, admittance to Honors Program, Chem. 103b, 104b, 243b, 245b.

401. **Human Gross Anatomy** (3) II Survey of the gross structure of the human body. 1R, 6L. Open to pharmacy students only. (Identical with Pcol. 401)

402. **Principles of Neuroanatomy** (4) GC II Cellular elements and recognized subsystems of the mammalian nervous system, with emphasis on general principles of neuroanatomical organization and their functional significance. Not open to premedical students. P, 8 units of biological lab. science; 401; Psyc. 302, Psio. 480 desirable. Consult department before enrolling. (Identical with Ex.S.S. 402, Psyc. 402, and Sp.H. 402)

415. **Vertebrate Reproductive Biology** (2) I Structure, function and control of the vertebrate reproductive system.

456. **Developmental Biology** (3) GC I (Identical with M.C.B. 456)

457. **Experiments in Developmental Biology** (4) GC II (Identical with M.C.B. 457)

467R. **Endocrinology** (3) GC II Neural and endocrine integration in the regulation of mammalian physiological functions. P, M.C.B. 103. (Identical with M.C.B. 467R)

467L. **Endocrinology Laboratory** (1) GC II Techniques in endocrinology. P, CR 467R (Identical with M.C.B. 467L)

495. **Colloquium**
   a. Introduction to the Neurosciences I (2) GC (Identical with Med. 495a, which is home)

550. **Topics in Pigment Cell Biology** (2) I Selected topics on the development function and control of normal and abnormal pigment cells in various pigmentary phenomena. (Identical with M.C.B. 550)

555. **Cancer Biology** (3) II 1988-89 (Identical with Micr. 555)

558. **Advanced Subjects in Endocrinology** (2) [Rpt.] I Selected topics in vertebrate and invertebrate endocrinology. P, 467R. (Identical with M.C.B. 558)

601. **Human Gross Anatomy** (8) I Comprehensive survey of the development and gross structure of the human body. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; consult department before enrolling.

602. **Microscopic Anatomy** (5) I Essentials of microscopic human anatomy. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; consult department before enrolling.

603. **Microscopic Structure** (1 to 3) II Selected concepts of structural organization at light and electron microscopic levels of the anatomy and development of the cells, tissues, and organs of vertebrates. P, 601, 602.

604. **Gross Human Anatomy** (2 to 6) [Rpt.] II Study in depth of the gross human anatomy of selected areas or systems. P, 601, 602.

605. **Neurosciences** (6) II Essentials of mammalian neural development, structure and function. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; M.C.B. 410a-410b. Consult department before enrolling. (Identical with Psio. 605)


610a-610b. **Anatomical Techniques** (1 to 4 - 1 to 4) Introduction to special techniques and procedures of analytical anatomy. P, 601, 602; consult department before enrolling.

615. **Topics in Neural Plasticity** (2) (Identical with M.C.B. 615)

616. **Introduction to Anatomical Literature** (1) II A problem-oriented, bibliographic approach to basic anatomical references. Primarily for those students planning a career in anatomy and wishing to prepare themselves for further graduate study. 3L.

696. **Seminar**
   b. Biological, Structural and Functional Interactions (1) [Rpt./4] II Open to majors only. P, Chem. 103b, 104b, 243b, 245b, Phys. 102b.

801. **Human Gross Anatomy** (8) I No grade is given until the full 8 units are completed.

802. **Microscopic Anatomy** (5)

805. **Neurosciences** (6) II (Identical with Psio. 805)

891. **Preceptorship**
   a. Anatomy (3 to 12) [Rpt./12 units]
ANIMAL PHYSIOLOGY

Committee on Animal Physiology (Graduate)

Professors Fred B. Roby, Chairperson, Robert B. Chiasson, Mac E. Hadley, Timothy G. Lohman, Dewey E. Monty, Jr., Raymond E. Reed, Gerald H. Stott (Emeritus), Charles M. Tipton

Associate Professors Ronald E. Allen, Ronald W. Hillwig

Assistant Professors Roger M. Enoka, William A. Schurg, Douglas R. Seals, Mark E. Wise

The interdisciplinary graduate program in animal physiology offers the opportunity for study toward the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

ANIMAL SCIENCES


Associate Professors Ronald E. Allen, R. Spencer Swingle

Assistant Professors Sue DeNise, Vincent Guerriero, William A. Schurg, Mark E. Wise

Lecturers Lonny T. Powell, Thomas Ventura, Thomas N. Wegner

Extension Specialists Dennis V. Armstrong, Albert M. Lane, Edward A. LeViness, Franklin D. Rollins

The curriculum prepares students for careers with livestock and poultry, farms, ranches, feedlots, dairies, agribusiness firms, banks and industries serving these enterprises. By the selection of different electives a student may also prepare for graduate work, agricultural communications, government service or race track management.

The degree of Bachelor of Science in Agriculture with a major in animal sciences is available through the agriculture, agricultural business or agricultural science curriculum. The department also offers programs leading to the Master of Science degree.

The major: In addition to the requirements of the College of Agriculture, the following courses are required: 180, 413, 415R, 430, 436 (students in the race track management option are not required to take 180 and may substitute N.F.S. 458 for 436); and three courses selected from 440, 442, 472, 473, 474, 475, 476, and 477 or 478. 102 is recommended but not required for all freshmen. A minimum graduation average of 2.0000 is required for all courses taken in animal sciences. M.I.S. 111 is required for all majors in animal sciences. All students enrolling in the agriculture or agricultural sciences curriculum must take PI.S. 100 and S.W. 200. However, students in the race track management option may substitute 6 units selected from Agricultural Economics, Nutrition and Food Science, Plant Sciences, or Soil Science. Also, majors in the agriculture curriculum must choose an option in business, production, science or race track management.

Business option: In addition to the courses listed under the major, the student must take Acct. 200 and four courses from the following: Acct. 320; A.Ec. 213, 215, 313, 450; Fin. 201, 251; M.A.P. 320, 330; Mktg. 361.

Production option: In addition to the courses listed under the major, the student must take 205; PI.S. 368 or 372 or R.N.R. 202 or Ra.M. 305; V.Sc. 403R or 405; and three courses from the following: A.Ec. 213, 215; Acct. 200; Fin. 201; M.A.P. 320, 330.

Science option: In addition to the courses listed under the major, the student must take Chem. 241a-241b and either Chem. 243a-243b or 322 and 323; Ecol. 181; Math. 119 or 123 or 125a or 263; and Phys. 102a.

Race track management option: In addition to the courses listed under the major, the student must take 142, 270, 295r, 342, 344, and 8 units of approved business courses.

102. Animal Industry (3) I, II A comprehensive view of the livestock and poultry industries, including the way the science of biology is used in modern livestock practice. 2R, 3L. Not open to students with more than 7 units of animal sciences.
134. **Feeds and Feeding** (3) I Selection, evaluation, and use of feeds for specific purposes; balancing rations for livestock and poultry. Not open to students with credit or CR in 430 or 436.

142. **Breeds and Registry Associations** (2) I Breeds of horses and dogs used in racing; their history, formal breed associations, and registry rules.

180. **Science of Meat and Meat Products** (3) I Techniques used in meat processing, with special reference to structure and composition of the various meats. Student has option to select a processing or selection-identification lab. 2R, 3L. Field trip. (Identical with N.F.S. 180)

205. **Live Animal and Carcass Evaluation** (3) II A comprehensive view of meat animal, dairy and horse selection techniques, including the evaluation of meat animals and their carcasses as related to economic importance; the selection of breeding animals based upon visual appraisal and performance records. 1R, 6L.

213. **Animal Genetics** (3) I Principles of inheritance as applied to domestic animals. P, 4 units of biology. (Identical with W.F.Sc. 213)

270. **Introductory Horse Science** (2) I The feeding, management and training of horses.


295. **Colloquium**


379. **Workshop**
   a. Livestock Judging (2) I 6L. P, 205.
   b. Advanced Livestock Judging (1 to 3) [Rpt./4 units] II 3L. Field trips. P, 205, 397a.

413. **Principles of Animal Breeding** (3) GC II Basic concepts involved in the improvement of economically important traits of livestock through application of genetic principles. Field trips. P, 213 or Ecol. 321 or P.S. 228; Math. 117e. (Identical with Gene. 413) Writing-Emphasis Course.*


415L. **Physiology of Reproduction Laboratory** (1) GC I Practice in semen collection and storage, artificial insemination, and hormone assay. P or CR, 415R. (Identical with V.Sc. 415L)

430. **Principles of Nutrition** (3) GC I II Digestion, absorption and metabolism of carbohydrates, lipids, proteins, vitamins and inorganic nutrients. Field trip. P, Chem. 101b and 102b or 103b and 104b. (Identical with W.Sc. 430 and N.F.S. 430)

436. **Applied Animal Nutrition** (4) GC II Application of principles of nutrition to the feeding of livestock and poultry, nutrient composition and characteristics of feeds, nutrient requirements and diet formulation. 3R, 3L. P, 430.


442. **Race Track Tax and Investment Concepts** (3) I Methods and principles of establishing race horses and breeding animals as agriculture businesses. Overall understanding of syndications, hobby vs. business, and general treatment of racing industry as a taxable entity. P, 142.

463. **Food Analysis** (3) GC II 1988-89 (Identical with N.F.S. 463)

472. **Dairy Herd Management** (3) GC I Proper milking, efficient housing, and health management of dairy cattle; marketing milk from the farm; milk production costs. Field trip. P, 430.

473. **Swine Production** (2) GC I The production, feeding and management of swine in intensive production systems. Field trip. P, 430.

474. **Sheep Production** (2) GC II The production, feeding and management of sheep on the farm and ranch. 1R, 3L. P, 430.

475. **Poultry Production** (3) GC II Application of biological principles to modern poultry production. Field trips. P, 430.
DEPARTMENTS AND COURSES OF INSTRUCTION

476. **Horse Production** (3) GC II Production, feeding, management, reproduction, and business aspects of modern horse management. 2R, 3L. Field trips. P, 415R, 430.

477. **Beef Cattle Production** (2) GC I The production, feeding, and management of beef cattle prior to finishing. Field trip. P, 430.

478. **Feedlot Beef Production** (2) GC II Feeding and management systems of beef cattle in the feedlot. All-day field trips. P, 430, 436.

497. **Workshop**
   a. **Race Track** (1) [Rpt./4 units] I

501. **Animal Growth and Development** (2) II 1988-89 Growth and development of domestic animals, with emphasis on skeletal muscle, bone and adipose tissue growth, from the cellular level to the whole animal. P, N.F.S. 406a or Bioc. 460 or 462a.

513. **Quantitative Genetics** (3) I 1988-89 Theory of quantitative genetics including idealized populations, forces that change gene frequency, breeding systems, and estimation of genetic parameters in a population. P, 6 units of genetics. (Identical with Gene. 513)

580. **Composition and Structure of Meat** (2) I 1988-89 The detailed structure and composition of muscle and its biochemical conversion to meat. P, N.F.S. 406 or Bioc. 460 or 462a. (Identical with N.F.S. 580)


596. **Seminar**
   a. **Animal Sciences** (1) [Rpt./3] I II

601. **Bioenergetics** (2) I (Identical with N.F.S. 601)

609. **Nutritional Biochemistry Techniques** (3) II (Identical with N.F.S. 609)

615. **Chemistry and Metabolism of Lipids** (3) I 1987-88 (Identical with N.F.S. 615)

622. **Mineral Metabolism** (2) I 1987-88 (Identical with N.F.S. 622)

635. **Ruminant Nutrition** (3) I Recent findings in ruminant nutrition; the physiochemical processes of digestion and absorption; importance and metabolism of rumen microflora; normal metabolism and abnormal metabolic disorders; modes of action of feed stimulants. P, 430, 436; Chem. 241a, 243a.


684. **Animal Physiology Research Techniques** (2) I 1988-89 Introduction to selected physiological and biochemical techniques used in animal research. 1R, 3L. Open to majors only. P, Bioc. 460 or 462a.

687. **Environmental Physiology of Domestic Animals** (3) II 1988-89 Physiological, behavioral and anatomical responses of domestic animals to their environment, with emphasis on adaptive mechanisms. P, 413, 415R, 430, 3 units of general physiology/anatomy.

"Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

ANTHROPOLOGY


Associate Professors Constance Cronin, Mary Ellen Morbeck, Richard A. Thompson, Norman Yoffee, Stephen L. Zegura

Assistant Professors Mark Nichter, John W. Olsen, Thomas K. Park

The science of anthropology is the study of human beings, their origins, thought, and behavior. The Department of Anthropology offers graduate and undergraduate course work in four subdisciplines: cultural anthropology, physical anthropology, archaeology, and linguistic anthropology, as well as specialized training for field research. Special programs in museum studies, cultural resource management, and forensic anthropology draw upon the extensive resources of the Arizona State Museum. The Bureau of Applied Research in Anthropology is a center for applied anthropological research in the American Southwest and similar multicultural and ecological settings elsewhere in the world. The department cooperates with the Arizona Center for Health Sciences in offering a program in medical anthropology.

The degrees offered by the department are the Bachelor of Arts, Master of Arts, and Doctor of Philosophy with a major in anthropology.

The major requires a minimum of 36 units of anthropology, 18 of which must be in upper-division courses. All majors must take 100, 102, 200, 235, 265, and 276, which provide the student with basic training in all four subdisciplines. The student may then select one of three programs: (1) a general program which requires one upper-division course in each of the four subdisciplines plus two additional upper-division courses (a minimum of six courses); (2) a special program which requires three upper-division courses in each of two subdisciplines (a minimum of six courses); or (3) a topical or areal specialization approved by the undergraduate adviser (a minimum of six upper-division courses).

The supporting minor may be chosen from any department or program within the University.

Honors: The department participates in the Honors Program.

100. Introduction to Physical Anthropology and Archaeology (3) I II Basic concepts and methods used by physical anthropologists and archaeologists.

102. Introduction to Cultural Anthropology and Linguistic Anthropology (3) I II Basic concepts and methods used by cultural and linguistic anthropologists.

110. Exploring Archaeology (3) I An introduction to the past as revealed by archaeological research; from Neanderthals and their antecedents to Stonehenge, Maya pyramids, and Homer’s Troy.

111. Biological Anthropology (3) I II An introduction to human evolution for the non-science student. Credit is allowed for this course or 100, but not for both.

171. Ancient Civilizations of the Near East (3) I (Identical with Or.S. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II (Identical with Or.S. 172)


205. Prehistoric Peoples of the Southwest (3) I II Nontechnical discussion of the lifeways of the ancient people of the Southwest. (Identical with A.In.S. 205)

206. Native Peoples of the Southwest (3) I II Nontechnical discussion of Southwestern Indian cultures from historic times to the present. (Identical with A.In.S. 206)

210. Survey of Anthropology for Engineers and Scientists (3) I Topics in human physical and cultural development: human ancestors back to 3 million B.C.; ancient Maya civilization as a case study of cultural complexity outside the Western tradition.

235. Principles of Archaeology (3) I II History of archaeological research; survey of concepts and methods for the study of prehistoric cultures. P, 100 or 110.

265. Human Evolution (3) I II Neontological and paleontological approaches to human evolution and variation, nonhuman primate studies, bio-molecular and anatomical variation, bio-cultural responses to environmental stress. P, 100 or 111.

276. The Nature of Language (3) I II An introduction to the basic concepts of linguistic anthropology and their implications for the study of culture and society. (Identical with Ling. 276)

301. Paranormal Anthropology (3) I Witchcraft and the occult in cross-cultural perspective.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>303</td>
<td>Sex Differences and Language (3)</td>
<td>Sex/gender differences in language use among adults and children and their social and biological bases. (Identical with Ling. 303 and W.S. 303)</td>
</tr>
<tr>
<td>304</td>
<td>Introduction to Archaeological Fieldwork (3)</td>
<td>Practical excavation, class discussion, mapping and the preliminary stages of artifact analysis. 2R, 6L. Field trips.</td>
</tr>
<tr>
<td>307</td>
<td>Ecological Anthropology (3)</td>
<td>Cultural adaptation, with emphasis on the systematic interaction of environment, technology, and social organization among hunter-gatherers, nomadic herders, and peasant farmers.</td>
</tr>
<tr>
<td>308</td>
<td>Family in the Modern World (3)</td>
<td>Introduction to the cross-cultural analysis of family and kinship systems in contemporary society.</td>
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<tr>
<td>309</td>
<td>Culture and the Individual (3)</td>
<td>Cultural and psychological dimensions of human development and human behavior. (Identical with Soc. 310)</td>
</tr>
<tr>
<td>310</td>
<td>World Ethnography (3)</td>
<td>The comparative study of selected societies of the world through extensive use of the media.</td>
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<tr>
<td>311</td>
<td>Mexican American Culture (3)</td>
<td>Historical background, cultural institutions, identity problems, social relations, and expectations of people of Mexican ancestry in the United States. (Identical with M.A.S. 319)</td>
</tr>
<tr>
<td>312</td>
<td>Archaeological Interpretation (3)</td>
<td>Survey of modern methods and theories in archaeology, with emphasis on current archaeological problems being investigated throughout the world. P, 235.</td>
</tr>
<tr>
<td>313</td>
<td>Studies in Modern Material Culture (3)</td>
<td>Studies relating contemporary behavior and material culture will be planned, implemented and evaluated to test methods of archaeological interpretation in modern societies and to develop new nonreactive methods of social science research. P, 3 units of social science.</td>
</tr>
<tr>
<td>314</td>
<td>Introduction to Classical Art and Archaeology (3-3)</td>
<td>1987-88 (Identical with Clas. 340a-340b)</td>
</tr>
<tr>
<td>315</td>
<td>Field Training in Archaeology (3-3)</td>
<td>S Archaeological methods, theory, and field techniques. 342a: Three-week field excavation and survey. 342b: Three-week laboratory processing and analysis. Registration limited. Contact department for application, which must be returned by April 1.</td>
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<tr>
<td>316</td>
<td>Primatology (3)</td>
<td>Comparative primate biology, behavior, ecology and evolution. P, 100 or 111 or 265.</td>
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<tr>
<td>317</td>
<td>Sociology of Latin American Societies (3)</td>
<td>(Identical with Soc. 384)</td>
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<tr>
<td>318</td>
<td>Honors Seminar (3)</td>
<td>(Identical with Soc. 384)</td>
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<tr>
<td>400</td>
<td>Processes of Culture Change (3)</td>
<td>GC II Intensive investigation of specific theories and varieties of culture change. P, 200.</td>
</tr>
<tr>
<td>401</td>
<td>Ancient Mesopotamia (3)</td>
<td>GC I 1988-89 Sumerian, Babylonian, and Assyrian civilization from the first cuneiform documents to the fall of the neo-Babylonian empire, with special attention to issues of sociopolitical organization. (Identical with Hist. 401 and Or.S. 401)</td>
</tr>
<tr>
<td>402</td>
<td>Kinship and Social Organization (3)</td>
<td>GC II Principles in the comparative study of social systems; types of social structure. P, 200, or 9 units of sociology (Identical with Soc. 402) Writing-Emphasis Course.*</td>
</tr>
<tr>
<td>403</td>
<td>Anthropology of Conflict Resolution (3)</td>
<td>GC II 1987-88 Decision making, conflict, and violence from a cross-cultural perspective, aiming to build both understanding of conflict processes and skills for managing and resolving them. 2R, 3L.</td>
</tr>
<tr>
<td>404</td>
<td>Sociology of the Southwest (3)</td>
<td>GC I (Identical with Soc. 404)</td>
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<tr>
<td>405</td>
<td>Urban Adaptation of Ethnic Groups (3)</td>
<td>GC I 1987-88 A survey of adaptations of ethnic and social groups to urban areas, focusing on a different group or region each semester.</td>
</tr>
<tr>
<td>406</td>
<td>Peasant Communities (3)</td>
<td>GC I Comparative analysis of traditional and contemporary peasant communities. On-going cross-cultural research project. (Identical with Soc. 407) Research-Writing-Emphasis Course.*</td>
</tr>
<tr>
<td>407</td>
<td>Anthropology and Public Policy (3)</td>
<td>GC II Examines the development, goals, techniques, and practices of anthropology as a policy science.</td>
</tr>
<tr>
<td>408</td>
<td>Economic Anthropology (3)</td>
<td>GC II Analysis of production, exchange, distribution, consumption, property, economic surplus, inheritance, and types of economic structure. P, 200, or 12 units of economics. (Identical with Econ. 409)</td>
</tr>
</tbody>
</table>
411. Anthropology of Religion (3) GC I Comparative approaches to the study of religion; systems of ritual and symbolization in the primitive world; shamanism and possession; religious movements; religion in the modern world. (Identical with Reli. 411)

412. Agricultural Economic Development in Latin America (3) GC II (Identical with A.Ec. 412)

413. Ethnology of the Southwest (3) GC II Culture history and economic, social, and religious institutions of the living people of the Southwest. P, 200. Writing-Emphasis Course.*

414a-414b. Indians of the Southwest (3-3) GC S History, arts and crafts, economics, social institutions, religions, and mythology of the present-day Indians of the Southwest.

415a-415b. Southwestern Indian Arts (3-3) GC 415a: Prehistoric utilitarian and aesthetic arts. 415b: The art of the modern Indians of the Southwest. 415a is not prerequisite to 415b. (Identical with A.In.S. 415a-415b and Art 415a-415b)

416. Contemporary Indian America (3) GC II 1987-88 The historical development and contemporary significance of the reservation system in the life of the Native American of the United States. (Identical with A.In.S. 416)

417. Cultures of Ancient Mexico (3) GC S Archaeological and ethnohistoric survey of the civilizations of ancient Mexico from earliest times to the period of the Spanish Conquest. Field trips. Fee.

418a-418b. Scientific Illustration-Photography (2 to 4 - 2 to 4) GC (Identical with Ecol. 418a-418b)

419. Psychological Anthropology (3) [Rpt./1] GC II Critical and historical survey of interrelationships between cultural and personal phenomena, with focus on childhood and adolescence, gender relations, dreaming and emotion.

420a-420b. Contemporary American Culture (3-3) GC 1987-88 Diverse perspectives on American values as expressed in organization of kinship, space, bureaucracies, media, social classes, ethnic groups, religious sects and movements. 420a is not prerequisite to 420b.


422a-422b. Pre-Columbian Art ((3-3) GC (Identical with Art 422a-422b)

423. Peoples of Mexico (3) GC II Cultural background and contemporary economic, social, and religious life of the Indian and mestizo populations of Mexico. (Identical with A.In.S. 423 and M.A.S. 423)

424. Gender and Social Identity (3) GC II Theories of sexual equality and inequality, plus an overview of sex roles and sex status in different types of societies and in different areas of social organization. (Identical with W.S. 424)

425. Ethnology of South America (3) GC I 1987-88 Comparative study of culture and history of South American indigenous peoples, including contemporary situation and Latin American policies toward them. P, 200.

427. Religion and Mythology of Mesopotamia (3) GC II 1987-88 Readings in translation of Sumerian and Babylonian myths and rituals stressing anthropological techniques in the interpretation of Mesopotamian cosmology. P, 100. (Identical with Or.S. 427 and Reli. 427)

428. Anthropology of Law (3) GC II 1988-89 Issues in the anthropology and history of law, focusing on the nature of law in its social context; selected case studies. (Identical with Or.S. 428)


430. The Anthropology of Visual Art (3) GC II 1988-89 An introduction to the anthropology of visual art and the interdisciplinary methodologies and techniques of studying art and aesthetics across-culturally as sociocultural phenomena. (Identical with A.In.S. 430, Engl. 430)

431. Anthropology and Development (3) GC II 1987-88 The role of anthropology in interdisciplinary projects involving economic development and planned change on the national and international levels.

432. Peoples of the Pacific (3) GC I 1988-89 Populations and cultures of Polynesia, Micronesia, and Melanesia; variability of these "natural laboratory" settings in an ecological framework.

433. Advanced Scientific Illustration (4) GC S (Identical with Ecol. 433)

435. Principles of Archaeological Fieldwork (3) GC II Introduction to the principles of archaeological fieldwork, with emphasis on method and theory of survey and excavation. 2R, 3L. P, 235.


437. The Relationship of Early Hominids and Contemporary Faunas (3) GC II 1988-89 The faunal association of contemporary animals and hominids world-wide. Peopling the New World. Methods utilized to analyze fossil assemblages when associated with hominids.
182 DEPARTMENTS AND COURSES OF INSTRUCTION

438. **Zooarchaeology (3) GC I** Animals in relation to man, with emphasis on past cultures, especially in the Southwest; morphology of animal skeletons; identification and interpretation of fragmentary remains.


440. **Laboratory in Zooarchaeology (3) GC 1988-89** Fragmentary animal remains in archaeological interpretation. Diagnostic morphological features; role in cultural interpretation. Analytical techniques; lab. analysis; report preparation. 1R, 6L.

441. **Organization of Museums (3) GC I** An intensive introduction to museum studies, with emphasis on the history, philosophy, structure, and function of museums.

442. **Museum Collections Management (3) GC I** Principles and procedures governing the acquisition, documentation, care and use of museum collections. 2R, 3L. P, 441.

443a - 443b. **The Archaeology of Neolithic and Bronze Age Greece (3-3) GC (Identical with Clas. 443a-443b)**

445. **Museum Exhibition (3) GC II** Method and theory in museum exhibit design. P, 441.

446. **Introduction to Museum Conservation (3) GC II** A basic introduction to the examination of the nature and properties of materials in anthropological collections and their deterioration, restoration, and preservation.

449a - 449b. **Folklore (3-3) GC (Identical with Engl. 449a-449b)**

450. **Social Stratification (3) GC I II (Identical with Soc. 450)**

451. **Archaeology of North America (3) GC I** Intensive survey of the development of culture in North America from the time of the initial peopling of the New World to the historic period.

452R. **Archaeology of the Southwest (3) GC I** Development of culture in the prehistoric Southwest from the late Pleistocene to the historic period. Field trip.

452L. **Archaeology of the Southwest (3) GC II** The nature of archaeological data recovered in the Southwest, with emphasis on their potential for the drawing of both cultural and chronological inferences. P, 452R.

453. **Mesoamerican Archaeology (3) GC I** Development of culture in Mexico and Central America from the early hunters and gatherers through the conquest of the Aztecs and Mayas by the Spanish. (Identical with M.A.S. 453) Writing-Emphasis Course.*

454. **Andean Archaeology (3) GC II** Development of culture in the Andean countries of South America from hunters and gatherers of the terminal Pleistocene through Inca civilization.

455. **Ethnoarchaeology (3) GC II** History, method, and theory of ethnoarchaeology with case studies of the use of ethnography in archaeological interpretation and theory-building. P, 235.

456. **Old World Prehistory (3) GC II** Man's cultural development in the Old World, as revealed by prehistoric archaeology, from earliest evidence through the development of agricultural villages.

457. **Prehistoric Mesopotamia (3) GC I 1987-88** Theories of the rise of civilization tested against archaeological data from Mesopotamia with comparative material from other areas. Time period: end of the Paleolithic to historic (Sumerian) civilization. (Identical with Or.S. 457)

461. **Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)**

462. **Introduction to Quaternary Ecology (3) GC I (Identical with Geos. 462)**

463. **Classical Field Archaeology (3) [Rpt./1] GC S (Identical with Clas. 463)**

464a-464b. **Introduction to Dendrochronology (3-3) GC (Identical with Geos. 464a-464b)**

465. **Women in International Development (3) GC II** The impact of international development on women as agricultural producers, householders, migrants, workers in formal/informal labor markets and participants in planned change. (Identical with W.S. 469; F.C.R. 469)

466. **Paleoanthropology (3) GC I** Evidence for human and nonhuman primate evolution including laboratory study of fossil casts and modern skeletal biology. P, 265 or consult dept. before enrolling. Writing-Emphasis Course.*

468. **Human Osteology (3) GC I** Human osteology for the archaeologist and physical anthropologist; techniques of in situ and laboratory identification, preservation and measurement. P, consult dept. before enrolling.

470a-470b. **Human Adaptability (3-3) GC** Study of human adaptability focusing on physiological plasticity, growth, nutrition, population ecology, demography, epidemiology and paleopathology. P, 265 or consult dept. before enrolling. 470a is not prerequisite to 470b. (470a identical with Gero. 470a)

471. **Introduction to Indic Civilization (3) GC I (Identical with Or.S. 471)**
473. Primate Anatomy (4) GC I 1987-88 Comparative primate functional anatomy from an anthropological viewpoint including extensive laboratory dissection and study of behavior, ecology, and evolution. P, 265 or consult dept. before enrolling.

474R. Ethnobotany (3) GC II Survey, with emphasis on cultural uses of plants, both past and present; discussions of contributions to the theory and techniques of the emergence of agriculture, archaeological botany, ethnomedicine, and other aspects of ethnobotany. P, 8 units of biology or anthropology.

474L. Ethnobotany Laboratory (1) GC II Field-lab course treating sampling, processing, storage, and identification techniques, procedures, and interpretation in selected areas of ethnobotany. Field trips. P, 8 units of biology or anthropology.


476. Language in Culture (3) GC II Survey of the nature of the interrelationships between language and other cultural phenomena. P, 276. (Identical with Ling. 476)

477. Discourse and Text (3) GC II 1987-88 Analysis and cross-cultural comparison of patterns of communication in discourse; modern approaches to discourse and text. P, 276, Ling. 200 or consult department before enrolling. (Identical with Ling. 477)

480. Historical Comparative Linguistics (3) GC I Types and mechanisms of linguistic change; language and dialect formation; determination of prehistorical relationships; reconstruction of proto-languages and cultures, and their origins in time and space. P, 276. (Identical with Ling. 480) Writing-Emphasis Course.*

481a-481b. Archaeology of Syria-Palestine in the Bronze and Iron Ages (3-3) GC (Identical with Or.S. 481a-481b)

482. Hopi Language in Culture (3) GC II A conversational introduction to Third Mesa dialect of Hopi, with emphasis on cultural context and covering essentials of Hopi language structure. (Identical with A.In.S. 482)

484a-484b. Akkadian Linguistics (3-3) GC 1988-89 Introduction to the standard literary language of the Babylonians and Assyrians. (Identical with Or.S. 484a-484b)

485. Social Organization of India and Pakistan (3) GC I (Identical with Or.S. 485)

486. Comparative Community Development (3) GC I (Identical with Soc. 486)

487. Poverty and Health (3) GC II (Identical with Nurs. 487)

488a. The Prehistory of East Asia (3) I GC The origins and subsequent development of prehistoric cultures in China, Japan, Korea, Mongolia, Siberia and Southeast Asia. Broad concepts such as cultural change and environmental adaptation are stressed in order to draw parallels among these geographically and culturally diverse regions. (Identical with Or.S. 488a)

488b. The Archaeology of Pre-Han China (3) II GC The origin and florescence of Chinese culture and civilization from an archaeological perspective. An in-depth survey of Chinese prehistory and early history from the early Pleistocene to the third century BC. 488a is not a prerequisite for 488b. P, 100 or consult department before enrolling. (Identical with Or.S. 488b)

489. Anthropology and Education (3) GC II The application of anthropological theory and methodology to education.

495. Colloquium
   a. Bilingual Health Communication (3) GC II (Identical with Nurs. 495a)

496. Proseminar
   f. Ceramic Analysis (3) GC I


501a-501b. Medical Anthropology (3-3) [Rpt./2] 501a: The anthropology of health, illness and sickness. Cultural perceptions of health, ethnophiology, illness causality and classification. 501b: Each semester the course will concentrate on a different world region. Examine indigenous medical traditions, changing health profiles, the interface between modern traditional medicine, and patterns of health care utilization.

502a-502b. Dynamics of Indian Societies (3-3) (Identical with A.In.S. 502a-502b)

514. Late Quaternary Geology (3) I (Identical with Geos. 514)

524. Theoretical Population Genetics (3) I (Identical with Ecol. 524)
DEPARTMENTS AND COURSES OF INSTRUCTION

561. **Paleoindian Origins** (3) I Chronological development of Paleo-Indian occupation of the New World in relation to environmental changes of the Quaternary Period; site discoveries, case studies, hypothesis on the peopling of the Americas. Field trip. (Identical with Geos. 596)

580a-580b. **Cross-Cultural Communication** (3-3) 580a: Linguistic Fieldwork. 580b: Cultural Fieldwork. 580a is not a prerequisite to 580b.

581. **Quaternary Palynology** (4) II 1987-88 (Identical with Geos. 581)

583. **Sociolinguistics** (3) I Contributions of the ethnography of communication, language variation studies, and conversational-discourse analysis to the interdisciplinary development of sociolinguistics. (Identical with Ling. 583)

584a-584b. **Readings in Akkadian** (3-3) 1987-88 Readings in selected literary, religious and economic texts designed not only to improve language mastery but to use those documents in elucidation of specific topics in Mesopotamian culture. P, 484a-484b. (Identical with Or.S. 584a-584b)

588. **Clinical Anthropology** (3) I II (Identical with Nurs. 588)

596. **Seminar**
   a. The Dynamics of Human Subsistence (3) II 1987-88 Consult department before enrolling.
   b. Pre-Columbian Art (3) [Rpt./4] I (Identical with Art 596e, which is home)
   c. Near Eastern Archaeology (3) [Rpt.] I II (Identical with Or.S. 596q, which is home)
   d. Quaternary Geochronology (1 to 4) I II (Identical with Geos. 596r, which is home)

597. **Workshop**
   a. Physical and Forensic Anthropology I (2) I Consult dept. before enrolling.
   b. Physical and Forensic Anthropology II (2) II Consult dept. before enrolling.

600. **Survey of Cultural Anthropology** (3) I Intensive introduction, overview, and synthesis of cultural anthropology.

635. **Survey of Archaeology** (3) I Major features of cultural development from earliest evidence to early civilizations. A basic introduction to method and theory in archaeology at an introductory graduate level.

642a-642b. **Advanced Field Course in Archaeology** (3-3) S Archaeological methods, theory, and field techniques. 642a: Three-week field excavation and survey; 642b: Three-week laboratory processing and analysis. Registration limited. Contact department for application, which must be returned by April 1.

645. **Early Civilizations** (3) [Rpt./2] II Comparative analysis of early civilizations from both the Old World and the New World, with emphasis on regularities in cultural development. P, 454, 456, 457, or 650.

650. **Ancient Civilizations of Mesoamerica** (3) 1987-88 Comparative study of cultural development in Mesoamerica, with emphasis on agricultural beginnings, settlement pattern and urbanization, hieroglyphic writing, and calendrical systems.

665. **Survey of Physical Anthropology** (3) II Modern physical anthropology including evolutionary theory, genetics, skeletal biology, primatology, paleoanthropology, human growth, adaptability and demography.


679. **Language and Ethnography** (3) I 1988-89 Training in the use of ethnographic method in linguistic and cultural research where naturally occurring speech is data. Analysis of data from observation, tape recording and videotaping. P, 6 units of linguistics.

680. **Survey of Linguistic Anthropology** (3) I II Major theoretical and methodological issues in linguistic analysis. Language as a cultural code, biological foundations, universals and typology, language and social reality, textual analysis.

695. **Colloquium**
   a. Forensic Anthropology (2) [Rpt./6 units] II 2R, 1L. P or CR 468 and 597b.

696. **Seminar**
   a. Archaeology (1 to 3) I II
   b. Cultural Anthropology (1 to 3) I II
   c. Linguistic Anthropology (1 to 3) I II
   d. Physical Anthropology (1 to 3) I II
   e. Museology (1 to 3) I II

"Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog)."
APPLIED MATHEMATICS

Committee on Applied Mathematics


Associate Professors Thomas F. Balsa (Aerospace and Mechanical Engineering), Peter J. Downey (Computer Science), William Filippone (Nuclear and Energy Engineering), K. Y. Fung (Aerospace and Mechanical Engineering), Juan C. Heinrich (Aerospace and Mechanical Engineering), Edward J. Kerschen (Aerospace and Mechanical Engineering), Richard E. Michod (Ecology and Evolutionary Biology), Olgiert Palusinski (Electrical and Computer Engineering), Tudor Ratiu (Mathematics), Randall Richardson (Geosciences), Moshe Shaked (Mathematics), Michael E. Sobel (Sociology), Malur K. Sundareshan (Electrical and Computer Engineering), Simon D. White (Steward Observatory)

Assistant Professors Chris K. Jones (Mathematics), John Palmer (Mathematics), Eugene W. Myers, Jr. (Computer Science), Arne J. Pearlstein (Aerospace and Mechanical Engineering), Timothy W. Secomb (Arizona Research Laboratories)

The program in applied mathematics encourages and supports cross-disciplinary research covering a broad spectrum of disciplines in science, engineering and business in which mathematics and modelling play fundamental roles. Students have considerable flexibility in the design of their individual programs. The program attempts to draw out from young men and women their ability to think maturely and more laterally and to train them in all facets of modern applied mathematics. Standards are high but the rewards are great, and graduates have made successful careers in industry and academia.

The committee offers programs leading to the Master of Science and Doctor of Philosophy degrees with a major in applied mathematics. For admission and degree requirements, please see the Graduate Catalog.

ARABIC

(See Oriental Studies)
ARCHITECTURE


Associate Professors Harry der Boghosian, Dennis Doxtater, Robert W. Dvorak, Robert L. Nevins

Assistant Professors William H. Cook (Adjunct), Charles M. Poster (Adjunct)

Lecturer Richard Ebeltoft

Undergraduate Program: The College of Architecture offers a five-year program leading to the first professional degree, Bachelor of Architecture. For degree requirements, see the College of Architecture section of this catalog. In addition to required architecture and general education courses, electives are taken in four areas of knowledge: sciences, humanities, business, and the arts. Open and architecture electives are also required enabling students to develop an elective concentration.

Architectural Design Courses (201, 202, 301, 302, 401, 402, 451, and 452): Design courses deal with buildings, design methods, building consequences and student development and maturation. The design sequence begins with 201, an introductory course for all students enrolled in the professional phase of the college. Early experiences are involved with an overview of design fundamentals, methods and vocabulary. Intermediate and advanced design courses deal with the technical and environmental factors that influence architectural form, with the evaluation and communication of design ideas and with analysis and planning for large-scale projects. All design courses stress synthesis and the application of previous course content and experience to current projects. Student projects may be retained by the college.

101. Architecture and Society (3) I II An overview of architecture and its relationship to society through a study of its history, its contemporary forms and its future; designed for nonmajors.

112. Graphic Communication I (3) I II Overview of the principles of architectural drawing; lectures on various types of graphic communication, supplemented by studio exercise; experience in orthographic projection, perspective, and shade and shadow.

114. Introduction to Architectural Theory (3) II A broad introduction to the historical, physical and cultural forces that affect the formation of buildings and physical environments. Lectures with slides examine current and recurring problems and principles.

118. Structure in Architecture (2) I An introduction to the role of structure in architecture; to the principles of structure, and to the behavior of structural elements, subsystems and systems.

201. Fundamentals of Architectural Design (6) Introduction to design of buildings and exterior space, with attention to human factors, horizontal systems of circulation, natural siting and site analysis, climatic analysis and passive methods of control, rudimentary structural forms and basic materials. P, 112, 114, 118, admission to professional phase, min. 2.0000 gpa.

202. Architectural Design (6) Design of buildings and exterior space with horizontal and vertical organization and systems of circulation, urban and suburban sites, active environmental control methods, advanced structural forms and materials (e.g., steel and concrete). P, 201, 222a.

222a-222b. Graphic Communication II (3-3) 222a: Techniques used to study and communicate architectural ideas, concepts, and space; conceptual diagramming, freehand perspective and sketching, shade and shadow, reflections, reproduction techniques and model building. 222b: Rendering techniques and media for use in finished architectural presentation. Lecture and studio. P, 112 and admission to professional phase.

228a-228b. Elements of Structure (3-3) The study of forces in static equilibrium, the internal response of structural members to such forces, and the design of structural components in wood and steel. P, 118, admission to professional phase.


236. Fundamentals of Environmental Control Systems (3) II Systems and means of environmental control with emphasis on passive and active methods and principles, energy conservation, and satisfying basic human needs with respect to heat, light and sound. P, 235.
244. Architecture Since 1945 (3) I Reflections of traditional, modern, contemporary and post-modern movements and trends.

263. Architectural Design and Drawing (3) [Rpt./1] S Studio-based coursework in architectural design or drawing with supplemental lectures. Emphases in building design, perspective and rendering, or construction documents. Students must select one area of concentration. Open to non-majors.

270. Introduction to Architectural Computing (3) I II Study of micro-computer hardware, software and programming techniques in architecture, including: word processing, spread sheet design, database management, graphics and structured programming using PASCAL. No previous computer experience required. P, professional phase admission.

287. Architecture and Behavior (3) [Rpt./1] I Human behavior, information processing, social organization and culture as related to the built environment; readings and projects analyzing specific environments; applications for pre-design programming and post-occupancy evaluation.

301. Synthesis in Architectural Design (6) Design of buildings with emphasis on principles of order, space and place making, and integration of building systems; synthesis of space, light, structure, environmental control systems and building code and zoning ordinance constraints. P, 202, 222b.

302. Enclosure Systems in Architectural Design (6) Continued building design with emphasis on the design of alternative means of enclosing architectural space; synthesis of the relationships of elements used in making the interface between natural and built environments. P, 301.


335. Environmental Control Systems (3) II Analysis of contemporary systems of environmental control including heating, ventilation, air conditioning, lighting, power distribution, plumbing and hygiene. Emphasis on integration of these systems into buildings and understanding the impact of systems upon architectural design and each other. P, 235. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


343. Watercolor Techniques for Architects (2) Techniques of watercolor communication utilized in architecture.

344. Architecture in Mexico (2) I Survey of architectural development in Mexico during the prehispanic, Spanish colonial and contemporary periods, with emphasis on design ideas from each period.


403. Solar Utilization in the Built Environment (3) GC I Survey of solar energy utilization principles, methods and case studies focused upon building and site planning design.


413. Architecture and the Arid Region (2) GC I Studies of the relationship between architecture and the climatic characteristics of arid regions with emphasis on passive cooling techniques. P, 302.

414. History of Architecture: American Architecture (2) GC II Developments in American architecture from the colonial to the early modern period. P, 6 units of art history or architectural history. Nonmajors may petition to enroll.


428. Field Methods in Environmental Psychology (3) GC II (Identical with Psyc. 428)
429. **Pre-Design Services** (3) GC II Principles and operations of gathering, analyzing, interpreting, translating and presenting information and ideas pertinent to architectural design. P, 302.

433. **Lightweight Construction Techniques** (3) GC II Survey of lightweight construction techniques, including pneumatics, tensile membranes, three-dimensional cable nets, grid shells and flexure stiff plates.

439. **Construction Documents** (3) GC I Content, intent, functions and practice of preparing documents needed for various construction delivery systems. P, 302.

444. **Site Planning** (2) GC II Studies relating to design determinants for development of outdoor space. Lectures and exercises dealing with individual design criticism including topography, hydrology, climate, and vegetation. Final project summarizing and applying all criteria to a realistic development project is required. P, 302. (Identical with Ping. 444)

451. **Topics in Architecture** (6) GC I Studio work in one of the following: building design, community design, computer-aided design, design development, historic preservation, design technologies, economics and politics in architecture, housing design, design in arid regions, or energy-conscious design. Offerings are limited by faculty availability, and all topics may not be offered each year. Other topics may be introduced. P, 335, 336, 338b, 424b, 402.

452. **Senior Project** (6) GC I II Studio-based project related to one of the topics in 451. Project should demonstrate a synthesis of knowledge or development of theoretical concepts. P, 451.

459. **Ethics and Practice** (3) GC I Standards and values of architectural services and professional project and practice management. P, 270 and 402.

470. **Computer Graphics in Architecture** (3) GC I Introduction to the theory, techniques, and applications of computer-aided design, design development, historic preservation, design technologies, economics and politics in architecture, housing design, design in arid regions, or energy-conscious design. Offerings are limited by faculty availability, and all topics may not be offered each year. Other topics may be introduced. P, 270 and 202.

473. **Introduction to the Conservation of Cultural Resources** (3) GC I An overview of the Historic Preservation movement in America, including discussion of concepts, rationale for and methods of resource utilization, implementation of plans, legislation, etc. Field trips.

480. **Computer Applications in Architecture** (3) GC II Advanced self selected projects exploring potential applications in computer-aided design with emphasis on graphic modeling. Seminars on technical topics with use of outside consultants. P, 470.

484. **Planning the Built Environment** (2) GC I A lecture survey dealing with the origins and implications of the physical manifestations of communal ordering systems. An analytic vocabulary is developed with which current and historic settlement patterns are visually compared to discover spatial attributes as a dimension of human experience. P, 302 and 424b.

487. **Space: A Social-Cultural View** (3) [Rpt./1] GC I Human, socio-cultural use of space including processes of symbolic expression. Investigation of the role of space through ethnographic readings describing both ritual and architectural examples. Consult department before enrolling.

497. **Workshop**
   1. **Community Design for Non-Designers** (3) GC I Field trips. Open to nonmajors only. (Identical with L.Ar. 497i and Ping. 497i)

56. **Seminar**
   a. Readings in Architecture (2) [Rpt.] II Open to majors only.
   u. Interdisciplinary Environment-Behavior-Design (3) [Identical with Idis. 596u, which is home]

597. **Workshop**
   a. Architecture (3 to 8) [Rpt.] I II Open to majors only. (Identical with Ping. 597a)

### ARID LANDS RESOURCE SCIENCES

**Committee on Arid Lands Resource Sciences (Graduate)**

Professors Robert B. Bechtel (Psychology), Daniel D. Evans (Hydrology and Water Resources), Martin M. Fogel (Renewable Natural Resources), Paul S. Martin (Geosciences), Richard W. Reeves (Geography), Ervin H. Zube (Renewable Natural Resources)

Associate Professors Michael E. Bonine (Oriental Studies), James C. Wade (Agricultural Economics)

Associate Director Charles F. Hutchinson
The Committee on Arid Lands Resource Sciences offers a program of graduate study leading to a Ph.D. degree. The program is designed for students whose educational goals are not found in the degree programs offered in traditional departments. The program is interdisciplinary and allows the student to select areas of study from within a variety of social, physical, and biological sciences.

The interested student should request additional information from the coordinator of the program. For admission and degree requirements, please see the Graduate Catalog.

ART


Assistant Professors Andrew Polk, Jeryldene Wood

The Department of Art provides a broad spectrum of theoretical, historical, and creative programs of instruction designed to prepare students for professional careers in studio art, graphic design and illustration, art history, and art education.

The department offers the following degrees: Bachelor of Fine Arts with majors in studio art and art education, and Bachelor of Arts in Art with a major in art history. The graduate degrees of Master of Fine Arts and Master of Arts are also available. For graduate admission and degree requirements, please consult the Graduate Catalog.

The major in studio art is for students planning professional careers as creative artists. The Bachelor of Fine Arts degree requires 45 units to be taken outside of the major department, including the general education requirements described under the College of Arts and Sciences/Faculty of Fine Arts in this catalog. All BFA students are also required to take at least one 3-unit course specifically focused on gender, race, ethnicity, or non-western civilization. This course can be part of the major, general education, or elective course work selected with the approval of the major advisor. In addition, the student must complete 75 units in art, at least 18 of which must be taken in residence at the University of Arizona. These 75 units in art are subdivided as follows:

- Foundations requirements — 15 units: 101, 102, 104, 117, 118.
- Distribution requirements — 30 units: 2-Dimensional Studies: 9-12 units chosen from 205, 241, 251, 265, 266, 280. 3-Dimensional Studies: 6-9 units chosen from 271, 273, 276, 287. Art history: 9-12 units of upper-division art history and/or related courses.

- Major area of concentration — 24 units in any one emphasis area:
  - 2-D studio emphasis in drawing, painting, printmaking, or an approved combination: 24 units of upper-division studio art courses.
  - 3-D studio emphasis in sculpture, ceramics, fibers, or metals: 24 units of upper-division courses including 15 units in primary medium and 3 units in each of 2 secondary media.
  - Photography emphasis: 24 units of upper-division courses to be selected from 341, 342, 346, 441, 445, 447, and 596p.
  - Graphic design emphasis: 24 units of upper-division courses including 364, 365, 368, 369, 464, 465, 468 (twice).
  - Illustration emphasis: 266 and 21 units of upper-division courses including 364, 365, 368, 369, 465, 466, 469.

- Art electives — 6 units from other courses in studio art and/or art history.

The major in art education is for students planning to teach art in the elementary and secondary schools. Graduates qualify for the K-12 Art Specialist Endorsement on a Secondary Certificate for the State of Arizona. This program approximates certification requirements of most states. At least 12 units of art must be taken in residence at the University of Arizona.
In addition to the general education requirements for the Bachelor of Fine Arts degree described under the College of Arts and Sciences/Faculty of Fine Arts in this catalog, the following major area of study requirements must be met: Foundations courses and Distribution courses as described in the major in studio art requirements (above), Art 130, 230, 430, 431, and 9 units of upper-division studio art courses. The candidate for the degree with this major must also complete the following education courses: Ed.P. 311, T.T.E. 329, 330, 3381, 435, 493b, 494b, and 3 to 6 units of general academic electives. A teaching minor is not required, but those students anticipating employment in areas where a teaching minor might be advantageous should consult with their advisor. The student should also consult with his or her advisor regarding any possible changes in certification requirements and consequent adjustments to degree requirements. Minimum total units required for the degree with this major — 126.

The major in art history is for students planning professional careers in art history or seeking an essentially cultural undergraduate education. This program provides an appropriate basis for advanced study of art history at the graduate level. To qualify for the degree with this major, 9 units of art (6 units specifically in the history of art) must be taken in residence at the University of Arizona.

In addition to the general education requirements for the Bachelor of Arts degree described under the College of Art and Sciences/Faculty of Fine Arts in this catalog, the student must complete a 34-unit major and a 20-unit minor. The following requirements for the major must be met: 101, 117, 118 and 18 units of art history, and 7 units of elective art courses — 14 units in the last two areas shall be upper-division courses. (See the Faculty of Fine Arts section of this catalog for more information on single or split minors). Minimum total units required for the degree with this major — 125.

Writing-Emphasis Course: A writing-emphasis course may be selected from specifically designated 300 and 400 level art history courses. Consult advisor before selection. (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.)

The Department of Art participates in the Honors Program.

**Studio**

101. **Drawing** (3) I II S Visual perception and the principles of composition presented through various drawing problems and materials. 6S.

102. **Color and Design** (3) I II S Elements and principles of two-dimensional composition, with emphasis on color mixing, interaction and control. 6S.

104. **Three-Dimensional Design** (3) I II Study of volume, mass, and space relationships through modeling, casting, carving, and construction. 6S.

205. **Figure Drawing** I (3) I II Drawing from the model and other subjects to develop pictorial and perceptual skills. 6S. P, 101.

241. **Beginning Photography** (3) [Rpt./2] I II Familiarization with basic photographic processes and aesthetics. 2R, 2S. Field trips. (Identical with R.T.V. 241)

251. **Printmaking** (3) [Rpt./1] I II Studio in intaglio media, including mixed techniques and color processes. 6S. P, 102, 205.

265. **Beginning Graphic Design** (3) I II Introductory study of principles, tools, and techniques of advertising layout. 6S. P, 101, 102.

266. **Beginning Illustration** (3) I II Exploration of techniques, styles and media for illustration. 6S. P, 102, 205, 265.

271. **Beginning Jewelry and Metalsmithing** (3) I II Introduction to the fundamentals of jewelry and metalwork processes. 6S. P, 104.

273. **Beginning Ceramics** (3) I II Introduction to the basic clay processes of hand construction, potter’s wheel, surface decoration and glaze application. 1R, 4S. P, 104.

276. **Beginning Fibers** (3) I II Structural development of fibers into woven forms, using the frame loom; fiber as a fine arts medium. 6S. P, 104.

280. **Painting** I(3) I II Elementary course in the methods and techniques of painting with oils and/or acrylics. 6S. P, 101, 102.

285. **Watercolor Painting** I (3) I II Introductory course in watercolor painting exploring basic materials and techniques. 6S. Field trips. P, 101, 102.

287. **Beginning Sculpture** (3) I II Composition in various sculpture techniques. 6S. P, 104, 205.
289. Beginning Figure Modeling (3) I II Study of the figure from the model through drawing, relief and sculpture to the round. Emphasis on understanding balance, proportion, relationships and structures of the human figure. 6S.

305. Figure Drawing II (3) [Rpt./2] I II Intermediate course in drawing problems using the model. 6S. P, 205.


342. Photography Since 1950 (3) I Slide presentations and discussions of major photographers since 1950. 2R, 2S.

346. Color Photography (3) [Rpt./2] I II Exploring conceptual and practical aspects of color picture-making with an emphasis on darkroom skills and the development of personal imagery. 2R, 2S. P, 341, acceptance of portfolio by Portfolio Committee.

350. Relief Printmaking (3) I II Relief printmaking covering the basic techniques of relief printing, woodcut, color techniques, linocut and rollup, and collograph. Field trips. 6S. P, 101, 102.

352. Basic Lithography (3) [Rpt./1] I II Techniques of image-making and printing from lithographic plate or stone; emphasis on drawing and concept. 6S. P, 305.

353. Alternative Methods in Printmaking I (3) I II Monotype, handmade paper, photographic processes and other less traditional printmaking methods. 6S. P, 102, 205.

364. Production Problems in Graphic Design (3) [Rpt./1] I II Preparation of visual material for reproduction by various printing processes. 6S. P, 265, 266, and acceptance of portfolio by Portfolio Committee.

365. Intermediate Graphic Design (3) [Rpt./1] I II Further exploration of design as a communications tool. Solutions to realistic promotional programs are executed from rough to comprehensive stage. 6S. P, 102, 205, 265, acceptance of portfolio by Portfolio Committee.

368. Rendering Techniques (3) [Rpt./1] I Drawing and rendering techniques with various media in the creation of editorial and advertising illustration. 6S. P, 265, 266, acceptance of portfolio by Portfolio Committee.

369. Advertising Illustration (3) [Rpt./1] I II 6S P, 265, 266, acceptance of portfolio by Portfolio Committee.

371. Intermediate Jewelry and Metalsmithing I (3) [Rpt./2] I Design and creation of jewelry and metalsmithing forms by construction methods. Emphasis on form development through raising, forging, repousse, casting, etc. 6S. P, 271.

372. Intermediate Jewelry and Metalsmithing II (3) [Rpt./2] I II Emphasis on surface enrichment through stone setting, reticulation, enameling, mokume, etc. 6S. P, 271.

373. Intermediate Ceramics (3) [Rpt./4] I II Continuation of form investigation, using hand construction and wheel; studio problems in clay and glaze formulation, kiln firing and ceramic history. 1R, 4S. P, 273.

376. Intermediate Fibers I (3) [Rpt./3] I Two-dimensional fibers techniques including 4-harness loom weaving (loom and weaver-controlled weaves) and tapestry weaving (cartoon as well as spontaneous methods). Emphasis on individual interpretation of traditional woven techniques. 6S. P, 276.

377. Intermediate Fibers II (3) [Rpt./3] I II Three-dimensional fibers techniques including tubular weaves, wedging, non-loom weaves, coiling, twining, crochet and knotting. Emphasis on the self-supportive fiber form. 6S. P, 276.

380. Painting II (3) [Rpt./2] I II Intermediate course in developing expressive and pictorial skills in oil and/or acrylic media. 6S. P, 280.


387. Intermediate Sculpture (3) I II In-depth exploration of the media and concepts of sculpture. 6S. P, 287.

389. Intermediate Figure Modeling (3) I II Study of the figure from the model with armature. Emphasis on structure of the figure; bones and muscles. 6S. P, 289.

405. Figure Drawing III (3) [Rpt./5] GC I II Advanced drawing with emphasis on personal expressive development. 6S. P, 6 units of 305.

409. Drawing Critique (3) [Rpt./5] GC I II Individual exploration and development of visual concepts through drawing, accompanied by individual and class critiques. P, 6 units of 405.

411. Advanced Photography (3) [Rpt.] GC I II Current trends, philosophies and experimentation in still photography. 2R, 2S. P, 341, acceptance of portfolio by Portfolio Committee.

DEPARTMENTS AND COURSES OF INSTRUCTION

447. Mixed Media Book [3] [Rpt./1] GC I II Investigation of the book as a format for presenting visual material; the process of making simple books. Contemporary bookmakers will be presented. 2R, 2S. Field trips. P, 12 units of studio art courses.

452. Advanced Lithography [3] [Rpt./5] GC I II Autographic lithography as personal creative medium and professional skill; multiple-color printing with emphasis on controls and quality. 6S. Field trips. P, 352.


454. Advanced Relief and Intaglio [3] [Rpt./5] GC I II Traditional modes of relief block and intaglio plate printmaking expanded via individual research and experiment; emphasis on development of personal aesthetic and professional standards. 6S. Field trips. P, 251.

464. Packaging Design [3] [Rpt./1] II Retail packaging, point-of-purchase displays, and lines of related products, with emphasis on graphic treatment, logotype design, and three-dimensional structure. 6S. Field trips. P, 9 units of graphic design courses and acceptance of portfolio by Portfolio Committee.

465. Portfolio Preparation [3] [Rpt./1] GC II Final approach to completion of portfolio. Student's portfolio is critiqued in areas of order, style, and degree of presentation to bring it to a professional level. 6S. P, 9 units of graphic design courses and approval of portfolio by Portfolio Committee.

466. Editorial Illustration [3] [Rpt./1] GC I Problems in editorial and book illustration. 6S. P, 9 units of illustration courses and approval of portfolio by Portfolio Committee.

468. Graphic Design Studio [3] [Rpt./1] GC I Classroom experience in a professional designer capacity with studio solutions to graphic design problems submitted from campus and community. 6S. Field trips. Consult department before enrolling. P, 9 units graphic design courses, acceptance of portfolio by Portfolio Committee.


477. Design on Fabric [3] II Surface design application on fabric, including silkscreen printing, block printing and direct dye application techniques (canning, batik, dye-drawing). 6S.

480. Painting III [3] [Rpt./5] GC I II Advanced painting concepts, with emphasis on personal expressive development and change. 6S. P, 6 units of 380.


483. Combining Media [3] [Rpt.] GC Individual and group projects, including collages, constructions, image sequences, and elements from other art forms (sound, language, movement, etc.).


489. Extensions of the Figure [3] [Rpt./2] GC I II Life modeling in clay over armatures and other techniques. 6S P, 287.

505. Graduate Figure Drawing [3] [Rpt./5] II Special problems in drawing, using the classroom model and outside sources as references for personal expression. 6S.


565. Graduate Graphic Design Problems [3] [Rpt./1] II Two-and-three-dimensional design considerations with emphasis on conceptualization and presentation. 6S. Field trips. P, acceptance of portfolio by Portfolio Committee.

567. Graduate Illustration [3] [Rpt./1] II Exploration of any optical material or phenomenon as a possible solution to illustration problems. 6S. P, 466, acceptance of portfolio by Portfolio Committee.
580. Graduate Painting (3) [Rpt./5] I II Graduate study in painting with an emphasis on the development of a personal imagery and body of work. 6S.

585. Graduate Watercolor Painting (3) [Rpt./5] I II High level experimentation in personal expression with watercolor and related media. Demonstration and critique.

596. Seminar p. Photography and Language (3) [Rpt./1] II 2R, 2S. Open to majors only. s. 3-D Concepts (3) [Rpt./3] II.

600. Painting Concepts (3) [Rpt./2] I II Presentation of one’s painting concepts and the concepts of others, citing parallel influences, research, related ideas and implications for highly concentrated student and faculty discussion.

642. Studio Photography Critique (3) [Rpt./5] I II Investigation of practical methods of critique and their influence on an artist’s developing body of work. Limited to art majors with photography concentration.

671. Graduate Jewelry and Metalsmithing (6 to 10) [Rpt./6] I II Graduate study in all phases of jewelry and metalwork. 12 to 20S.

673. Graduate Studio in Ceramics (6 to 10) [Rpt./6] I II Studio research and instruction with emphasis on personal creative development. 12 to 20S. Field trips. P, 473.

676. Graduate Fiber Studies (6 to 10) [Rpt./6] I II Graduate experimentation in all aspects of fiber work, with emphasis on the development of a personal style within the medium. 12 to 20S. P, 476.

680. Graduate Studio (6 to 10) [Rpt./6] I P, 12 units of graduate credit in art.

687. Graduate Problems in Sculpture (3) [Rpt./6] I II Personal response to form and composition using a variety of technical means including welding, casting, carving and nontraditional techniques. 6S. P, 487.

Art History

117. Survey of World Art, Prehistoric-Gothic (3) I II The art and architecture of Western civilizations through the Gothic era, and of world prehistoric and primitive cultures.

118. Survey of World Art, Renaissance-20th Century (3) I II The art and architecture of Western civilization, Renaissance through the 20th century.

207. Western Civilization and the Arts: The Twentieth Century (3) I II (Identical with F.A. 207)

210. Introduction to Pre-Columbian Art (3) I 1987-88 New World cultures from 2000 BC through the end of the sixteenth century and from the southern Andes of South America through the desert southwest of the United States.

224. Introduction to the History of Photography (3) Technical and aesthetic considerations from 1839 to the present.

307. Western Civilization and the Arts: Paleolithic through Renaissance (3) I II (Identical with F.A. 307)

310. Classical Art (3) Stylistic analysis of the emergence of classical art and architecture from Minoan Crete to the transformation of the classical spirit in the Hellenistic world — 800 to 32 B.C. P, both surveys (117, 118) or 6 units of history. (Identical with Clas. 310)

317. Western Civilization and the Arts: Baroque through Nineteenth Century (3) I II (Identical with F.A. 317)

319. Introduction to American Art (3) I Survey of American architecture, painting, sculpture, photography, and the decorative arts from colonial times to present.

320. Introduction to European Modern Art (3) I Painting and sculpture in Europe from about 1886 to recent times.

329. Art History of the Cinema (3) I (Identical with Clas. 329)

340a-340b. Introduction to Classical Art and Archaeology (3-3) 1987-88 (Identical with Clas. 340a-340b)

396H. Honors Proseminar (3) I II

411. Roman Art and Architecture (3) GC The origin and development of Italian art and architecture from Etruscan beginnings through the Republic to the late Empire. P, both surveys (117, 118) or 6 units of ancient history. (Identical with Clas. 411)
DEPARTMENTS AND COURSES OF INSTRUCTION

412a-412b. Medieval Art (3-3) GC 412a: II Arts of the nomadic invasions of Western Europe and Hiberno-Saxon, Merovingian, and Carolingian art. 412b: I 1987-88 Survey of Ottonian, Romanesque, and Gothic art from A.D. 1000 through 1250. 412a is not prerequisite to 412b.

413a-413b. Renaissance Art in Italy (3-3) GC Painting, sculpture and architecture in Italy. 413a: I 13th-15th centuries. 413b: II High Renaissance to 1600. P, 6 units of history or art history. 413a is not prerequisite to 413b.

414a-414b. Netherlandish Art (3-3) GC 414a: Development of painting in the Netherlands and France from the 14th through the 16th centuries. 414b: Painting, sculpture, and architecture in Holland and Flanders. P, 6 units of history or art history. 414a is not prerequisite to 414b.

415a-415b. Southwest Indian Arts (3-3) GC (Identical with Anth. 415a-415b)

417a-417b. 19th-Century European Art (3-3) GC Painting and sculpture. 417a: From the French Revolution to about 1850. 417b: From about 1850 through Impressionism. P, 6 units of history or art history.

418a-418b. 20th-Century Art (3-3) GC Painting and sculpture in Europe. 418a: From the French Revolution to about 1850. 418b: Between the World Wars. P, 6 units of history or art history. 418a is not prerequisite to 418b.

422a-422b. Pre-Columbian Art (3-3) GC 422a: Art of the high cultures of Mesoamerica, with the focus on architecture, sculpture, painting and crafts prior to European contact. 422b: Pre-Columbian art of Central and South America, with particular attention to the Andean area. 422a is not prerequisite to 422b. (Identical with Anth. 422a-422b)

424a-424b. History of Photography (3-3) GC 424a: From its invention to 1895; impact of photography on the art and culture of the 19th century. 424b: As an art medium from 1895 to 1965. P, 6 units of art history. 424a is not prerequisite to 424b.

428. 17th-and 18th-Century Art in Italy and France (3) GC Painting, sculpture, and architecture of the Baroque and subsequent periods. P, 6 units of history or art history.

429a-429c-429d. American Art (3-3-3-3) GC Art in the United States. 429a: Colonial art. 429b: 19th century art. 429c: From 1900 through 1940. 429d: Twentieth century American art from the 1930s to recent times. May be taken in any order. P, 6 units of history or art history.

511. Methods of Art History (3) I Major intellectual approaches to the visual arts developed within the past 150 years. Field trips. Open to majors only.

596. Seminar
   a. American Art (3) [Rpt./2] I II
   b. Problems in Renaissance-Baroque (3) [Rpt./2] II
   c. Studies in Medieval Art (3) [Rpt./2] II
   e. Pre-Columbian Art (3) [Rpt./4] I Consult instructor before enrolling. (Identical with Anth. 596a)
   f. History of Photography (3) [Rpt./4] I II P, 424a or 424b.

693. Internship
   a. Art Museum Training (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 12 units of graduate art history courses.
   b. Curatorial Training for Archives of Photography (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 511, 12 units of graduate art history courses.
   c. Archivist Training for Collection of Photography (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 12 units of graduate art history courses.
   d. Archives of Photography: Preservation/Cataloging (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 511, 12 units of graduate art history courses.

Art Education

130. Appreciating the Visual Arts (3) I II Introduction to techniques for describing and analyzing works of art utilizing relevant material from history and aesthetics. 2R, 2S.


338I. The Teaching of Art (3) I Carries credit in education only. (Identical with T.T.E. 338I)

400. Art for Exceptional Learners (3) Adaptation of structured art curricula to exceptional learner populations. Not open to art education majors. P, previous coursework in art and/or special education.

430. Understanding the Visual Arts (3) I II A discipline-based introduction to the visual arts that provides students with the opportunity to acquire beginning expressive skills, to learn the value of art within western culture, and to become aesthetically literate. 2R, 2S. P, junior standing.
The Nature of Artistic Expression (3) GC II A discipline-based study of the visual arts providing knowledges and skills necessary to understand and discuss works of art in an historical setting, place works of art in an aesthetic context, and express ideas through art materials. P, 430.

Community Arts Careers (3) GC I Structure and function of community arts agencies with emphasis on their relationship to art education theory and practices.

Art Criticism in Art Education (3) GC Methods of analyzing art works and aesthetic experiences appropriate to art classroom teaching. Videotapes, films, and readings illustrate concepts and terminology.

Introduction to Research in Art Education (3) I II Development of competency in application of language, methods, and diverse research procedures used in the visual arts and education as demonstrated by a scholarly written research report.


History and Philosophy in Art Education (3) Critical examination of literature containing fundamental concepts that have shaped the development, scope, and current significance of art education.

Issues and Recent Research in Art Education (3) I The identification of problems in art education at various curricular levels; examination of related research with possible implications for practice. P, T.T.E. 493b (in art), or teaching experience.

Art Instruction in Higher Education (3) I Philosophy of art learning and teaching in higher education. Training in processes of instruction in art for community colleges, four-year colleges, and universities. P, 15 units of graduate study in art education, art history, or studio art.

ASTRONOMY

Professors Peter A. Strittmatter, Head, J. Roger Angel, George V. Coyne, William F. Hoffmann, J. R. Jokipii, Frank J. Low, George H. Rieke, Elizabeth Roemer, Thomas L. Swihart, Rodger I. Thompson, William G. Tiff, Neville J. Woolf
Associate Professors Marc Aaronson, John Black, Adam Burrows, William J. Cocke, Charles J. Lada, James W. Liebert, Ramesh Narayan, Andrzej G. Pacholczyk, Marcia Rieke, Raymond E. White, Simon White
Assistant Professors Craig Hogan, Christopher Impey

The department offers the degrees of Bachelor of Science and Bachelor of Arts with a major in astronomy, Master of Science and Doctor of Philosophy.

The major for the B.S. is designed for students who plan to pursue graduate studies in astronomy or a related science. The requirements for the major are 30 units of upper-division courses in astronomy, physics and mathematics, including Astr. 400a-400b; other courses are to be selected in consultation with the departmental adviser.

Entering freshmen should take a mathematics class (Math. 117e and/or Math. 118, or Math. 125a), followed by Astr. 271 and Phys. 110. The supporting minor should be physics, although other minors may be selected with the consent of the advisor. A double major in astronomy and physics is also possible. It is recommended that the language requirement be fulfilled in French, German or Russian.

The major for the B.A. is oriented toward students with interests in science education, such as high school or junior college teaching, planetarium work, library science, and journalism. The requirements for the major are 35 units, including 120, 271, 272, 400a, Phys. 330 and 3 additional upper-division units of physics; 6 units in the history or philosophy of science. The remaining units should be mostly upper division and must be courses chosen from the sciences, mathematics, engineering, history or philosophy of science. The minor need not be in the sciences.

With foresight in course selection, a student could maintain the option of obtaining either the B.S. or the B.A. degree into the senior year.

Honors: The department participates in the Honors Program.

100.* Essentials of Astronomy (3) I II S A survey of astronomy, with attention to its interdisciplinary aspects and its relationships to other sciences. Planetarium work and some night-time observing sessions and field trips supplement class lectures. Primarily for nonscience majors.

100L. Astronomy Laboratory (1) I II S Projects, telescope observing, planetarium work, discussions. Can be taken alone or with 100. Combination is equivalent to 110a.
105. **The Universe and Humanity: Origin and Destiny** (3) I II (Identical with Pty.S. 105)

106. **Survey of the Solar System** (4) I II (Identical with Pty.S. 106)

110a-110b.* **Introductory Astronomy** (4-4) A broad introduction to traditional and modern astronomy combining class lectures, planetarium and lab. work, and night-time observing and field trips. 110a: P, one semester high-school algebra. 110b: P, 100 or 110a.

*Credit will be allowed for only one of the following: 100 or 110a.

121. **Philosophical and Historical Aspects of Astronomical Thought** (3) II Historical development of astronomical concepts and the scientific method; cosmological concepts from ancient times to the present; controversies in astronomy in the recent past and at present.


272. **Introduction to Observational Astronomy** (3) II Observational applications of coordinate systems and time; basics of astronomical instruments; photodetectors; measuring equipment and reduction techniques. Practice in observing. 2R, 3L. P, Math. 125a.

311. **Classical and Solar System Astronomy** (3) II Coordinate systems and time; orbits and ephemerides; atmospheres, surfaces, and interiors of planets and satellites; the small bodies; the Sun; origins. P, CR Phys. 410.

400a-400b. **Theoretical Astrophysics** (3-3) GC Stars, interstellar matter, galaxies, radio sources, cosmology. P, Math. 254, 6 units upper-division physics. 400a is a Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

403. **Introduction to the Solar System** (3) GC I (Identical with Pty.S. 403)

404. **Exploration of the Solar System** (3) GC I S (Identical with Pty.S. 404)

502. **Introductory Astronomical Instrumentation and Technique** (3) I 1988-89 Survey of instrumentation and techniques applicable to astronomical problems; noise sources, mechanical and optical technology, spectrum analyzers, polarimetry, image analyzers, video and electronic techniques.

515. **Gaseous Nebulae and the Interstellar Medium** (3) II 1988-89 Ionization equilibrium; heating and cooling of HI and HII regions; determination of physical conditions from emission-line spectra; dark and reflection nebulae; interstellar grains.


535. **Stellar Structure** (3) II 1987-88 Virial theorem; gas spheres in hydrostatic equilibrium; polytropes; convective and radiative equilibrium; equations of state; opacities; nuclear reaction rates; stellar model computation; stellar atmospheres and evolution. Strittmatter

540. **Basic Properties of Galaxies** (3) II 1988-89 Classification, mass determination, photometric properties, dust and gas content, stellar content, systems and clusters, distance scales, galactic dynamics. Tifft/Strittmatter

545. **Stellar Atmospheres** (3) I 1987-88 Radiative transfer, gray atmosphere, opacity, line formation, non-LTE, curves of growth, stellar hydrodynamics.

551. **Satellite and Planetary Perturbation Theory** (3) II (Identical with Pty.S. 551)

556a-556b. **Electrodynamics of Conducting Fluids and Plasmas** (3-3) 1988-89 (Identical with Pty.S. 556a-556b)

575. **General Relativity and Cosmology** (3) II 1988-89 General relativity, with applications to cosmology and stellar structure; formation of stars and galaxies. Cocke/Weymann


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**ATMOSPHERIC SCIENCES**


Associate Professor Kenneth C. Young
The department offers the degrees of Bachelor of Science, Master of Science, and Doctor of Philosophy with a major in atmospheric sciences.

**The major:** 30 units in Atmo. The following courses are required: Math. 125a-125b, 223, 254; Stat. 361 or 461; S.I.E. 170; Phys. 110, 116, 121; Chem. 103a-103b, 104a-104b; Atmo. 300, 350, 421, 441a-441b, 451a, 471, 472.

In conjunction with the Institute of Atmospheric Physics, the Department of Atmospheric Sciences offers opportunities for study and research in the atmospheric sciences.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101a-101b</td>
<td>The Atmospheric Environment</td>
<td>(4-4)</td>
<td>Exposition of the atmosphere about us and its interaction with human activity; atmospheric evolution and pollution; weather and climate and their inadvertent and inadvertent modification; local and severe storms. Course includes demonstrations and lab. exercises. Credit will not be given for both 101a-101b and 171. P, Math. 116.</td>
</tr>
<tr>
<td>171</td>
<td>Introduction to Meteorology and Climatology</td>
<td>(3-3)</td>
<td>Basic elements that constitute the weather, including fronts and cyclones, precipitation processes, the wind systems of the world, severe storms, and weather modification. P, Math. 116. Credit will not be given for both 101a-101b and 171. (Identical with Geog. 171)</td>
</tr>
<tr>
<td>171L</td>
<td>Introduction to Meteorology and Climatology Laboratory</td>
<td>(1)</td>
<td>Application of the basic concepts of meteorology and climatology, with emphasis on the interpretation and detection of selected weather phenomena. P, Math. 117e, CR 171, Section 1. (Identical with Geog. 171)</td>
</tr>
<tr>
<td>300</td>
<td>General Meteorology</td>
<td>(3)</td>
<td>Survey of physical and dynamic meteorology, recommended for students wanting a more quantitative approach to meteorology than provided in 171. P, Math. 123.</td>
</tr>
<tr>
<td>350</td>
<td>Atmospheric Measurements</td>
<td>(3)</td>
<td>Theory and practice in the use of meteorological instruments; lab. and field demonstrations and practices. 2R, 3L. Field trip. P, Phys. 103a-103b, or 116 and 121.</td>
</tr>
<tr>
<td>421</td>
<td>Physical Climatology</td>
<td>(3)</td>
<td>Heat and water balances of the earth-atmosphere system viewed from both the local and global scales; paleoclimatology and theories of climatic change; man's impact on climate. P, 171. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).</td>
</tr>
<tr>
<td>441a-441b</td>
<td>Dynamic Meteorology</td>
<td>(3-3)</td>
<td>Thermodynamics and its application to planetary atmospheres, hydrostatics, fundamental concepts and laws of dynamic meteorology. P, Phys. 121; Math. 254.</td>
</tr>
<tr>
<td>450</td>
<td>Air Pollution Meteorology</td>
<td>(3)</td>
<td>Theoretical description and experimental practice relating to the dispersion of gases and particulate matter in the atmosphere. Attention given to the scales of dispersion and the scales of atmospheric turbulence as related to local, regional and global pollution. P, 300 or consult department before enrolling.</td>
</tr>
<tr>
<td>451a-451b</td>
<td>Physical Meteorology</td>
<td>(3-3)</td>
<td>Introduction to atmospheric physics, including atmospheric radiation, fluid mechanics, aerosol physics, cloud physics, and atmospheric electricity. P, Phys. 121; Math. 254.</td>
</tr>
<tr>
<td>465</td>
<td>Mesoscale Meteorology</td>
<td>(3)</td>
<td>Description and dynamics of weather systems of the mesoscale. Topics may include fronts, thunderstorms, gravity waves, lake effect storms and sea breezes. P, 300.</td>
</tr>
<tr>
<td>471</td>
<td>Synoptic Analysis</td>
<td>(3)</td>
<td>Principles of meteorological analysis, including surface and upper-level charts, cross-sections, kinematic analysis, structure of the troposphere and tropospheric systems, thermodynamic diagrams. 1R, 6L. P, CR 441a, or 300.</td>
</tr>
<tr>
<td>472</td>
<td>Weather Forecasting</td>
<td>(3)</td>
<td>Techniques for weather forecasting and actual forecasting experience; advanced synoptic analysis. 1R, 6L. P, 471.</td>
</tr>
<tr>
<td>489</td>
<td>Sunlight and Skylight</td>
<td>(3)</td>
<td>The nature of the sun and solar radiation. Optical phenomena in the atmosphere such as mirages, rainbows, haloes, and glories. P, 451a.</td>
</tr>
<tr>
<td>518</td>
<td>Experimental Methods of Planetary Science</td>
<td>(3)</td>
<td>(Identical with Pty.S. 518)</td>
</tr>
<tr>
<td>530</td>
<td>Micrometeorology</td>
<td>(3)</td>
<td>Theoretical aspects of atmospheric turbulence, including discussions of laminar flow, turbulent flow, the mechanical energy equations, and the shearing stress and the wind profile. P, 441b.</td>
</tr>
<tr>
<td>535</td>
<td>Air/Sea Interactions</td>
<td>(3)</td>
<td>Physical characteristics of the oceans; the dynamics of ocean currents and their interactions with the atmosphere; El Niño and other teleconnections between the oceans and the atmosphere. P, 300.</td>
</tr>
<tr>
<td>544</td>
<td>Physics of the High Atmosphere</td>
<td>(3)</td>
<td>(Identical with Pty.S. 544)</td>
</tr>
<tr>
<td>560</td>
<td>Aerosol Science</td>
<td>(3)</td>
<td>Physics, mechanics, and optics of individual atmospheric aerosol particles. Topics include formation, dynamics, nucleation and growth, coagulation, scattering and absorption of radiation, and aerosol technology. (Identical with E.C.E. 560)</td>
</tr>
</tbody>
</table>
DEPARTMENTS AND COURSES OF INSTRUCTION

585. **Tropospheric Chemistry** (3) I 1987-88 A study of tropospheric chemistry, with emphasis on the controls and feedbacks involving the major constituents, the cycles of the minor constituents, methods of measurement, and applications.


595. **Colloquium**
   a. Atmospheric Measurement Techniques (1 to 3) II 1987-88

641. **Theoretical Meteorology** (3) I Methods of solution of the hydrodynamic equations; identification and analysis of acoustic, gravity, Kelvin-Helmholtz, inertial, Kelvin, barotropic and baroclinic waves. P, 441b.


656a-656b. **Atmospheric Optics and Radiation** (3-3) 1988-89 Theory of atmospheric radiative transfer processes; specific methods for solving relevant equations; applications to problems in radiative transfer and optics. P, Phys. 420. (Identical with Opti. 656a-656b)

663. **Principles of Atmospheric Remote Sensing** (3) II 1988-89 For remote sensing applications, mathematical methods are developed to infer the physical properties of the atmosphere. Techniques using optical and microwave frequencies are examined for their information content. P, 656b; Math. 254. (Identical with E.C.E. 683)

BIOCHEMISTRY


Associate Professors Hans J. Bohnert, Don P. Bourque, Wah Chiu, William J. Grimes, Jennifer D. Hall (Molecular and Cellular Biology), John W. Little, Marc E. Tischler

Assistant Professors Danny L. Brower (Molecular and Cellular Biology), James F. Deatherage, Carol Dieckmann, Ivan Rayment, Elizabeth Vierling

Biochemistry provides the fundamentals for study of the molecular principles in biology, medicine, and the health sciences and agricultural sciences. Teaching and research in biochemistry are carried out in several locations in the University. The faculty members listed above constitute the University Department of Biochemistry, which is responsible for instruction in biochemistry in the Colleges of Agriculture, Arts and Science, and Medicine. These programs serve as an excellent background for graduate study in biochemistry or the many health-related sciences, including a major preprofessional program for qualification for professional schools of medicine, dentistry and osteopathy.

The University Department of Biochemistry offers the Bachelor of Science, Bachelor of Arts, Master of Science and Doctor of Philosophy degrees with a major in biochemistry. Applicants are not admitted directly to the Master of Science program. The degree is awarded only in rare instances when individuals admitted to Ph.D. programs terminate early.

The major for the B.S.: Chem. 103a-103b, 104a-104b, or 105a-105b, 241a-241b, 245a-245b, 325, 326, 480a and 480b or 481, Math. 125a-125b, 223; Phys. 123a-123b, 108; M.C.B. 103 or Ecol. 204; 462a-462b, 463, 494, 496a (2 units), and 10 upper-division units in biology, chemistry, mathematics, or physics, exclusive of individual studies. All students will participate in a senior research practicum (494) for a minimum of 3 units after taking 462a-462b and 463. Senior research is conducted in the laboratory of a faculty member with approval of the adviser.

The major for the B.A.: Chem. 103a-103b, 104a-104b, or 105a-105b, 241a-241b, 243a-243b, 325, 326, 480a; Math. 117f, or 117e and 118, 125a; Phys. 102a-102b; M.C.B. 104; 462a-
462b, 463, 496a (2 units); and 6 upper-division units in biology, chemistry, mathematics, or physics, exclusive of individual studies. Those applying for medical school should take Ecol. 320 in preparation for the Medical College Admission Test (MCAT).

The minor for both undergraduate degrees consists of 20 units of lower-division courses in chemistry and mathematics.

**Honors:** The department participates in the Honors Program.

181. **Life: The Science of Biology I** (4) I (Identical with M.C.B. 181)

182. **Life: The Science of Biology II** (4) II (Identical with Ecol. 182)


462a-462b. **Biochemistry** (4-3) GC I Introduction to the properties and metabolism of proteins, nucleic acids, enzymes, carbohydrates and lipids. Designed primarily for majors and minors in chemistry, biochemistry and biology. P, Chem. 241b, CR 325. (Identical with Chem. 462a-462b and Tox. 462a-462b)

463. **Biochemistry Laboratory** (2) GC II Introduction to experimentation with biochemical systems, processes and compounds of biochemical importance. 1R, 5L. P, 460 or 462a, or CR 462b.

473. **Recombinant DNA Techniques** (3) GC II (Identical with M.C.B. 473)

496. **Proseminar**
   a. Biochemistry (1) [Rpt. /1] I II Open to majors only. P, 462a or CR. Consult department before enrolling. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

501. **Medical Biochemistry** (5) I Comprehensive treatment of general biochemistry, oriented towards human biology, with emphasis on basic concepts; protein and nucleic acid chemistry and metabolism, enzymology, metabolism of lipids and carbohydrates, metabolic regulation and closely related topics. P, Chem. 103b, 104b, 241b, 245b; Phys. 102b.

504. **Intermediate Medical Biochemistry** (5) I An intermediate treatment of several areas of general biochemistry including metabolism and nutrition, genetics and membranes. Designed to build on the student's prior knowledge of biochemistry. Consult dept. before enrolling. P, 462a-462b.

555. **Molecular Mechanisms of Development** (3) II 1988-89 (Identical with M.C.B. 555)

561a-561b. **Introduction to Biochemical Literature** (1-1) II (1988-89) Discussion of the biochemical literature aimed at helping the student evaluate and report the published literature. Primarily for first year graduate students planning a career in biochemistry and desiring to prepare themselves for continued study. P, CR 462a-462b. 561a is not prerequisite to 561b. (Identical with Chem. 561a-561b)


570. **Molecular Biology of the Cell Membrane** (3) I 1988-89 Cell membrane functions including biosynthesis, structures of membrane components; importance of cell communication, differentiation, adhesion, immune response, and cancer. Discussions on the use of monoclonal antibodies, recombinant DNA technology, and DNA transfections in studies on the biology of the cell membrane. (Identical with Chem. 570 and M.C.B. 570)

572. **Metabolic and Hormonal Control of Cell Function** (3) II 1988-89 Advanced treatment of the biochemical aspects of metabolic regulation and hormone action. P, 462a-462b and 575 or consult department before enrolling. (Identical with Chem. 572)

575. **Biochemical Techniques** (3) I Survey of current techniques used in biochemical research including methods used to study proteins, nucleic acids, membranes, and metabolism. P, 462a-462b. (Identical with Chem. 575)

576. **Biophysical Techniques** (3) I Survey of current physical techniques used in biochemical research including solution properties of macromolecules, optical spectroscopy, magnetic resonance and x-ray and electron diffraction. P, 462a-462b and Chem. 480a-480b. (Identical with Chem. 576)

595. **Colloquium**
   b. Topics in Electron Microscopy (2) [Rpt./2] 1987-88 II (Identical with M.C.B. 595b, which is home)

665. **Chemistry of Food Proteins** (3) II 1987-88 (Identical with N.F.S. 665)
DEPARTMENTS AND COURSES OF INSTRUCTION

681. Introduction to Biochemical Research (1 to 2) I II Supervised research experiences in the labs. of individual faculty members. 3 or 6L. Open only to first-year majors. P, CR 561a-561b.

696. Seminar
   a. Biochemistry I (1 to 3) I
   b. Biochemistry II (1 to 3) II

800. Research (1 to 16) Yr.

801. Medical Biochemistry (5)

804. Intermediate Medical Biochemistry (5) I

891. Preceptorship
   a. Biochemistry (3 to 12) [Rpt./12 units]

BIOLOGY

Three departments (Ecology and Evolutionary Biology, Microbiology and Immunology, and Molecular and Cellular Biology) teach and do research in biology. They share a common core of courses. Details of their programs may be found under their respective listings.

BIOMEDICAL ENGINEERING

Committee on Biomedical Engineering

Biomedical engineering can be defined as a multidiscipline in which physical scientists and engineers interact with life scientists and physicians to solve problems ranging from basic biomedical engineering research to applications in clinics and health care delivery systems. The University Committee on Biomedical Engineering coordinates options available to students in the College of Engineering and Mines.

Upper-division undergraduate students may select biomedical engineering courses and projects as technical electives. Graduate students working toward the Master of Science or Doctor of Philosophy in an engineering department may select courses and research topics in biomedical engineering as part of their minor programs. No biomedical engineering degrees are offered.

Courses available in biomedical engineering are offered through engineering departments and include A.M.E. 485, A.M.E. 585; E.C.E. 411, 415, 417, 515; Ch.E. 485, 586; Psio. 418, 419 and S.I.E. 581. Additional courses in biomedical engineering are being developed, and supporting coursework in the life sciences is also available. Collaborative research projects permit the student to participate in interdisciplinary associations which can enhance progress in the fields of biology, medicine, and engineering. Individual programs are determined by the student and an engineering departmental advisor.

For additional information contact Dr. J. F. Gross (Chemical Engineering), Chairperson, Committee on Biomedical Engineering, or Dr. K. C. Mylrea (Electrical and Computer Engineering) Director, Clinical Engineering.

BLACK STUDIES

Committee on Black Studies

Professors James W. Clarke (Political Science), Vine De Loria (Political Science)
Associate Professors Edwin M. Gaines (History), Celestino Fernandez (Sociology)
Research Social Scientist Myra Dinnerstein (Women’s Studies)
Acting Director Glenn Smith (Office of Student Affairs)
The minor in Black Studies consists of at least 20 units selected by the student in consultation with the adviser of the Black Studies Program. This minor is designed to provide all students with basic information about Black Heritage around the world. Students will have an opportunity to examine topics, materials and research methods to expand their knowledge of African and Black American history and culture.

160. Minority Relations and Urban Society (3) I II (Identical with Soc. 160)
220. Introduction to Black Studies (3) I Introductory survey of the literature, history, culture and social issues affecting Black Americans.
222. Black Studies: A History of Ideas (3) [Rpt./2] II Enduring problems in the black experience through an examination of some of the political and social ideas in the history of black thought.
230. The History of Black America (3) I (Identical with Hist. 230)
330. Minority Groups and American Politics (3) I II (Identical with Pol. 330)
347. The Old South (3) (Identical with Hist. 347)
348. The South Since the Civil War (3) (Identical with Hist. 348)
396H. Honors Proseminar (3) I II
429. Cultures and Societies of Africa (3) GC II (Identical with Anth. 429)
435. The Coming of the Civil War, U.S. 1845-1861 (3) GC I (Identical with Hist. 435)
436. Civil War and Reconstruction, U.S. 1861-1878 (3) GC II (Identical with Hist. 436)
450a-450b. French Literature of Black Africa and the West Indies (3-3) GC 1987-88 (Identical with Fren. 450a-450b)
452. American Ethnic History (3) GC II (Identical with Hist. 452)
461. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)
468. Government and Politics of Africa (3) I II (Identical with Pol. 468)
483. Urban Economics (3) GC II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Econ. 483)
487. Race and Public Policy (3) GC I (Identical with Pol. 487)
495. Colloquium
 b. Studies in Black America (3) GC I II (Identical with Hist. 495b, which is home)

BUSINESS ADMINISTRATION

Committee on Business Administration

Professors William B. Barrett (Vice Dean), Chairperson, Gerald O. Bierwag (Finance and Real Estate), Dipankar Chakravarti (Marketing), William L. Felix, Jr. (Accounting), Roy E. Marsten (Management Information Systems), Jay F. Nunamaker, Jr. (Management Information Systems)
Associate Professors John Z. Drabicki (Economics), Gregory B. Northcraft (Management and Policy)

The graduate program in business administration is designed to meet the demand for professors, consultants, and management personnel trained in the application of scientific research to business problems. Both the Master of Business Administration and the Doctor of Philosophy degrees are offered. For admission and degree requirements, please see the Graduate Catalog.

CHEMICAL ENGINEERING

Professors Gary K. Patterson, Head, Milan Bier, Joseph F. Gross, Richard M. Edwards (Emeritus), Alan D. Randolph, Thomas R. Rehm, Jost O. L. Wendt, Donald H. White
DEPARTMENTS AND COURSES OF INSTRUCTION

Associate Professors William P. Cosart, Thomas W. Peterson, Farhang Shadman
Assistant Professors Heriberto Cabezas, Simon P. Hanson, Arne J. Pearlstein

Chemical engineering is concerned with utilization and application of scientific theory and principles to develop economically sound manufacturing processes in which chemical and/or physical changes take place. The curriculum prepares the student for employment in the research, development, design and operations aspects of the chemical, petroleum, metals, plastics, food, energy and related industries.

The department offers the following degrees: Bachelor of Science in Chemical Engineering, Master of Science and Doctor of Philosophy with a major in chemical engineering.

The major requires 137 units of science, engineering and humanities—social science courses as shown in the College of Engineering and Mines section of this catalog. No minor is required but opportunity for specialization is offered through a number of technical electives options.

102. Chemical Engineering Techniques (3) II The philosophy of process synthesis and analysis as applied to chemical engineering with an introduction to material balances. P, Math. 125a.

201. Elements of Chemical Engineering (3) I Chemical engineering calculations and principles of energy and material behavior. P, 102, Chem. 103a-103b, 104a-104b, Math. 125a, S.I.E. 170.


204. Chemical Engineering Mass Transfer (3) I Theory and practice in the unit operations of distillation, gas absorption, extraction, drying, and filtration. P, 201, 203.


304. Chemical Engineering Operations Laboratory (3) II Lab. investigation of process equipment. A field trip is made in mid-January of the junior year. Students will deposit travel expenses, not more than $150, with the University before trip. P, 201, 203, 204.


306. Chemical and Physical Equilibrium (3) II Applications of thermodynamics to equilibrium processes; chemical and physical equilibrium in multicomponent systems. P, 206, Chem. 480a.


322. Chemical Engineering Industrial Methods (2) II Practical aspects of design and manufacturing methods in the chemical process industry; management of personnel problems. P, 304.

341. Senior Project (1 to 3) I II Preparation of an engineering report based on independent application of chemical engineering principles to a literature or experimental project.

402. Intermediate Engineering Analysis (3) GC I Solution of complex chemical engineering problems utilizing both analytical and numerical techniques. P, Math. 254, Ch.E. 202, CR 204.

413. Process Control and Simulation (3) GC I Theory of automatic control as applied to elementary chemical engineering processes. Use of continuous system simulation languages for study of practical control problems in the process industries. P, CR 402.

418. Physiology for Engineers (4) GC I (Identical with Psio. 418)

419. Physiology Laboratory (2) GC I (Identical with Psio. 419)

421. Topics in Real-Time Computing (3) GC I Introduction to microcomputer- and minicomputer-based real-time computing for data acquisition and process control. Includes study of various languages and operating systems. 2R, 3L.


435. Corrosion (3) GC II (Identical with M.S.E. 435)

442. Chemical Engineering Design Principles (3) GC I Preliminary economic and design principles associated with chemical process equipment. P, 201, 203, 204, 304, 305; CR 430.
443. Chemical Engineering Plant Design (3) GC II Design project from scoping and process selection, through material and energy balances, equipment design and sizing, to economic analysis of capital cost and operating expense. P, 442.


461. Chemical Process Simulation (2) GC II Use of existing large, modular computer programs for computer-aided process design and analysis; program structure, convergence accelerators and control blocks. P, 442.

465. Current Problems in Energy and Power (1 to 4) [Rpt/1] GC II (Identical with N.E.E. 465)


532. Solid-Fluid Reactions (3) I Characterization of solid structural properties; principles of heterogeneous reactions involving a fluid and a reacting solid. P, 306 and 430, or M.S.E. 450R and 412. (Identical with M.S.E. 532)

545. Combustion Generated Air Pollution (3) II (Identical with A.M.E. 545)


567. Advanced Solar Engineering (3) II (Identical with N.E.E. 567)

569. Energy Use: Analysis and Management (3) I (Identical with N.E.E. 569)


696. Seminar
   a. Chemical Engineering (1) [Rpt/6] I II
   b. Combustion (1) [Rpt/6] I II
   c. Kinetics (1) [Rpt/6] I II
   d. Pollution Control (1) [Rpt/6] I II
   e. Crystallization (1 to 3) [Rpt/6] I II
   f. Extrusion (1) [Rpt/6] I II
   g. Biomedical (1) [Rpt/6] I II
   h. New Developments (1) [Rpt/6] I II
CHEMISTRY


Associate Professors Neal R. Armstrong, Michael F. Burke, Dennis L. Lichtenberger, John V. Rund, G. Krishna Vemulapalli

Assistant Professors Peter F. Bernath, Eugene A. Mash, Jr., Jeanne E. Pemberton, Mark A. Smith, David E. Wigley

Lecturer Walter B. Miller, III

The Department of Chemistry provides both general and professional training, giving a strong foundation upon which to base a career in the fields of medicine and related health sciences, in secondary education, or leading to industrial work or graduate specialization in chemistry.

The degrees of Bachelor of Science and Bachelor of Arts with a major in chemistry, and Bachelor of Science in Education and Bachelor of Arts in Education with a teaching major or minor in chemistry are offered. A Master of Arts, Master of Science and Doctor of Philosophy with a major in chemistry are also available, as is a Master of Education with a teaching major in chemistry.

The major for the B.A.: 103a-103b and 104a-104b, or 105a-105b; 241a-241b, 243a-243b or 245a-245b, 325, 326, 400a, 424, 480a-480b. Not less than 15 units must be upper-division course work. Math. 125b; Phys. 102b or 103b and 180b, or 121; and S.I.E. 170 or 272 are prerequisite to courses in the major.

The major for the B.S.: 103a-103b and 104a-104b, or 105a-105b; 241a-241b, 245a-245b, 325, 326, 400a-400b, 424, 480a-480b, and 6 additional units in chemistry, including one 3-unit lab. course. Not less than 23 units must be in upper-division course work. It is highly recommended that the foreign language requirement be fulfilled in German or Russian, and all students are encouraged to participate in undergraduate research (499). Math. 223; Phys. 103b and 180b, or 121; and S.I.E. 170 or 272 are prerequisite to courses in the major. Twenty units in the first two fields meet the requirements for a split minor. Other minors may be chosen with the consent of the major professor.

The teaching major includes 103a-103b and 104a-104b, or 105a-105b; 241a-241b, 243a-243b or 245a-245b, 325, 326, 400a, 424, 480a-480b.

The teaching minor includes 103a-103b and 104a-104b, or 105a-105b; 241a-241b, 243a-243b or 245a-245b, 325 or 322, 326 or 323.

Honors: The department participates in the Honors Program.

101a*-101b.** Lectures in General Chemistry (3-3) 101a: An introduction to general and organic chemistry with special topics related to many different major fields of study. 101b: A brief introduction to organic chemistry and a concentration on physiological chemistry. Intermediary metabolism is accompanied by a case study approach involving metabolic dysfunction. Both courses are for students in prenursing and allied health field programs as well as non-science majors. Neither course is a prerequisite for higher level chemistry courses. P, algebra recommended, CR 102 encouraged.

102a*-102b.** General Chemistry Laboratory (1-1) I II The basic functions of a chemical laboratory, including how to safely perform chemical experiments, interpret the results, and an introduction to some basic chemical techniques, instruments, and calculations. 102a focuses on general chemistry while 102b emphasizes organic and biochemistry. P, CR 101a-101b. Both 102a and 102b are offered each semester.

103a-103b.* Fundamentals of Chemistry (3-3) Essential concepts and problem-solving techniques, with emphasis on chemical bonding, structure and properties, stoichiometry, kinetics, equilibria, and descriptive organic and inorganic topics. 103a: P, completion of Math. 117e or an equivalent level of proficiency as demonstrated by the student's score on the Math Readiness Test; CR 104a. Both 103a and 103b are offered each semester. For Honors listing, see 105a-105b.
104a-104b.* Fundamental Techniques of Chemistry (1-1) Basic techniques in college chemistry, with emphasis on experimental methods, techniques of measurement, separation, purification, and analysis of organic and inorganic substances. P, CR 103a-103b. Both 104a and 104b are offered each semester. For Honors listing, see 105a-105b.

105a-105b.* Honors Fundamentals of Chemistry (4 to 5-3† to 5) Fundamental concepts of chemistry, with emphasis on theoretical and physical principles; atomic and molecular structure and theory, properties of gases, liquids and solids, thermodynamics and equilibria, kinetics, descriptive inorganic chemistry. Lab. stresses individual studies and library research. Extra unit credit available for students pursuing optional original lab. research problem. 4R, 3 or 6L. Open to students who have had high school chemistry and physics and received acceptable scores on the ACT tests.

†Without lab.

112.* Foundations of Science: Chemistry (3) II Chemical principles developed through examples important in daily life. Topics range from atmospheric pollution to human metabolism, with emphasis on demonstrations and laboratory experiences. Designed for non-sciences majors. 2R, 3L.

*Credit is allowed for only one of the following lecture-lab. combinations: (1) 101a, 102a, (2) 103a-103b, 104a-104b, (3) 105a-105b, or (4) 112.

241a-241b.** Lectures in Organic Chemistry (3-3) General principles of organic chemistry. P, 103b and 104b, or 105b. Both 241a and 241b are offered each semester.

242a-242b.** Honors Lectures in Organic Chemistry (3-3) I II General principles of organic chemistry. P, 103b and 104b, or 105b.

243a-243b.** Organic Chemistry Laboratory (1-1) Preparation, reactions, and analysis of organic compounds and an introduction to the lab. techniques of organic chemistry. 3L. Not open to B.S. chem. majors except with permission of dept. P, CR 241a-241b or 242a-242b. Both 243a and 243b are offered each semester.

245a-245b.** Organic Chemistry Laboratory (1-1) Similar to 243a-243b. Designed for chem. majors and chemical engineers. 5L. P, CR 241a-241b or 242a-242b.

302. Scientific Glassblowing (1 to 2) I II Methods of design and construction of scientific glass apparatus. 6L.

322.** Principles of Analysis I (2) I II Principles of modern quantitative analysis. Open to nonmajors only. P, 103b and 104b, or 105b; CR 323.

323.** Principles of Analysis I Laboratory (1) I II Experiments in modern quantitative analysis. Open to nonmajors only. 3L. P, CR 322 or 325.

324. Principles of Analysis II (2) I GRD Survey of modern instrumental methods of analysis: spectrochemistry, gas chromatography, electroanalytical and thermal methods of analysis, radiochemistry. Open to nonmajors only. P, 322 or 325.

325.** Analytical Chemistry (2) I I GRD Principles of modern quantitative analysis, including consideration of stoichiometry, equilibrium principles, treatment of experimental data, titrimetric and photometric analysis, and analytical separation processes. P, 103b and 104b, or 105b; CR 323 or 326.

326.** Analytical Chemistry Laboratory (2) I II Experiments in modern quantitative analysis. Designed for chemistry majors. 6L. P, CR 325.

396. Proseminar a. Reports on Current Research (1) II

396H. Honors Proseminar (3) II

400a-400b. Chemical Measurements Laboratory (2-2) GC I Lab. work in modern chemical measurements and instrumentation. 1R, 6L. 400a: P, 424 or CR; for majors, S.I.E. 170 or 272. 400b: P, 480b. Writing-Emphasis Course (400a). P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

410. Inorganic Chemistry (3) GC I Fundamentals of inorganic chemistry. P, 480a or CR.

412. Inorganic Preparation (3) II Standard inorganic lab. preparations, including coordination compounds, isomeric compounds, and compounds typifying the groups of the periodic table. 9L. P, two semesters of lab. chem. beyond the first yr.

424.** Instrumental Analysis (3) GC II Principles of modern instrumental methods of analysis treating basic instrumentation and data acquisition, spectrochemical methods, mass spectrometry, gas chromatography, and electroanalytical and thermal methods. P, 241b, 242b, 325 or 322, Phys. 102b or 103b, 180b.

440. Qualitative Organic Analysis (3) GC II 1987-88 The systematic classification and identification of organic compounds. 1R, 6L. P, 241b, 242b, 243b or 245b, 325 or 322.
206 DEPARTMENTS AND COURSES OF INSTRUCTION

446. Organic Preparations (3) GC I 1988-89 Special experimental methods for the synthesis of organic compounds. 1R, 6L, P, 241b, 242b, 243b or 245b.

460.** General Biochemistry (5) GC I (Identical with Bioc. 460)

462a-462b.** Biochemistry (4-3) GC (Identical with Bioc. 462a-462b)

**Credit is allowed for one course only in each of the following groups: 101b, 241a-241b or 242a-242b; 102b, 243a-243b, 245a-245b; 325, 322; 424; 326, 323; 460, 462a-462b.

480a-480b. Physical Chemistry (3-3) GC Fundamental principles of physical chemistry. P, 103b and 104b, or 105b; Math. 125b; Phys. 102b or 103b or 116 or CR.

481. Biophysical Chemistry (3) GC II Topics in physical chemistry pertinent to the biological sciences, including chemical dynamics, transport processes, thermodynamics, bonding, and spectroscopy. P, 480a.


503. Intermediate Physical Chemistry (3) I General survey of physical chemistry, including thermodynamics, structure, kinetics and electrochemistry. P, 480b.

504. Intermediate Inorganic Chemistry (3) I Principles of modern inorganic chemistry, including synthesis, structure, physical properties, and reactivity of inorganic compounds and materials.

510a-510b. Advanced Inorganic Chemistry (3-3) II I Survey at the advanced level of the chemistry of the elements. P, 410.

512. Advanced Inorganic Preparations (2 to 4) II Modern inorganic syntheses, including instruction in the use of high pressure, temperature, and vacuum techniques and in the manipulation of unstable compounds. 6 to 12L.

517. Structural Chemistry (3) II 1988-89 Introduction to the determination of structures of complex molecules by X-ray crystallography; the evaluation of structural information; current topics in structural chemistry. 2R, 3L.


521. Advanced Instrumental Analysis (3) I Topics in spectrophotometry, emission spectrometry, chromatography, electroanalysis, principles of instrumentation and data acquisition at an advanced level. P, 424, 480b.

522. Electroanalytical Methods (3) II 1988-89 Principles of electrochemistry and electroanalysis, including topics on electrochemical equilibrium and kinetics, potentiometry, voltammetry, amperometry, coulometry, chronopotentiometry, and modern cyclic and pulse methods. P, 480b.


524. Chemical Instrumentation (4) I Data acquisition and experiment control by analysis and digital techniques; design of chemical instrumentation. 3R, 3L, P, 424.

525. Chemistry of Metal Chelates (3) I 1987-88 Theory underlying the application of chelating reagents in chemical analysis. P, 523.


528. Advanced Instrumental Laboratory (2) I Laboratory experiments in spectrophotometry, emission spectrometry, chromatography and electroanalysis. 6L, P, CR, 521.

530. Radiochemistry and Radiation Detection (3) I (Identical with N.E.E. 530)

540. Organic Syntheses (3) I Organic reactions and the methods by which they are applied to synthetic problems in organic chemistry. P, 241b, 480b.


561a-561b. Introduction to Biochemical Literature (1-1) (Identical with Bioc. 561a-561b)

565. Enzymes (3) II 1988-89 (Identical with Bioc. 565)
570. Molecular Biology of the Cell Membrane (3) I 1988-89 (Identical with Bioc. 570)
572. Metabolic and Hormonal Control of Cell Function (3) II 1988-89 (Identical with Bioc. 572)
575. Biochemical Techniques (3) I (Identical with Bioc. 575)
576. Biophysical Techniques (3) I (Identical with Bioc. 576)
580. Introduction to Quantum Chemistry (3) I An introduction to quantum mechanics, with applications to atomic structure and spectra, the nature of chemical bonding and molecular structure. P, 480b.
581. Chemical Thermodynamics (3) II Advanced concepts in both classical and modern thermodynamics, with particular emphasis on thermodynamics in solution. P, 480b.
582. Statistical Thermodynamics (3) I Introduction to classical and quantum statistical thermodynamics with application to ideal gases and simple solids; equations of state and elementary solution theory. P, 480b.
587. Introduction to Molecular Spectroscopy (3) II Modern molecular spectroscopy including rotational, vibrational, and electronic spectroscopy and their various combinations. P, 480a-480b or consult department before enrolling.
614. Organometallic Compounds (3) II 1988-89 Compounds containing carbon-to-metal bonds, with emphasis on those of the transition elements, and the determination of their structures. P, 410.
615. Coordination Chemistry (3) I 1987-88 Selected topics in the area of coordination compounds of transition metals, with particular emphasis on ligand field theory, the symmetry aspects of the spectral properties of transition metal complexes and their magnetic behavior. P, 510b or CR.
618. Computations in Chemistry (3) [Rpt./1] II 1988-89 State-of-the-art computational methods in chemical research, including approximate and ab initio electronic structure methods, molecular mechanics, and modeling graphics. 2R, 3L. P, consult department before enrolling.
644. Heterocyclic Compounds (3) I 1987-88 The behavior of the more important heterocyclic systems. P, 540.
680. Quantum Chemistry (3) II Principles of quantum mechanics with applications to the properties of molecules. P, 580.
691. Preceptorship
   a. College Teaching (1) I II S
   b. Chemistry Course Development (1) I II S
   c. Professional Service (1) I II S
   Note: A combination of 691 a, b, or c may be taken up to a total of 6 units.
695. Colloquium
   a. Chemical Research Opportunities (1)
   b. Exchange of Chemical Information (1 to 3) [Rpt./7 units] I II S
DEPARTMENTS AND COURSES OF INSTRUCTION

696. Seminar
   a. Analytical Chemistry (1 to 3) [Rpt./8 units] II
   b. Inorganic Chemistry (1 to 3) [Rpt./8 units] II
   c. Organic Chemistry (1 to 3) [Rpt./8 units] II
   d. Physical Chemistry and Chemical Physics (1 to 3) [Rpt./8 units] II

697. Workshop
   a. NMR Methods (1 to 3) I II
   b. Electron Spectroscopy and Surface Analysis (1 to 3) I II
   c. X-Ray Crystallography (1 to 3) I II
   d. Computational Methods (1 to 3) I II
   e. Chemical Instrument Fabrication (1 to 3) I II
   f. Chemical Glasswork (1 to 3) I II
   g. New Methods in Chemistry (1 to 3) [Rpt./9 units]

CHILD DEVELOPMENT AND FAMILY RELATIONS
(See Family and Consumer Resources)

CHINESE
(See Oriental Studies)

CINEMA STUDIES
(See Media Arts)

CIVIL ENGINEERING AND ENGINEERING MECHANICS

Professors Carl J. Buckman (Emeritus), Dinshaw N. Contractor, Donald A. DaDeppo, Chandrakant S. Desai, David J. Hall (Emeritus), Simon Ince, Rudolf A. Jimenez, James D. Krieh (Emeritus), Emmett M. Laursen (Emeritus), Allan J. Malvick, Haaren A. Miklofsky (Emeritus), Richmond C. Neff (Emeritus), Philip B. Newlin (Emeritus), Robert A. Phillips, Ralph M. Richard, Raymond A. Sierka, Terry Triffet
Associate Professors Gary L. Amy, Donald B. Hawes (Emeritus), Edward A. Nowatzki, Robert H. Wortman
Assistant Professors Robert G. Arnold, Curtis W. Bryant, Jay S. DeNatale, Mohammad R. Ehsani, Tribikram Kundu, Bruce E. Logan, James M. Witkowski

The department offers the Bachelor of Science in Civil Engineering, and the Master of Science and Doctor of Philosophy degrees with majors in civil engineering and engineering mechanics. (See the College of Engineering and Mines section of this catalog for specific undergraduate program requirements.)

Additional information relating to each of these programs may be obtained by contacting the department head.

Civil Engineering

In addition to the courses listed below, the faculty of the Department of Civil Engineering and Engineering Mechanics is prepared to offer temporary courses in the following areas, subject to faculty availability and student interest: public works planning and engineering, construction engineering, hydraulic engineering, sanitary and environmental engineering, structural engineering, soils engineering, transportation engineering, surveying and mapping, and urban planning and engineering.

Credit for these courses is offered in both civil engineering and engineering mechanics.
110. **Engineering Graphics** (3) I II S GRD Representations and analysis of systems of orthographic projection and graphical methods used in engineering design and production, correlated with technical sketching. 1R, 6L.

151. **Elementary Surveying** (3) I II GRD Theory of measurements and errors; vertical and horizontal control methods; topographic, public land and construction surveys; use of surveying instruments. 2R, 3L. P, 110, Math. 118.

214. **Statics** (3) I II S GRD Equivalent force systems; equilibrium; geometric properties of areas and solids; friction; virtual work; potential energy. P, Phys. 103a, Math. 125b.

217. **Mechanics of Materials** (3) I II S GRD Material behavior; relationship between external forces acting on elastic and inelastic bodies and the resulting behavior; stress and deformation of bars, beams, shafts, pressure vessels; stress and strain; combined stresses; columns. P, 214.

300. **Civil Engineering Projects** (3) I II Individual design study in fields of the student's major emphasis or completion of a research and a development project under direct staff supervision.


307. **Contracts, Specifications and Engineering Relations** (2) I II S Law as applied to engineering contracts and contract documents, including specifications. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

320. **Fluid Mechanics Laboratory** (1) I II S Open-channel and closed conduit studies of basic flow phenomena, with emphasis on continuity, conservation of momentum, and exchange of energy; measurement and analysis of turbulence; calibration of flow-measuring devices. One 3-hr. lab. weekly. P, 214; CR 321; A.M.E. 232.


330. **Structural Engineering I** (3) I II S Analysis of statically determinate structures, including beams, frames and trusses; influence lines, virtual work moment area and conjugate beam; Betti's theorem and Castigliano's theorem. P, 217.

331. **Structural Engineering II** (3) I II S Analysis of statically indeterminate beams, frames, and trusses; use of computer programs. P, 302, 330.

336. **Structural Design in Steel** (3) I II S Design of steel members, connections and simple structures, including tension members, laterally supported and unsupported beams, columns, beam-columns, bolted and welded connections; introduction to load and resistance factor design. P, 330, CR 331.


340. **Soil Engineering** (4) I II S Physical and mechanical properties of soils, shear strength, consolidation, settlement, lateral earth pressures, and bearing capacity. 3R, 3L. P, 217, Chem. 103b.

360. **Transportation Engineering** (3) I II S Basis for planning, design, and operation of transport facilities; transport modes discussed include mass transit, passenger cars, bicycles, and pedestrian movement. P, 151, 214, S.I.E. 265.


371. **Water and Wastewater Treatment Process** (3) I II S Analysis of processes controlling water quality in natural water systems and design of water and wastewater treatment systems. P, 370.

380. **Materials Laboratory** (2) I II S Mechanical properties of concrete, concrete aggregates, steel, and other metals as engineering materials. 1R, 3L. P, 217, Chem. 103b.

394. **Practicum**

   a. Junior Field Trip (1) II Students are urged to take this trip in the jr. yr. Fee, not to exceed $40, determined and collected when trip is arranged.

407. Drainage of Irrigated Lands (3) GC II (Identical with A.En. 407)

423. Hydrology (3) GC I II Elementary treatment of major topics in hydrology, including rainfall, evaporation, groundwater, and runoff. Field trips. P, 321. (Identical with Hydr. 423)

424. Hydraulic Engineering Design (3) GC II Hydraulic criteria for design of bridges, stilling basins, gates, open-channel distribution and collection systems; sediment-transport effects; pipe networks and pumping systems. P, 322.

432a-432b. Advanced Structural Engineering Design (3-3) GC Advanced problems in the analysis and design of concrete, steel, and wood structures; yield line and plastic design methods, lateral and vertical load analysis of bridges and multi-story buildings; introduction to seismic design; use of structural computer programs. 432a: P, 336. 432b: P, 337.

440. Foundation Engineering (3) GC II Site and subsurface investigations, design of footings and pile foundations; design of foundations on collapsing and swelling soils; computer methods. P, 340.

441. Stability Problems in Geotechnical Engineering (3) GC I Stability analysis for earth slopes, including planar, circular piecewise-linear, and composite-surface methods: analyses for static and steady-flow conditions; earth pressure theories and calculations for generalized conditions; design of rigid and flexible retaining structures; design of braced and tie-back shoring systems; design of reinforced earth walls; computer-aided analysis and design. P, 340.

452. Engineering Surveys (3) GC I CDT Solar and Polaris observations; mineral, public, and private land surveys; route surveying, curves, and earthwork; triangulation, photogrammetry, and modern engineering surveys. 2R, 3L. P, 151.

454. Photogrammetry (3) GC II Reading, interpretations, and geometric characteristics of aerial photographs; stereoscopic principles and their application in the production of planimetric and topographic maps. 2R, 3L. Field trips. P, 151, Math. 125a.

455. Irrigation Engineering (3) GC II (Identical with A.En. 455)

456. Boundary Surveys and Legal Principles (3) GC II Boundary control; property descriptions; public land surveys; writing and interpretation of deeds; subdivision standards; legal aspects; rights, duties and liabilities of land surveyors. Field trip.


463. Traffic Engineering (3) GC I Methods for the efficient and safe operation of transport facilities through analysis of capacity, safety, speed, parking, and volume data. P, 360.

464. Airport Planning and Design (3) GC II Location, analysis and design of airports and airport facilities, including aircraft characteristics, site selection, configuration, capacity, access and terminals. Field trips. P, 360.

465. Civil Engineering Design (3) GC I II Methods and approaches to civil engineering planning and design problems including the consideration of social, environmental, physical, and organizational constraints; application of systems concepts and analytical methods in planning and design problems and projects.

468. Urban Transportation Planning (3) GC II CDT Transportation planning in relation to urban development; techniques and procedures for developing long-range regional plans. P, 360 or consult department before enrolling. (Identical with Png. 468)

471. Water Quality Control (3) GC II Aspects of water quality maintenance; physical, chemical and biological factors in water and wastewater treatment and natural purification. 2R, 3L. Degree credit available for nonmajors only. P, Chem. 103b. (Identical with Hydr. 471 and Ws.M. 471)


479. Environmental Air Pollution (3) GC I Air pollution sources and pollutant control, with special consideration of the meteorological, urban, rural, industrial, and health aspects.

481. Construction Methods (3) GC II Introduction to estimating; construction planning and methods; selected topics of fundamental importance in construction, including the Critical Path Method and PERT. 2R, 3L. P, 336 or 337, 380 or CR.

486. Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487. Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

503. Subsurface Fluid Dynamics (3) I (Identical with Hydr. 503)

504. Numerical Methods in Subsurface Hydrology (4) II (Identical with Hydr. 504)
River Engineering (3) II River geomorphology, stabilization and rectification of alluvial rivers, canalization, waterborne commerce, impacts of river engineering works. P, 322.

Hydropower Engineering (3) II Hydrologic analysis, evaluation of site potential, turbine selection, power plant civil works, project feasibility. P, 322, 423.

Water Quality Modeling (3) I Deterministic and stochastic modeling of surface water systems with particular emphasis on water quality management functions. Applications and modifications of Streeter-Phelps technique for predicting oxygen levels in streams. P, 321. (Identical with W.R.A. 525)

Water Quality Management (3) II (Identical with W.R.A. 526)


Advanced Strength of Materials (3) II Advanced problems in the analysis of deformable solids including curved beams, nonprismatic beams, torsion of thin-walled members, beam on elastic foundation, inelastic deformation.

Plastic Analysis and Design (3) II Material and member behavior to full plastification; redistribution of forces; plastic design of continuous beams and frames; influence of axial and shear forces; deflections and rotations; alternating plasticity; shakedown analysis. P, 432 or consult department before enrolling.

Computer-Aided Geometric Design (3) I (Identical with A.M.E. 536)

Prestressed Concrete Structures (3) II Behavior, analysis, and design of statically determinate and indeterminate prestressed concrete structures. P, 337.

Soil Stabilization (3) II Purpose of soil stabilization; stabilization using mechanical means, cement, asphalt, lime, salt and resins; factors governing stabilization techniques; special application. P, 340.

Seepage and Earth Dams (3) I Principles of flow in porous media; analytical and approximate solutions of confined and unconfined flow; seepage erosion piping and filter design; earth and rock fill dam construction and design; stability analyses. P, 340.

Numerical Methods in Geotechnical Engineering (3) I Brief statements and applications of numerical methods based on closed-form solutions, finite difference, finite element and boundary element methods for problems involving soil structure interaction such as piles, retaining walls, group piles, underground works; seepage; and consolidation. P, 340, 402.

Ground-Water Management (3) II (Identical with W.R.A. 560)

Structural Design of Flexible Pavements (3) I Analysis of loads, stresses, material characteristics, and environmental factor for the theoretical and practical design, construction and maintenance of pavements. P, 340, 361.

Structural Design of Rigid Pavements (3) II Analysis of loads, stresses, material characteristics, and environmental factors for the theoretical and practical design, construction and maintenance of these pavements. P, 340, 361.


Quick Response Transportation Planning Methods (3) I 1987-88 Quick response transportation tools for subarea, problem and policy analysis, and strategic planning in the urban setting. (Identical with Ping. 565)

Highway Geometric Design (3) II 1988-89 Study of geometric elements of streets and highways, with emphasis on analysis and design for safety. P, 463.

Traffic Operations and Safety (3) II 1987-88 Application of traffic control devices for street and highways, design of traffic control systems, analysis and management of highway traffic, evaluation of safety. P, 463.

Urban Public Transportation Systems (3) I 1988-89 Development, operation, management, financing, evaluation and travel demand estimation for urban public transportation systems. (Identical with Ping. 568)

Solid and Hazardous Waste Management (3) I Engineering, legal, planning, and management aspects of solid and hazardous wastes; overview of waste generation, collection, transport, processing, recovery, and disposal; emphasis on municipal wastes.

Microbiology of Environmental Engineering (3) I Microbiological concepts and their application to natural and engineered systems for upgrading water and wastewater quality. 2R, 4L P, 370.

Chemistry of Environmental Engineering (3) I Chemistry of natural waters and water and wastewater treatment processes. Chemical thermodynamics, equilibria and kinetics are applied to environmental systems. Lab. emphasizes analytical methods. 2R, 3L P, 370.
596. Seminar
   a. Sanitary and Environmental Engineering (1 to 3) II
   b. Geomechanics/Mechanics (1) [Rpt./2] II (Identical with E.M. 596b)


621. Sediment Transportation (2) I Erosion, transportation and deposition of sediments by flowing water; sediment properties and their measurement; bed load and suspended load movement; river behavior and control. P, 321.


623. Flow through Hydraulic Structures (3) II 1988-89 Subcritical and supercritical flow through culverts, bridges, spillways, stilling basins, transitions, bends; hydrologic effects on inflow; pumps and turbines. P, 322.

624. Planning and Design of Multipurpose Water Resources Projects (3) II Design of water resource systems for surface water supply, flood control, hydropower and navigation, either as single purpose or as multipurpose projects; brief review of environmental, economic and legal aspects. Field trips. P, 321, 423.

633. Reinforced Concrete Members (3) I Inelastic behavior of beams and columns; short-and long-term beam deflections; combined bending, shear, and torsion in beams; behavior under load reversals; analysis and design of beam to column connections and shear walls. P, 432b.

637. Soil-Structure Interaction (3) I 1987-88 Explanation of soil-structure interaction, closed form and numerical solutions, beams, axially and laterally loaded piles and walls, wave equation for piles, group piles, slabs on deformable media. P, 640 or 641 or consult department before enrolling.

640. Advanced Soil Mechanics (3) I Site investigation and in situ testing; shear strength of sands and clays; interpretation of laboratory test results; consolidation theory: one-dimensional infinitesimal and finite strain; slope stability. P, 340.


642. Engineering Characteristics of Soil (3) II Advanced theories of mechanical and physical aspects of soil. Lab testing including index parameters, compaction, consolidation, shear strength; introduction to critical state and plasticity aspects. 1R, 6L. P, 640.


648. Constitutive Laws for Engineering Materials (3) II 1987-88 Statement of axioms of continuum mechanics strain, stress and nonlinear behavior. Laboratory testing including hyperelasticity, hypoelasticity, rate type models, plasticity review, hardening, volume change and dilatancy, softening, inherent and induced anisotropy, laboratory testing and implementation. P, E.M. 505, 603, or consult department before enrolling. (Identical with E.M. 648)


671. Advanced Water and Wastewater Analysis (3) II Advanced chemical, physical and microbiological analyses as related to water and wastewater quality and advanced treatment process design. 1R, 6L. P, 371.

673. Advances in Water and Waste Reclamation and Reuse (3) II Theory, application, and evaluation of currently developing techniques in water and waste reclamation and reuse. P, 675.

675. Wastewater Treatment (3) I Administration, financing, design, construction, and operation of wastewater disposal systems. P, 371.

Engineering Mechanics

In addition to the courses listed below, the faculty of the Department of Civil Engineering and Engineering Mechanics is prepared to offer temporary courses in the following areas, subject to faculty availability and student interest: analytical mechanics, plates and shells, structural dynamics and earthquake engineering, experimental mechanics, and fluid mechanics. Credit for these courses is offered in both civil engineering and engineering mechanics.

402. Introduction to Finite Element Methods (3) GC I II (Identical with C.E. 402)

502. Advanced Finite Element Analysis (3) II Approximation functions, Lagrangian and Hermitian interpolation, isoparametric elements and numerical integration; mixed, hybrid and boundary element methods, nonlinear analysis, nonlinear problems in solids under static and dynamic loads, time integration schemes, fluid and heat flow coupled problems and mass transport. P, 402 or consult department before enrolling. (Identical with A.M.E. 502)

505. Continuum Mechanics (4) I 1987-88 Analysis of deformation, principal stresses and strains, velocity fields, and rate of deformation; constitutive and field equations; elementary elasticity.

539. Advanced Structural Mechanics (3) II (Identical with A.M.E. 539)

596. Seminar
   b. Geomechanics/Mechanics (1) [Rpt./2] II (Identical with C.E. 596, which is home.)

603. Elasticity Theory and Application (3) I General three-dimensional equations of elasticity; problems in plane stress, plane strain, extension, torsion; energy and residual (Galerkin) methods; applications to rings, beams, plates, torsion and other problems. P, C.E. 217, 302 or S.I.E. 270.

604. Plasticity Theory and Application (3) II Yield conditions and flow rules for perfectly plastic and strain hardening materials; application to various elastoplastic problems such as bars, cylinders and plates; effect of volume change behavior, isotropic and anisotropic hardening plasticity with expanding/contracting yield surfaces.


635. Matrix Methods in Structural Mechanics (3) I Formulation of the force and displacement methods; the finite element method, with application to bar, beam, plate, and shell structures; organization and development of computer programs; linear and nonlinear systems. P, C.E. 331 or A.M.E. 436.


CLASSICS

Professors David Soren, Head, Norman Austin, Albert Leonard, Jr., Garnet D. Percy (Emeritus)
Associate Professors Richard C. Jensen, Jon D. Solomon, Thomas D. Worthen
Assistant Professor Holt Parker
Lecturer Robert A. Burns

The cultural environment of Greece and Rome is the subject matter taught in the Classics Department. Courses are given in the language, literature (in the original and in translation), art and archaeology and in the development and heritage of these civilizations.

The department offers a degree of Bachelor of Arts with majors in Greek, Latin, and classics and a degree of Master of Arts with a major in classics with concentrations in ancient Greek, Latin, or classical archaeology. Programs leading to a Bachelor of Arts in Education and a Master of Education with a teaching major in Latin are also available. In addition, a number of the department’s courses may be used toward a supporting minor in other graduate programs. Requirements for the B.A. are as follows:

CLASSICS 213
The major in Greek: 34 units, including 102a-102b, 202a-202b, 250a-250b, and 9 units of 402.

The major in Latin: 34 units, including 101a-101b, 201a-201b, 250a-250b, and 9 units of 401.

The major in classics: 34 units, including 101a-101b or 102a-102b, 201a-201b or 202a-202b, 6 units in ancient history, and at least 12 upper-division credits in classics. The program of study should be planned in consultation with an adviser.

The supporting minor should be chosen in consultation with the major adviser.

The teaching minor: 25 units in Latin, including 101a-101b, 201a-201b, and 9 units of 401. For information on the graduate degrees, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.

101a-101b. Elementary Latin (4-4) The Latin language presented as far as possible from the point of view of its influence on English.

102a-102b. Elementary Classical Greek (4-4) Introduction to ancient Greek for students of the Bible and of the Hellenic authors.

103a-103b. Elementary Modern Greek (4-4) Development of skills in conversation, composition, and reading, with emphasis upon audiovisual practice.

115. The Study of English Words (3) I Vocabulary building through the systematic study of English words derived from Latin and Greek. Readings in translation.

120. Introduction to the Greek Bible (3) S Grammar, syntax and vocabulary of Koine Greek, textual criticism of the Bible, concentration on the New Testament. Open to nonmajors only.

126. Mythology (3) I II The myths, legends, and folktales of the Greeks and other peoples of antiquity. Readings in translation. (Identical with Reli. 126)

201a-201b. Intermediate Latin (4-4) Reading and discussion of selected passages from Virgil's Aeneid or other texts; grammar, some composition. P, 101b or two years of high school Latin.

202a-202b. Intermediate Greek (4-4) Selections from classical Greek chosen in accordance with the student's needs and interest. P, 102b.

203a-203b. Intermediate Modern Greek (4-4) Pronunciation, grammar, and vocabulary of modern Greek; development of skills in conversation, composition, and reading; emphasis on aural-oral skills. P, 103b.

204. Ancient History: Greek History (3) I (Identical with Hist. 204)

205. Ancient History: Roman History (3) II (Identical with Hist. 205)

250a-250b. Classical Literature in Translation (3-3) Historical survey of the major authors and works of ancient Greece and Rome. 250a: From Homer to the New Testament. 250b: Roman literature of the Republican period, and the Silver Age, to the end of the pagan period. 250a is not prerequisite to 250b.

260. Ancient Philosophy (3) I (Identical with Phil. 260)

310. Classical Art (3) (Identical with Art 310)

329. Art History of the Cinema (3) I Survey of major artistic movements, including academicism, expressionism, cubism, and surrealism, and their influence on film in Germany, Italy, America, and France. (Identical with Art 329, Dram. 329)

340a-340b. Introduction to Classical Art and Archaeology (3-3) 1987-88 An archaeological history of Greece and Italy through the study of major excavations and monuments, with emphasis on cultural developments and relationships. 340a is not prerequisite to 340b. (Identical with Anth. 340a-340b, Art 340a-340b.)

345. Ancient Cosmology (3) I Investigation of ancient Greek concepts of the universe, with emphasis on theories regarding nature, matter, and the soul. Readings in translation.

346. Classical Greek Tragedy (3) I Readings in ancient Greek tragedy in translation.

347. Love in Classical Literature (3) II Love as a theme in Greek and Roman literature of various genres: lyric, tragedy, comedy, philosophy, satire, and romance read in English translation.

348. Myth and Archetype (3) II An investigation of modern psychological theories and their relevance to ancient Greek and Roman myths. Readings in translation. P, 126 (Identical with Reli. 348)

370. Issues in Greek Philosophy (3) (Identical with Phil. 370)

396H. Honors Proseminar (3) I II

401. Latin Reading Course (3) [Rpt] GC I II Extensive readings in one of the following: epic, lyric, drama, history, oratory, satire, epistles, novel, philosophical, technical or medieval literature. P, 201b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
402. Greek Reading Course (3) [Rpt.] GC II Extensive readings in major Greek authors including Homer, Plato, and the historians and dramatists. P, 202b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

403a-403b. History of Greece (3-3) GC (Identical with Hist. 403a-403b)
404a-404b. History of Rome (3-3) GC (Identical with Hist. 404a-404b)

409. Greek Composition (3) GC II Analysis of Greek prose style and practice in composing Greek prose. P, 202b.


411. Roman Art and Architecture (3) GC (Identical with Art 411)

412. Topics in Greek Philosophy (3) [Rpt./1] GC Extensive readings in Greek in one of the following areas of Greek philosophy: the pre-Socratics, Plato’s ethics and epistemology, Aristotle’s Nicomachean Ethics.

413. Augustan Literature (3) GC II Survey of the major writers of the Augustan Age, the period from about 30 B.C. to 14 A.D., with the exception of the Elegiac poets. Readings in Latin. P, 201b.


443a-443b. The Archaeology of Neolithic and Bronze Age Greece (3-3) GC History, art and culture of prehistoric Greece through the study of archaeological excavations. 443a: Paleolithic through the end of the Middle Bronze Age. 443b: The Minoan and Mycenaean cultures of the Late Bronze Age. 443a is not prerequisite to 443b. P, 6 units in classics, history, or anthropology. (Identical with Anth. 443a-443b)

454. Greek and Roman Sculpture (3) GC A survey of the development of classical sculpture from the eight century B.C. to circa 300 A.D. P, 340a-340b.

456. Greek and Roman Painting (3) GC Greek vase painting from the Dipylon vases of the Geometric period in Athens to the Orientalizing animal styles of Corinth and the Black and Red figured attic style. Also, survey of ancient Roman painting and mosaics. P, 340a-340b

457. Greek Architecture (3) GC A survey of the architecture and architects of Greece from the Neolithic to Roman periods including such sites as Nea Nikomedia, Aegina, Lerna, Tyrins, Mycenae, Athens and Corinth. P, 340a-340b

463. Classical Field Archaeology (3) [Rpt./1] GC S Field training and lecture program for students beginning in archaeology; includes trench supervision, stratigraphy, locus theory, and oral and written reports on field techniques. Offered on several archaeological sites in the Mediterranean area. P, consult department before enrolling. (Identical with Anth. 463)

470. Greek Philosophy (3) GC [Rpt./1] (Identical with Phil. 470)

488. History of Byzantium (3) GC II (Identical with Hist. 488)

497. Workshop
b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)


511. Greek Lyric Poetry (3) Intensive study in Greek of the early Greek Lyric writers from Archilochus to Bacchylides, including Pindar. P, 202b.

512. Topics in Greek Drama (3) Close Reading in Greek of either (1) tragedy — one play each by Aeschylus, Sophocles and Euripides or (2) comedy — two plays of Aristophanes, one of Menander. P, 202b.

513. Roman Drama (3) Representative plays of Plautus, Terence and Seneca, read in Latin. P, 201b.

514. Homer (3) Close reading of selections from the Iliad and Odyssey in Greek and an introduction to the critical secondary literature. P, 202b.

515. Cicero (3) The life of Cicero illustrated by means of close reading of selected works in Latin (pro Caelio, selections from the Philippics, the Verine Orations) as well as selections from his letters. P, 201b.

553. Introduction to Graduate Study in Classical Archaeology (3) An historiographic survey of classical archaeology with discussion of Heinrich Schliemann, Luigi Palma de Cesnola, Charles Follin McKim and others. P, 340a or 340b.
DEPARTMENTS AND COURSES OF INSTRUCTION

554. Topics in Greek and Roman Architecture and Urbanism (3) Research papers on an aspect of ancient architecture which involves not only monuments themselves but attempts to consider a building in its physical and cultural setting. P, 340a or 340b.

555. Topics in Greek and Roman Archaeology (3) Research papers and oral presentations on different aspects of Greek and Roman archaeology; preparation in writing scholarly articles for refereed journals. P, 340a or 340b.

556. Greek and Roman Provincial Archaeology (3) Survey of classical archaeology in ancient Tunisia, Cyprus, Portugal and Turkey. P, 340a or 340b.

595. Colloquium
   f. Advanced Studies in Ancient History (3) [Rpt./5] II (Identical with Hist. 595f, which is home)

596. Seminar
   a. Ancient Greek Literature (3) Open to graduate majors only.
   b. Latin Literature (3) Open to graduate majors only.
   c. Aegean, Roman and Mediterranean Provincial Archaeology (3) Open to graduate majors only.

CLINICAL ENGINEERING
(See College of Engineering and Mines)

CLOTHING, TEXTILES AND INTERIOR DESIGN
(See Family and Consumer Resources)

COMMUNICATION

Professors Michael Burgoon, Head, Judee K. Burgoon, Henry L. Ewbank, Jr., Klonda Lynn (Emerita), Alethea S. Mattingly (Emerita), Frank L. Meyskens (Internal Medicine)
Associate Professors James W. Davis, Henry C. Kenski, Jr. (Political Science), Margaret Neale (Management and Policy), Robert W. Sankey, David A. Williams
Assistant Professor David B. Buller
Lecturer William E. Bailey

The Department of Communication offers courses to promote understanding of the functions of communication at all levels of society, from interpersonal communication to the social effects of mass media. Because communication is the most basic social behavior and the means by which the individual functions in society, the study of communication is relevant to all academic and career interests.

The degrees offered by the department are the Bachelor of Arts, the Master of Arts, including an interdisciplinary Master of Arts program (for example, in organizational communication), and the Doctor of Philosophy with a major in communication. Students should consult the Faculties of Humanities, Science, and Social and Behavioral Sciences sections of this catalog for the undergraduate program requirements for the Bachelor of Arts degree. For graduate admission and degree requirements, students should consult the Graduate Catalog.

The major requires 36 units in communication, 20 of which must be upper-division course work. All majors must meet the following course requirements: (1) 7 units from basic communication competency courses, including 100, and 6 additional units selected from 102, 103, 104, and 106; (2) 9 units in analysis courses: 200, 225, 280; (3) 20 units of upper-division courses, including 300 and at least one theory and one research course from the following lists: Theory: 309, 312, 318, 403, 409, 411, 412, 421, 423, 425, 445, 446, 462; Research: 415, 417, 428, 447, 496.

The teaching major requires the following 36 units: 100, 102, 103, 104, 106, 200, 225, 280, 300, 309, 312, 318, 417 and 493.

The teaching minor requires 24 units: 100, 102, 103, 104, 106, 200, 225, 280, 300 and 493.
The minor in communication for students interested in law, law-related or public policy professions is designed to improve communication skills and decision-making processes. It consists of 24 units of 100, 102, 103, 104, 106, 225, 318, 408, plus one course in the department at the 300 or 400 level.

Honors: The department participates in the Honors Program.

100. **Fundamentals of Communication** (1) I II S An introductory course designed to introduce beginning students to the scope of the discipline of communication. CR, 102, 103, 104, 105, or 106.

101a-101b. **Communication for Foreign Students** (3-3) Communication skills designed to meet the particular needs of foreign students. Initial placement is determined by testing. 101a is not prerequisite to 101b.

102. **Public Speaking** (2) I II S Beginning course in the practice of public speaking, with emphasis on organization, effective thinking, and delivery. P or CR, 100.

103. **Communication in Small Groups** (2) I II Introduction to small group communication with practice and exemplification of principles in small group discussion. P or CR, 100.

104. **Interpersonal Communication** (2) I II Study and application of basic communication concepts to the description and analysis of interpersonal communication transactions. P or CR, 100.

105. **Developing Physical and Vocal Skills** (2) I II Developing the speaking voice and cultivating its effectiveness; emphasis on voice quality, articulation, and intonational features as well as on nonverbal cues. P or CR, 100.

106. **Communication of Literature** (2) I II Introduction to the performance of literature, with emphasis on the sound and gesture and the emotional and intellectual meanings of the texts of prose, poetry, and drama. P or CR, 100.

111. **Critical Thinking in Communication** (3) I II S Argument identification and evaluation in a variety of communication contexts. Argument preparation and presentation in written and oral situations.

112. **Introduction to Organizational Communication** (3) I II Analysis of the structure and function of communication in complex organizations. Interpersonal, group, and public communication experiences are provided.

125a. **Communication Activities in Debate and Forensics** (1) [Rpt.] I II S Student participation in intercollegiate debate and forensics. Open only to members of the university forensics team. Approval of the instructor is required prior to admission to this offering. No more than 3 units of 125 credit (a or b taken in any combination) may count toward graduation.

125b. **Communication Activities in Interpreters' Theatre** (1) [Rpt.] I II S Student participation in Interpreters' Theatre. Open only to students cast in departmental shows. Approval of the instructor is required prior to admission to this offering. No more than 3 units of 125 credit (a or b) may count toward graduation.

200. **Fundamentals of Analysis of Communication Behavior** (3) I Study and application of principles of analysis to communication functions operating to structure social groups and social systems.

225. **Argumentation** (3) I II Study of the philosophy, theory and practice of argumentation; analysis and comparison of classical and contemporary models of advocacy and evidence; examination of argument in public policy, legal, and debate settings.

280. **The Nature of Inquiry in Communication** (3) I II Introduction to communication research methods to enable students to become more qualified consumers of communication literature.

300. **Introduction to Communication Theory** (3) I Origin and development of basic concepts in communication theory and research; survey and analysis of theories and models in research. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


312. **Small Group Decision Making** (3) I II A practical and theoretical study of decision making, conflict management, and communication interaction in task-oriented work groups.

318. **Persuasion** (3) I II Theories of audience analysis and the motivation of human conduct; the study of rhetorical devices.

396H. **Honors Proseminar** (3) I II

403. **Theories of Small Group Communication** (3) GC I II Theories of small group communication, their research backgrounds, and their relevance to communicative interaction in small groups.

408. **Parliamentary Procedure** (3) I II Theory, strategy, and practice of decision-making procedure in democratic organizations. (Identical with Pol. 408).
DEPARTMENTS AND COURSES OF INSTRUCTION

409. **Theories of Mass Communication** (3) GC II An in-depth analysis of theories of the social effects of various mass media sources on society.

411. **Bargaining, Negotiation, and Conflict Management** (3) GC I Consideration of advanced problems in group interaction, with emphasis on the analysis and solution of communication problems.

412. **Organizational Communication** (3) GC Analysis of interpersonal and group communication practices affecting goal achievement in business, governmental, and professional organizations.

415. **Nonverbal Communication** (3) GC I Theory and research on nonverbal communication codes (kinesics, touch, voice, appearance, use of space, time and artifacts) and social functions (impression formation and management, relational communication, emotional expressions, regulation of interaction, social influence).

417. **Relational Communication** (3) GC II The relational communication process and messages people use to define interpersonal relationships, including dominance-submissiveness, affection, involvement and similarity. P, 104.

421. **Political Communication** (3) GC I 1988-89 Investigation and analysis of communication principles and practices in contemporary campaigns for elective office.

422. **Topics in Rhetorical Theory** (3) [Rpt. /1] GC Intensive reading and analysis of the works of major rhetorical theorists. Each semester will focus on a specific era or perspective.


428. **Communication Research Methods** (3) GC II 1988-89 Theories of communication and their research backgrounds; research methodology in communication behavior studies.

445. **Communication of Poetry** (3) GC I Types of poetry analyzed, with emphasis on their differentiation for oral presentation; preparation for and presentations of a public recital. P, 106.

446. **Communication of Fiction** (3) GC II Analysis of short stories and selected short novels, with emphasis on point of view, tone, and characterization in preparation for performance. P, 106.

447. **Group Communication of Literature** (3) GC I 1988-89 Study in forms, styles, and aesthetics of Readers Theatre, Chamber Theatre, and the documentary; examination of essay, biography, short fiction, novel, and dramatic literature for group reading. P, 3 units in communication, drama, or English.

462. **Communication and Human Relationships** (3) GC S An advanced course enabling students to inventory, evaluate, and develop oral communication skills in the interpersonal, group, and organizational dimensions of their lives. P, senior standing.

496. **Proseminar**

525. **Rhetorical Criticism** (3) I 1987-88 Systems of criticism; rationale of approaches to the critical act; analysis of representative criticism of rhetorical events and movements.

610. **Communication Theory** I (3) I An overview of theoretical perspectives on the role of verbal and nonverbal communication in the process of generating and understanding development of interpersonal relationships.

620. **Communication Theory II** (3) II An overview of historical and theoretical perspectives on communication strategies used in social influence attempts from interpersonal to mass media contexts.

621. **Theory Construction in Communication** (3) I Theoretical and metatheoretical positions in the discipline of communication with an emphasis on approaches to analyzing and developing original theories.

660. **Research Methodologies I** (3) I An introduction to research methods and designs used in contemporary communication research.

670. **Research Methodologies II** (3) II Advanced study of research design and statistical analysis in contemporary communication research.


696. **Seminar**
   a. Rhetorical Criticism (3) [Rpt./3] I II
   b. Literature as Communication (3) [Rpt./1] I II
   c. Rhetorical Theory (3) [Rpt./3] I II
   d. Social Influence (3) [Rpt./1] I II
   e. Mass Media (3) [Rpt./2] I II
   f. Linguistic Investigations and Applications (3) [Rpt./3] I II (Identical with Ling. 696f)
   g. Argumentation (3) [Rpt./3]
COMPARATIVE LITERATURE AND LITERARY THEORY

Professors J. Douglas Canfield, Director (English), Barbara A. Babcock (English), Lawrence J. Evers (English), N. Scott Momaday (English), Suresh Raval (English), Herbert N. Schneiderau (English), Jonathan Beck (French and Italian), Richard P. Kinkade (Spanish and Portuguese), Ellana S. Rivero (Spanish and Portuguese), Robert ter Horst (Spanish and Portuguese), David H. Chisholm (German), Alex De Jonge (Russian and Slavic Languages), Norman Austin (Classics), Adel Gamal (Oriental Studies), Robert M. Gimello (Oriental Studies)

Associate Professors Susan H. Aiken (English), Jerrold E. Hogle (English), Patrick J. O'Donnell (English), Charles Sherry (English), Ingeborg Kohn (French and Italian), Adele Barker (Russian and Slavic Languages), Jon Solomon (Classics), Leslie Flemming (Oriental Studies), Esther Fuchs (Oriental Studies), Ronald C. Miao (Oriental Studies)

Assistant Professors Tenney Nathanson (English), Linda Zwinger (English), Lise Leibacher (French and Italian), Frances Aparacio (Spanish and Portuguese), Marie Chan (Oriental Studies)

The Committee on Comparative Literature and Literary Theory offers programs leading to the Master of Arts and the Doctor of Philosophy degrees with a major in comparative literature and literary theory. The cooperating departments include English, French and Italian, Spanish and Portuguese, German, Russian and Slavic Languages, Classics, and Oriental Studies. Students may choose their literatures from these departments or any other area in which the University affords expertise, such as American Indian Studies. The master's degree is considered primarily as leading to the Ph.D. degree.

Admission to the program is based on the following kinds of evidence: (1) Excellent undergraduate performance in language and literature (preferably majors and minors) as indicated by a transcript. (2) Three letters of recommendation from persons familiar with the student's performance in language and literature. (3) An example of the student's writing on a literary topic. For students applying for the doctoral program this must be an article-length and article-quality piece that will serve as a qualifying exam.

In addition, students wishing to study in English, French, German, Spanish and Russian should submit the following kinds of evidence of competence (scores in verbal aptitude and area competence are expected to be above the 75th percentile): (a) GRE Aptitude test, with emphasis on verbal competence. (b) GRE Subject test in one literature (not available in Russian). (c) GRE Subject test in another literature, or (d) GSFLT exam in a second language. (e) TOEFL exam for foreign students. Applicants' linguistic competence to do graduate-level work in the literatures of the particular languages will be judged by a special committee.

The master of arts: Degree requirements include at least 36 units: 24 units in graduate-level literature courses in at least two original languages; no more than 12 units may be taken in the student's native language; no more than 6 units may be taken below the 500 level; 6 units 503a-503b; 3 units in a basic linguistics course (such as Ling. 500); 3 units 550. A final examination evaluated by the Executive Committee, augmented by at least one specialist in the area of the paper.

The doctor of philosophy: Degree candidates are required to take at least 36 units for the major, no more than 12 units of which can be below the 500 level; 18 units dissertation; and a minor. Course work (at least 6 units of which must be in 596) aimed at a preliminary exam in (a) a genre of a period (or some other justifiable combination) in at least two literatures; (b) a branch of literary theory; (c) either (1) a third literature, same genre, same period, or (2) an ancillary discipline (such as anthropology, linguistics, history, American Indian studies, women's studies) or an interdisciplinary combination. If a discipline is chosen and one of the student's...
DEPARTMENTS AND COURSES OF INSTRUCTION

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literatures under (a) above is in his or her native language, the student must pass a reading exam in a second foreign language.

Minor: Supporting areas of study will be approved by the CPLT Director and Executive Committee and may be obtained through any academic unit offering an approved doctoral minor.

503a-503b. Introduction to Comparative Literature and Literary Theory (3-3) Major theories of East and West. 503a: Theories of representation in the West. 503b: Non-Western theories of literature (Amerind, Chinese, Japanese, Indian, and Arabic). (503a is identical with Engl. 503a; 503b is identical with Or.S. 503b)

550. Modern Theories of Criticism (3) I Twentieth-century theories of criticism most apposite to the study of literature, such as semiotics, structuralism, post-structuralism.

596. Seminar
   a. Comparative Literature and Literary Theory (3) [Rpt.] I II

COMPUTER SCIENCE

Professors Ralph E. Griswold, David R. Hanson
Associate Professors Gregory R. Andrews, Acting Head, Peter J. Downey, Christopher W. Fraser
Assistant Professors Scott E. Hudson, Eugene W. Myers, John C. Peterson, Larry L. Peterson, Richard D. Schlichting

The Department of Computer Science offers courses in programming languages, software systems, and theory of computation. Undergraduate courses introduce students to core topics in computer science and prepare them for graduate study. Graduate programs prepare students for the design and development of computer systems and applications, and for industrial or academic research in computing.

The department offers graduate programs leading to the Master of Science and Doctor of Philosophy with a major in computer science. For admission and degree requirements, consult the Graduate Catalog.

A minor in computer science within the College of Arts and Sciences: a minimum of 20 units including 115, 227, 237, 327, 342, one 400-level course and Math. 243.


121. Business Programming (3) I II (Identical with M.I.S. 121)

227. Program Design and Development (3) I II Programming using a high-level language such as Pascal. Several medium-sized projects will be required, with emphasis on program design using stepwise development. P, 115.

237. Introduction to Assembly Language Programming (3) I II Introduction to digital computers; elementary hardware concepts; machine operations and instructions; assembly language concepts; programming in assembly language. P, 115.

301.* Program and Data Structures (3) I II (Identical with M.I.S. 301)

327. Comparative Programming Languages (3) I II Introduction to several major high-level programming languages and their characteristics. Programming projects are required in at least three languages. P, 227 or M.I.S. 301. (Identical with M.I.S. 327)

331. * Data Management Systems (3) I II (Identical with M.I.S. 331)

342. Data Structures (3) I II Mathematical preliminaries; fundamental data structures and associated algorithms, implementations and applications: stacks, queues, trees, graphs, sorting, and searching. P, 227 or CR 327; Math. 243 or C.Sc. 362. (Identical with M.I.S. 342)

402. Mathematical Logic (3) GC II 1987-88 (Identical with Math. 402)

421.* Simulation Modeling and Analysis (3) GC (Identical with M.I.S. 421)

422.* Mathematical Programming and Applications (3) (Identical with M.I.S. 422)

430. Software Tools (3) GC I II Techniques for the design and implementation of programs that assist in programming: filters; file managers; editors; text processors. P, 327, 342.
443. Theory of Graphs and Networks (3) GC II (Identical with Math. 443)
452. Principles of Operating Systems (3) GC I II Concepts of modern operating systems; concurrent processes; process synchronization and communication; resource allocation; kernels; deadlock; memory management; file systems; protection mechanisms. P, 237 or E.C.E. 271 b; CR 430.
453. Translators and Systems Software (3) GC II Design and implementation of translation-oriented systems programs: macroprocessors; preprocessors; assemblers; loaders; linkers; introduction to compilers. P, 237, 430.
472. Continuous-System Simulation (3) GC I (Identical with E.C.E. 472)
473. Theory of Computation (3) GC I II Mathematical preliminaries; finite automata, regular expressions, applications; context-free grammars, pushdown automata, Turing machines, undecidability. P, knowledge of a programming language; Math. 243 or 215. (Identical with Math. 473)
474. Digital Logic Design (3) GC I II (Identical with E.C.E. 474)
475a-475b. Mathematical Principles of Numerical Analysis (3-3) GC (Identical with Math. 475a-475b)
476. Computer Architecture (3) GC I Functional overview of computer systems; interconnection of basic components; input/output; interrupts; virtual addressing; stack architecture; microprogramming; microprocessors. P, 237, 342. (Identical with E.C.E. 476)
478. Computational Methods of Algebra (3) GC II (Identical with Math. 478)
479. Game Theory and Mathematical Programming (3) GC II 1987-88 (Identical with Math. 479)
450. Principles of Programming Languages (3) II Global semantics of algorithmic languages, including scope of declarations, data types, retention, block structure, binding time, subroutines, coroutines, extensibility; implementation issues. P, 430.
451a-521b. Advanced Systems Modeling and Simulation (3-3) (Identical with M.I.S. 521 a-521b)
452. Principles of Computer Networking (3) II Theory and practice of computer networks, emphasizing the principles underlying the design of network software and the role of the communications system in distributed computing. Topics include data representation, channel semantics, synchronization, resource naming, and resource sharing. P, 430, 452.
541a-541b. Computer-Aided Information Systems Analysis and Design (3-3) (Identical with M.I.S. 541 a-541b)
545. Analysis of Algorithms (3) II Time, space complexity; recurrences; algorithm design techniques; lower bounds; graph, matrix, set algorithms; sorting; fast Fourier transform; arithmetic complexity; intractable problems. P, 342, 473, Math. 362.
552. Principles of Concurrent Programming (3) I Fundamental concepts of concurrent programming; synchronization mechanisms based on shared variables and message passing; systematic development of correct programs; paradigms for distributed programming. P, 452, 473.
555. Principles of Compiliation (3) I Finite automata and lexical analysis; context-free grammars; parsers; parser generators; code generation; graph-theoretic approaches to optimization. P, 453, 473.
571. Digital Systems Design (3) I II (Identical with E.C.E. 571)
573. Microprocessors, Minicomputers and Real-Time Distributed Processing (3) II (Identical with E.C.E. 573)
575a-575b. Numerical Analysis (3-3) (Identical with Math. 575a-575b)
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620. Advanced Topics in Programming Languages (1 to 3) [Rpt./12 units] I Design, implementation, and compilation of programming languages; specific topics to be determined by current literature and faculty and student interest.

630. Advanced Topics in Software Systems (1 to 3) [Rpt./12 units] I Problems in design and development of large systems of programs; specific topics to be determined by current literature and faculty and student interest.

645. Advanced Topics in Algorithm Analysis (1 to 3) [Rpt./12 units] II Design and analysis of algorithms; specific topics to be determined by current literature and faculty and student interest.

652. Advanced Topics in Operating Systems (1 to 3) [Rpt./12 units] II Operating system design, development, analysis, and performance; specific topics to be determined by current literature and faculty and student interest.

674. Sequential Circuits and Automata (3) I (Identical with E.C.E. 674)

696. Seminar
   a. Foundations of Computing (3) [Rpt./2] I II S P, Ph.D. candidate or consult department before enrolling.

CONSUMER STUDIES
(See Family and Consumer Resources)

CORRECTIONAL ADMINISTRATION
(See Management and Policy)

COUNSELING AND GUIDANCE
(See Family and Consumer Resources)

CREATIVE WRITING
(See English)

CRIMINAL JUSTICE ADMINISTRATION
(See Management and Policy)

DANCE

Committee on Dance

Professor John M. Wilson, Chairperson
Associate Professors Isa Bergsohn, Nina Janik

The Committee on Dance, a division of the Faculty of Fine Arts, provides studies in the art, the teaching, and the analysis of dance. The dance curriculum offers 4 years of technique in ballet and modern dance, choreography and ample performing experience, leading to the Bachelor of Fine Arts degree with a major in dance.
A concentration in dance is offered by the Department of Drama as an option within their Master of Arts degree with a major in drama. For information consult the Graduate Catalog or the Department of Drama.

The major: Dance majors must audition for placement in dance technique courses. For information regarding the placement session, please contact the Committee on Dance. The following courses must be taken: Dnc. 100, 143, 209, 240a-240b, 241a-241b, 245a-245b, 259, 340a-340b, 341a-341b, 440a-440b or 441a-441b; any three of 343a or 343b or 343c or 343d, 270, 346, 496d, 394a-394b, 445; Mus. 107, 108. Phil. 110; Dram. 101, 115, 117, 118, 220, 221. During the student's years of study, 6 units of Dnc. 291 must be completed in service to concert productions. The B.F.A. degree requires 45 units outside of the major department including the general education requirements (described in the College of Arts and Sciences section of this catalog), and 16 units of combined electives in art, art history, drama, music, media arts, and creative writing. All B.F.A. students are required to take at least one 3-unit course focusing on gender, race, ethnicity, or non-Western civilization. Thirty units in dance classes, including 4 units in ballet technique, 4 units in modern technique, Dnc. 291 (for cumulative units) and Dnc. 394a-394b, must be taken in residence. Minimum units required for the degree with the major in dance—125.

Honors: The Committee participates in the Honors Program.

100. Looking at Dance (3) I Origins of dance as human expression in ritual, social, and theatrical context. Twentieth century developments in ballet, modern dance, movie, and show dancing. Bergsohn/Janik

112. Ballet I II S
   a. Beginning Ballet (1)
   b. Ballet for Beginners with Limited Experience (1) P, Dnc. 112a.
   c. Intermediate Ballet (2)

143. Improvisation (1) I II

152. Modern Dance
   a. Beginning Modern Dance (1) I II S
   b. Modern Dance for Beginners with Limited Experience (1) I II 2S. P, Dnc. 152a.
   c. Intermediate Modern Dance (2) I II S

175. Theatre Dance (1) I II S Jazz movement styles for the beginning dancer; basic steps, phrases, and performing techniques for musical comedy and media dance entertainment. (Identical with Mus. 175)

207. Western Civilization and the Arts: The Twentieth Century (3) I II (Identical with F.A. 207)

209. Percussion for Dance Students (2) I 1988-89 (Identical with Mus. 209)

239a-239b. Beginning Ballet Pointe (1-1) [Rpt/1] Strength, stretch, and placement techniques for the beginning student in preparation for ballet pointe; barre and center practice. 2S. P, Dnc. 112c or audition.

240a-240b. Ballet Technique I (2-2) Janik

241a-241b. Modern Dance Technique I (2-2) Wilson

244a-244b-244c-244d. Jazz Dance Technique (2-2-2-2)

245a-245b. Basic Choreography (2-2) Study of the elements of time, space, and energy; basic concepts of phrasing and structure leading to dance composition. 4S. P, Dnc. 143. Bergsohn

259. History of Dance (3) II History of dance as theater art within the western world from 1581 to the present. Bergsohn

270. Human Movement in the Arts (3) II 1988-89 Anatomical and biomechanical foundations of human movement from the viewpoint of the performing and visual arts. Historical development and stylistic treatment of the human figure in action. Wilson

307. Western Civilization and the Arts: Paleolithic through Renaissance (3) I II (Identical with F.A. 307)

317. Western Civilization and the Arts: Baroque through Nineteenth Century (3) I II (Identical with F.A. 317)


341a-341b. Modern Dance Technique II (2-2) P, Dnc. 241b.

343a-343b-343c-343d. Dance Ensemble (2-2-2-2) a and b sections 1988-89; c and d sections 1987-88. Production preparation, rehearsal methods, repertorial development, and performance of dance, with particular emphasis on ensemble. 6L. Enrollment by audition only.

DEPARTMENTS AND COURSES OF INSTRUCTION

394. Practicum
   a. Dance Project (1) I II 3L.
   b. Production Project (1) I II 3L. P, 445.


441a-441b. Modern Dance Technique III (2-2) P, 341b.

445. Advanced Choreography (2) I GC Movement qualities, motif development, and geometric principles applied to group composition. 4S. P, 245b.

460a-460b. Advanced Ballet (2-2) [Rpt./1] GC P, 440a-440b.

496. Proseminar
   d. Dance-Related Art Forms (2 to 3) GC II 1988-89 (Identical with Dram. 496d) Bergsohn

541. Professional Level Modern Dance Technique (3) [Rpt./1] P, 441a-441b. Wilson

543. Dance Ensemble (2) [Rpt./1] I II Rehearsal methods, repertorial development, and performance of dance with particular emphasis on ensemble. 4S. P, repertory audition; intermediate level in modern and ballet (340, 341).

545. Literary Resources for Choreography (3) II 1988-89 Studies in primary world literature, in drama, and in psychology of personages as sources for choreographic themes; presentation of motifs and scenario. 6S. P, 445. Wilson. (Identical with Dram. 545)

595. Colloquium
   a. Evaluation of Dance and Body Technique (2) I P, intermediate level ballet or modern dance techniques. (Identical with Dram. 595a)

697. Workshop
   a. Concert Production and Choreography (1 to 4) [Rpt./4 units] I II 4-8S. P, 445.

Dietetics
(See Nutrition and Food Science)

Drama

Professors Sam Smiley, Head, Robert C. Burroughs, Irene F. Corner (Emerita), J. Michael Gillette, Robert A. Keyworth (Emeritus), Frank K. La Ban, Peter R. Marroney (Emeritus)
Associate Professors Harold W. Dixon, Rosemary Gipson, Richard T. Hanson, Peggy Kellner, William A. Lang, Peter Lehman, Mary Z. Maher, Patricia D. Van Metre, Jeffrey L. Warburton
Assistant Professor Dianne J. Winslow

The Department of Drama offers the following degrees: Bachelor of Fine Arts with a major in drama production with options available in acting/directing, design/technical production, and theatre specialist; Bachelor of Fine Arts with a major in drama-musical theatre; Bachelor of Fine Arts with a major in drama education; Bachelor of Arts in Drama with a major in dramatic theory; Master of Arts and Master of Fine Arts.

The Department of Drama cooperates with the Department of Media Arts in providing course work for cinema studies. For additional information regarding studies in cinema, see the Department of Media Arts section of this catalog.

The Department of Drama is committed to providing pre-professional training at the undergraduate and graduate levels in the theatre arts through a program of performance-centered activities and creative studies, the object of which is to insure that each student acquires a thorough understanding and appreciation of the theatre and cinema arts through classroom study, studio-laboratory training, and university theatre production. The program is designed to instill in the student the highest academic standards and professional skills required to initiate a career in educational or professional theatre.
Drama core curriculum: Undergraduates in the department with a major in drama production or in drama education are required to take the same curricular core. In addition to the 45 general education units described under the Bachelor of Fine Arts in the Faculty of Fine Arts section of this catalog, the following lower division requirements must be met: Dram. 105, 106, 111, 112, 113, 115, 116, 117, 118, 120, 140a-140b, 149, 151, 220, 221, 222, 223, 224, 225 and 245.

The requirements for the various programs are listed below.

Bachelor of Fine Arts (major in drama production): The Bachelor of Fine Arts with major in drama production is an extensive pre-professional training program for highly talented and motivated theatre students. Admission to upper division is granted only if the student has demonstrated strong potential for a professional career in the theatre. The faculty in the student's area of specialization will evaluate each student's professional potential, trainability, and talent after an audition, interview, and/or portfolio review. Options are as follows:

Acting/directing option: Admission is by interview and audition at the completion of the drama core curriculum at the end of the sophomore year. The following requirements must be met: Dram. 250, 251, 305, 306, 430, 440a-440b, 449, 451, 452, 455, 475, 4 units from 497; 6 units of drama literature; 4 units selected from Ex.S.S. 132a, 132c, 132d, Dnc. 112a, 112c, 143a, 152a, 152c, 175; one course selected from Sp.H. 260 or 367 or Comm. 467; and one course from Mus. 103 or 111a or 205 or Mus. 180v. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option: 125.

Design/technical production option: Admission is by portfolio review and interview at the completion of the drama core curriculum. The following requirements must be met: 415, 416, 420, 421, 423, 424, 425, 427, 429, 440a-440b, 4 units selected from 497a, 497b, 497c, 497d, or 497e, and 6 units of dramatic literature. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option: 125.

Theatre specialist option: Admission is by interview with supporting documents and completion of the drama core curriculum. Upper-division course work must be planned at the beginning of the undertaking of a declared specialty with an academic advisor. This option offers the student the opportunity to design a specific curriculum in consultation with a departmental faculty advisor. The course of study may not substantially parallel that offered in any other departmentally administered degree program. The following requirements must be met: Dram. 440a-440b, 18 units of drama courses, and 6 units of dramatic literature. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option: 125.

NOTE: All Bachelor of Fine Arts students must enroll in Dram. 497 every semester after admission to upper division (minimum of four semesters).

Bachelor of Fine Arts (major in drama-musical theatre): The drama-musical theatre major is an extensive professional training program for those students interested in a career in musical theatre. The course of study, offered in cooperation with the School of Music and Committee on Dance, emphasizes the collaborative process of musical theatre and provides an intensive course of study in music, dance, and drama. Admission to upper division is granted only if the student has demonstrated strong potential for a professional career in musical theatre. Admission to advanced drama-musical theatre course work is by interview and audition at the completion of the drama core curriculum at the end of the sophomore year. At that time, the faculty will evaluate each student's professional potential, trainability, and talent. Required course work: Lower-division drama courses: Dram. 105, 106, 111, 112, 113, 115, 116, 117, 118, 140a or 140b, 149, 151, 205, 250, 251. Music courses: 110a, 110b, 120a, 120b, 130a, 130b, 8 semesters of Voice (to include 4 units of 285v, minimum level of proficiency), and 200 (8 units Drama 497f may be substituted for approved production). Dance courses: 112a or 112b, 112c, 143, 152a, 175, 241a or 141b, 244a, 244b, 244c, or 244d. Upper-division drama course work: Dram. 304, 305, 306, 404, 449, 451, 452, 497f (4 units). Minimum total units for a degree with this major: 125.

Bachelor of Fine Arts (major in drama education): Students may be admitted upon completion of drama core curriculum and an interview. This major is designed for students preparing for a teaching position in the junior and senior high schools. The student must complete the following drama courses: Dram. 250, 251, 410, 455, and 456; and the following education
DEPARTMENTS AND COURSES OF INSTRUCTION

courses: Ed.P. 311, T.T.E. 225, 329, 330, 338t, 435, 493a, and 494b. A teaching minor is not required, but those students anticipating employment in areas where a teaching minor might be advantageous should consult with their advisor. At least 18 units in the major must be taken in residence. Minimum total units required for the degree with this major: 125.

Bachelor of Arts in Drama (major in dramatic theory): The Bachelor of Arts in Drama is designed for the theatre generalist and provides an appropriate basis for advanced study of theatre history, theatre criticism, and playwriting at the graduate level. In addition to the general education units required, as described under the Bachelor of Arts in the Faculty of Fine Arts section of this catalog, the following requirements must be met: Dram. 105, 111, 112, 113, 116, 117, 118, 140a-140b, 149, 245, 440a-440b, 460a or 460b, and 6 units of dramatic literature. A 20-unit minor is also required. (See the Faculty of Fine Arts section for details.) If the minor is in a field other than the fine arts, it is recommended that additional general electives be taken in fine arts. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this major: 125.

Drama minor/teaching minor (20 units): Performance/playwrighting/management classes (6 units minimum) choose from Dram. 100, 103, 410 412, 431, 432, 436, 460a, 460b; (Drama minors may not take Dram. 105, 106, 149 and 151 to satisfy this requirement.) History classes (6 units minimum) choose from Dram. 140a, 140b, 245, 440a, 440b; Production classes (6 units minimum) choose from Dram. 111, 112, 113, 115, 116, 117, 118, 120, 220, 221, 222, 223, 224, 225.

NOTE: All Bachelor of Fine Arts students are required to take at least one 3-unit course focusing on gender, race, ethnicity, or non-western civilization. This course can be part of the major, general education, or elective course work and must be approved by the major advisor.

Production and Performance

100. Acting for General College Students (3) I II S The craft of acting with emphasis on body, voice and mind. Theoretical background and practical experience, including in-class performances of selected scenes. Open to non-majors only.

105. Voice and Movement for the Actor I (1) [Rpt/1] I Beginning voice and movement skills for the actor including the Linklater approach, phonetics, physical isolation and awareness exercises. 2S. Open to drama majors only.

106. Voice and Movement for the Actor II (1) [Rpt/1] II Continued voice and movement skills for the actor with a new focus on stage dialects and physicalization of character. 2S. Open to drama majors only. P, 105.

111. Stagecraft (2) I II Basic principles of the scenic process: construction and use of materials.

112. Stagecraft Laboratory (1) [Rpt/2] I II S Scenic and property shop techniques and practices. P, CR 111 and 113 for majors.

113. Stagecraft Crew (1) [Rpt/2] I II S Crew work on building theatrical sets or properties for department productions. P, CR 111 and 112 for majors.

115. Makeup (1) I II History and essentials of makeup; straight, character, and special types; effects of light on makeup; opportunity for experience in production. 2S.

116. Stage Costume (2) I II Trends of historic dress analyzed in relation to social and economic background; design and execution of costumes; and the organization and care of departmental wardrobes.

117. Stage Costume Laboratory (1) [Rpt/3 units] I II S Costume construction techniques and shop practices. P, CR 116 and 118 for majors.

118. Stage Costume Crew (1) [Rpt/3 units] I II S Crew work involved with costume construction, wardrobe maintenance and storage. P, CR 116 and 117 for majors.

120. Basic Theatre Graphics (2) I II Practical graphic skills essential to theatrical productions. 4S.

149. Acting I (3) I Fundamental techniques of acting, with emphasis on the actor’s approach to characterization and the performer’s relationship to all parts of the play’s production. 2R, 2S. Open to drama majors only.

151. Acting II (3) I Intensive study of text analysis and the actor’s approach to characterization as it pertains to modern realism. 2R, 2S. P, 105, 149.

194. Practicum
a. Performance (1 to 2) [Rpt/4 units] I II S

205. Musical Theatre (2) [Rpt/1] I II S American musical theatre: its origins, development and influences. Practical applications. 1R, 2S.
220. Stage Lighting (2) Studies in stage lighting equipment, procedures, and design techniques.

221. Stage Lighting Laboratory (1) [Rpt./2] I II S Stage lighting techniques and shop practices. P, CR 220 and 222 for majors.

222. Stage Lighting Crew (1) [Rpt./2] I II S Crew work on theatrical stage lighting productions. P, CR 220 and 221 for majors.

223. Scene Design (2) I II Basic principles of scenic design.

224. Scene Design Laboratory (1) [Rpt./3 units] I II S Scene painting techniques and shop practices. P, CR 223 and 225 for majors.

225. Scene Design Crew (1) [Rpt./3 units] I II S Crew work involved with painting and decorating sets for department productions. P, CR 223 and 224 for majors.

239. Speaking for Radio and Television (3) I II Communication learnings and behavior for presenters on radio and television; includes backgrounds, current trends, and performance experience in various types of radio and television speaking. (Identical with M.Ar. 239)

250. Acting III (3) I Intensive work in expanding the versatility of the actor's instrument. Improvisation, class exercises and scene work. 2R, 2S. P, 106, 151.

251. Acting IV (3) I Non-realistic styles, including expressionism, absurdism and the contemporary avant-garde; work with select exercises in both representational and presentational modes. Analytical skills, scene performance and critique. 2R, 2S. P, 250.

304. Musical Theatre II (3) I Intensive text and score analysis in relation to the process of characterization for the actor, singer, dancer in musical theatre. Individual and group performance. Open to majors only. 2L, 2S. P, 205 and audition.

305. Voice and Movement for the Actor III (1) [Rpt./1] I Intermediate voice and movement skills for the actor including standard stage speech and period manners and movement; emphasis on Shakespearean style. 2S. Open to majors only. P, 205 and audition.

306. Voice and Movement for the Actor IV (1) [Rpt./1] II Continued intermediate voice and movement skills for the actor including individualized attention to special voice problems and period manners and movement. Emphasis on Commedia dell'arte, Moliere and English Restoration styles. 2S. Open to majors only. P, 305.

404. Musical Theatre III (3) GC II Intensive scene study and exploration of the major historical styles and genres of the American musical theatre. 2R, 2S. Open to majors only. P, 304 and audition.


416. Theatre Graphics III (2) GC II Advanced practical color theory in pigment and light, scenographic rendering mediums and techniques. P, 120.


421. Lighting and Sound Technology (3) GC II Applied theory and techniques associated with sound system and visual effects in the theatre. 2R, 3L.

423. Scene Painting (3) GC I Techniques and methods of scenic painting.


425. Advanced Stagecraft (3) GC I Advanced studies in scenic construction methods and techniques. P, 111.

427. Advanced Stage Costume Construction (3) GC II Advanced techniques in costume construction, including period pattern design, cutting and draping techniques. P, 116.


430. Stage Management (2) GC I Principles and techniques of stage management, practical applications, problems and analysis of stage managing. P, 111, 151.

431. Theatre Publicity and Box Office (2) GC I Publicity, press releases, sales, advertising, display techniques, subscription procedures. P, 12 units of drama.

432. Theatre Management (2) GC II Amateur, educational and professional theatre organization and management; theatrical contracts, professional unions and representative organizations. P, 12 units of drama.

436. Shakespeare through Performance (3) GC I Understanding Shakespeare's plays through performance. Performance-oriented analysis compels a thorough comprehension of the ideas, emotions, attitudes, and intent of the plays being studied.
Acting V (3) GC I
Intensive study of classical acting styles with emphasis on Shakespeare. Individual and group performance. 2R, 2S. P, 251 and audition.

Acting VI (3) GC II

Acting VII (3) GC I
Audition material, techniques and research into problems of a professional career in the theatre, television, motion pictures and related fields. 2R, 2S. P, 305, 449.

Acting VIII (3) GC II
Intensive scene study and character analysis. Survey and review of major modern acting theories and techniques. 2R, 2S. P, 452.

Directing I (3) GC I
Basic techniques of stage directing including play analysis, director-actor communication and technical problems of movement, composition, picturization and blocking. 2R, 2S.

Directing II (3) GC II
Techniques of stage direction with the study of factors leading to a completed production; special attention given to director-designer communication and the production process. Direction of one-act plays. 2R, 2S. P, 455.

Screen Acting Techniques (3) GC II
Principles and techniques of various performance methods involved in acting for television and motion pictures; basic problems faced by the professional actor seeking employment in these media; on camera experience with directed exercises and dramatic scenes. 2R, 3L. (Identical with M.Ar. 475)

Proseminar
a. Portfolio (1 to 2) GC II

Workshop
a. Technical Production (1 to 6) [Rpt./20 units] GC II S
b. Costume Production (1 to 6) [Rpt./20 units] GC II S
c. Lighting/Sound (1 to 6) [Rpt./20 units] GC II S
d. Production Design (1 to 6) [Rpt./20 units] GC II S
e. Scenic Design (1 to 6) [Rpt./20 units] GC II S
f. Performance (1 to 6) [Rpt./20 units] GC II S

Literary Resources for Choreography (3) 1988-89 (Identical with Dnc. 545)

Colloquium
a. Evaluation of Dance and Body Techniques (2) I (Identical with Dnc. 595a)

Advanced Voice and Movement for the Actor I (4) [Rpt./1]
Advanced study and exercise in voice and movement for the actor: relaxation, breathing, physical and vocal freedom, resonance, articulation and improvisation including the Linklater Approach, I.P.A., and Neutral Mask. 2R, 4S.

Advanced Voice and Movement for the Actor II (4) [Rpt./1]
Continued advanced study and exercise in voice and movement for the actor: standard stage speech, stage dialects, period customs, manners and movement. 2R, 4S. P, 605.

Experimental Theatre I (3)
Post-Stanislavsky experimental theatre techniques and theories of the first half of the twentieth century. Rehearsal and performance of select projects.

Experimental Theatre II (3)
Theories and techniques of avant-garde theatre. Rehearsal and performance of select projects.

Advanced Directing I (3)
Techniques of analyzing and staging classical texts for a contemporary audience; use of directorial style and the adaptation of directorial philosophies with an emphasis on the staging of Shakespeare. 2R, 2S. P, 456.

Advanced Directing II (3)
Techniques of analyzing and staging classical texts for a contemporary audience; use of directorial style and the adaptation of directorial philosophies with an emphasis on staging the plays of Moliere, the English Restoration, and similar historical texts. 2R, 2S. P, 655.

Seminar
a. Contemporary Trends (1 to 3) II
b. Special Topics in Acting (1 to 3) II
c. Special Topics in Directing (1 to 3) II
d. Musical Theatre Production (1 to 3) II
h. Theatrical Design (1 to 3) [Rpt./3 units]
i. Period Design Style (1 to 3) II

Theatre Appreciation (3) II
An introduction to the art used in producing the play: directing, acting, technical production. Open to non-majors only.
140a-140b. History of the Theatre and Drama in Western Civilization (3-3) Origins and development of the arts of theatre from primitive ritual to modern times; integrated study of plays, theatre architecture, dramatic styles, and theories of significant periods. 140a is not prerequisite to 140b.

207. Western Civilization and the Arts: The Twentieth Century (3) I II (Identical with F.A. 207)

237. Oral Interpretation of Classical Drama (3) I Backgrounds in and analysis of structure and content of dramatic masterpieces of world literature from the Golden Age in Greece through the Restoration, with emphasis on oral presentation of selected scenes.

238. Oral Interpretation of Modern Drama (3) II Interpretation of modern plays from Ibsen to the present; presentation of speakers in drama, with emphasis on the physical and vocal qualities that project these characters; deals with the modern masters, such as Shaw, Miller, and Williams.

245. Principles of Dramatic Structure (3) I Interpretation of structural elements of major dramatic forms and styles in relation to stage presentation and film; reading and analysis of representative plays.

307. Western Civilization and the Arts: Paleolithic through Renaissance (3) I II (Identical with F.A. 307)

317. Western Civilization and the Arts: Baroque through Nineteenth Century (3) I II (Identical with F.A. 317)

338t. Teaching of Theatre Arts (3) II Carries credit in education only. (Identical with T.T.E. 338t)

396H. Honors Proseminar (3) I

410. Creative Drama (3) GC I Principles and procedures of improvisation, role-playing, creative playwrighting techniques, and program development in creative dramatics applicable to the elementary and secondary school levels. P, 12 units of drama or education.

412. Theatre for Children (3) GC II Principles and techniques of selecting plays, playwrighting, directing, designing and producing theatre for children. 2R, 3L. P, 12 units of drama or education.


460a-460b. Writing for Stage and Screen I (2-2) GC Preparation and analysis of brief scripts for stage and motion pictures; staged readings and lab. productions. Writing-Emphasis course for Cinema Option (General Fine Arts Studies major). P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

467. English Phonetics (3) I II Scientific study of the sounds of speech; emphasis on laws and principles determining articulatory features, dialect variation, sound change, and sound as communication context. (Identical with M.Ar. 467)

560a-560b. Writing for Stage and Screen II (3-3) Preparation and analysis of full-length scripts for stage and motion pictures. Production possible for selected scripts.

600. Introduction to Graduate Study of Drama (2) I Methods and materials for research in theatre and drama; introduction to the bibliography of these fields; organization and form of thesis.

640. Dramatic Criticism: Tragedy (3) I Comparative analysis of tragedy and theories of tragedy from antiquity to the present for stage and screen; writing of critical papers.

641. Dramatic Criticism: Comedy (3) II Comparative analysis of comedy and comic theory from antiquity to the present for stage and screen; writing of critical papers.

642a-642b. Studies in Theatre History (3-3) Concentrated study in theatre history, with major emphasis on the physical theatre, standard scholarly works, and source materials. 642a: Beginnings to circa 1660. 642b: Circa 1660 to 1975. 642a is not prerequisite to 642b.

644. History of the American Theatre (3) II Studies in the American theatre and drama. Directed and individual projects will be assigned.

696. Seminar
   a. Contemporary Trends (1 to 3) I II
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315. Intermediate Film Production (3) I II (Identical with M.Ar. 315)
321. American Cinema: Directors and Genres (3) I (Identical with M.Ar. 321)
329. Art History of the Cinema (3) I (Identical with Clas. 329)
471. Film/Video Production Financing (3) GC I II Strategies for production financing for independent film/video projects and ways to position project in marketplace. Students will develop a prospectus for their own project. P, M.Ar. 215 or 310. (Identical with M.Ar. 471)
496. Proseminar
   a. Portfolio (1 to 2) GC I II
   c. Advanced Topics in Film Studies (3) [Rpt./3] GC I II P, 109 or consult department before enrolling.
497. Workshop
   g. Cinema Production (1 to 6) [Rpt./20 units] GC I II S
696. Seminar
   c. Special Topics in Directing (1 to 3) I II
   d. Musical Theatre Production (1 to 3) I II
   f. Film Editing (1 to 3) I II
   g. Documentary and Educational Films (1 to 3) I II

EARLY CHILDHOOD EDUCATION
(See Teaching and Teacher Education; Family and Consumer Resources)

ECOLOGY AND EVOLUTIONARY BIOLOGY

Associate Professors Russell Davis, Robert S. Mellor, Richard E. Michod, Stephen M. Russell, David J. A. Vleck, Oscar G. Ward
Assistant Professors Michael J. Donoghue, Robert H. Robichaux, Richard E. Strauss, D. Lawrence Venable, J. Bruce Walsh
Lecturer C. William Gaddis

The Department of Ecology and Evolutionary Biology provides general and professional education for those intending to pursue graduate study or for those planning a career in fields where training in basic or applied organismic, evolutionary and environmental biology is necessary or desirable. Courses in population, community and physiological ecology, behavior, population theory, biogeography, natural history, genetics, systematics, morphology, and evolution are offered. In addition to excellent instructional facilities on campus, the department uses the Marine Biology Station at Puerto Penasco, Sonora, Mexico; the Southwestern Research Station at Portal, Arizona; the Boyce-Thompson Arboretum at Superior, Arizona and the Research Ranch at Elgin, Arizona. It also operates the research vessel, LA SIRENA, for marine biological teaching and research in the Sea of Cortez (Gulf of California), and curates excellent regional collections of plants and animals.
The department administers the Bachelor of Arts and Bachelor of Science degrees with majors in ecology and evolutionary biology and the Bachelor of Science degree in Biology. The department also administers advanced degrees, the Master of Science and Doctor of Philosophy in ecology and evolutionary biology, and botany.

**The major in biology for the Bachelor of Science degree** provides a broad background covering aspects of molecular, cellular, organismic, physiological, ecological, and evolutionary biology. The requirements are: 181, 182, 302, 304, 320; M.C.B. 410a or Bioc. 460 or 462a (first semester of a one-year course), Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b, 180a-180b; Math. 125a-125b.

Additional upper-division credits must be taken to a minimum of 35 credits in the major. These elective units may be selected from the departments of Ecology and Evolutionary Biology, Molecular and Cellular Biology, Microbiology and Immunology and other departments upon the approval of the major advisor. No more than four of these elective units may be taken as 399 or 499 (independent study). Programs resulting in the equivalent of majors in botany, physiology and zoology may be pursued. Other areas of emphasis are genetics, invertebrate zoology, marine biology, predentistry, premedicine and other appropriate preprofessional preparation. The biology program has a structured minor in chemistry/mathematics or chemistry/physics.

**The major in ecology and evolutionary biology for the Bachelor of Science degree** is designed primarily for students who plan to pursue graduate study in ecology and evolutionary biology or a related science. The requirements for the major are 181, 182, 304, 320, 435; in addition, Chem. 103a-103b, 104a-104b, Phys. 102a-102b, or 103a-103b and 180a-180b, or 110, 116, and 121; Math. 125a-125b and 223 which courses constitute the minor. At least 12 additional upper-division units totalling 35 in the major must be selected upon consultation with the major advisor. Courses may be selected from the departments of Ecology and Evolutionary Biology, Molecular and Cellular Biology, Microbiology and Immunology and other departments upon the approval of the major advisor. At least 6 additional units of mathematics or nonbiological science are required (a list of acceptable courses is available from departmental advisors).

**The major in ecology and evolutionary biology for the Bachelor of Arts degree** is designed for students with interests in natural history and the biological sciences who may not wish to continue with graduate study. The requirements for the major are 181, 182, 302 and 304 (requires Math. 125a-125b), or 304, and 16 upper-division elective units from the Department of Ecology and Evolutionary Biology or from other appropriate departments with the approval of the major advisor, totalling 32 units in the major. Also required are Chem. 103a-103b, 104a-104b; Phys. 102a-102b, Math. 117e, 118, and one course from the following: 119, 123, 125a, 263 which courses constitute the minor.

**The teaching major:** The same as the biology major, administered by the Department of Ecology and Evolutionary Biology.

**The teaching minor:** 181, 182, 320 and 8 upper-division units to be selected in consultation with an ecology and evolutionary biology advisor.

**Honors:** The department participates in the Honors Program.

105. **Introductory Botany** (3) I Structure, function, and development of flowering plants and an overview of the plant kingdom. 3R.

106. **Environmental Biology** (4) I Principles of ecology applied as background for understanding the interactions between the human species and natural ecosystems. Nonmajors orientation. 3R, 3L Field trip.

120. **Plants and Society** (3) II Lecture-demonstration course on the interrelationships between plants and man; discussion of plants as a source of food, fiber, drugs and other products; plants for esthetic value, survival and energy.

123. **Introduction to Organic Evolution** (2) I Study of the origin and maintenance of the diversity of life.

130. **Natural History of the Southwest** (3) I Elementary biology of the common plants and animals of the Southwest; identification, distribution, ecology. 2R, 2L. Field trips.

150. **Fundamentals of Marine Biology** (3) II Survey of the marine environment and its biotic communities, with emphasis on the natural history of marine organisms. 2R, 3L. Weekend field trip.

159aR-159bR. **Human Anatomy and Physiology** (3-3) Correlated structure and function of the human body. Primarily for majors in nurs., phrm., and e.x.s.s.; not designed for bio. majors.

159aL-159bL. **Human Anatomy and Physiology Laboratory** (1-1) P, CR 159aR-159bR.

181. **Life: The Science of Biology I** (4) I (Identical with M.C.B. 181)
182. **Life: The Science of Biology II (4)** Origin, diversity and evolution of life; physiology of plants, animals, and organ systems; processes of micro- and macroevolution; animal behavior and ecology of populations and communities emphasizing biotic interactions and biogeography. Designed for biology majors. 3R, 3L. High school biology recommended. Optional field trips. (Identical with Bioc. 182, M.C.B. 182, Micr. 182)

260. **Elementary Plant Physiology (4)** Functions, nutrition, metabolism, and development of higher plants. 3R, 3L. P, 181 and 182, or P.I.S. 100; Chem. 101b, 102b.

295. **Colloquium**
   a. **Ecology and Evolutionary Biology (1)** P, Ecol. 182, consult department before enrolling.


304. **Organismic Biology (4)** Structure, function, development, and economic value of flowering plants; structure, function, and development of animals; brief survey of the plant and animal kingdoms. 3R, 3L. P, 181 and 182, Chem. 103b-104b. Consult department before enrolling.

320. **Genetics (4)** The principles that govern the inheritance of all living organisms including molecular, chromosomal, organismal, population and evolutionary aspects of genetics with laboratory experience and problem solving. 3R, 3L. P, 181 and 182, Chem. 103b, 104b. (Identical with M.C.B. 320)


402. **History of Biology (3)** GC II (Identical with Hist. 402)

403R. **Biology of Animal Parasites (3)** GC I (Identical with V.Sc. 403R)

405. **Aquatic Entomology (3)** GC II 1988-89 (Identical with Ento. 405)

412. **Plants Useful to Man (2)** GC S Lecture-demonstration course for teachers and others wishing information on the uses of plants: foods and food plants, medicinal plants, plants and industry, plants in textiles and other manufacturers.

413. **The Plant Kingdom (3)** GC S Designed for public school teachers and others wishing to become familiar with the major plant groups in our environment; collecting and growing plants. Field trip.

414. **Plants of the Desert (2)** GC S Designed for teachers and others wishing to become familiar with common native and cultivated plants; identification, ecology, and uses.

418a-418b. **Scientific Illustration-Photography (2 to 4 — 2 to 4)** GC Individual basic training in the execution of thesis drawings and graphic art techniques. 418a: Illustration. 418b: Photography. Consult dept. before enrolling. (Identical with Anth. 418a-418b)

421. **Philosophy of the Biological Sciences (3)** GC 1987-88 (Identical with Phil. 421)

428R. **Advanced Microbial Genetics (3)** GC II (Identical with M.C.B. 428R)

428L. **Advanced Microbial Genetics Laboratory (2)** GC I (Identical with M.C.B. 428L)

431. **Environmental Physiology (3)** GC II 1987-88 Analysis and synthesis of recent studies of the physiological responses of animals to their environments. P, 468R.

433. **Advanced Scientific Illustration (4)** GC S Individualized advanced work in scientific illustration; lecture demonstrations on a variety of techniques. Field trips. P, 418a. (Identical with Anth. 433)

434. **Population Interactions (4)** GC I Empirical and theoretical treatment of competition, exploitation, and mutualism within and between species, with emphasis on application of modern dynamics to ecological problems. Computer lab. 3R, 3L. P, 302, two semesters of calculus.

435. **Evolution (3)** GC I A balanced survey of the present-day concepts of the process and products of evolution, with emphasis on contrasting models and their consequences; recent techniques for the elucidation of phylogenetic pathways. P, 302, 320; Math. 125a, CR 125b. (Identical with Gene. 435)

436. **Plant Ecology (4)** GC II Dynamic processes giving rise to ecological patterns in plant populations and communities. 2R, 6L. Field trips. P, 302 and a basic ecology and a basic botany course.

438. **Biogeography (3)** GC II The role of historical events and ecological processes in determining the past and present geographic distribution of plants and animals. P, 302 or Geos. 225. (Identical with Geos. 438)

440R. **Oceanography (2)** GC II Introduction to the physical, chemical, geological, and biological dimensions of the oceans, with emphasis on their importance as biological environments.

440L. **Oceanography Laboratory (2)** GC II Field and lab. investigations of the Gulf of California, with emphasis on research techniques important to biological oceanography. Weekend field trips. P. 440R or CR.
441. Limnology (4) GC I (Identical with W.F.Sc. 441)

442. Marine Ecology (6) GC S A field introduction to basic concepts in marine ecology with emphasis on the behavior and ecology of invertebrates and fishes and the factors affecting the diversity and community structure of marine communities. The entire course is conducted at selected sites in the Gulf of California. Consult instructor before enrolling.

444. Insect Ecology (3) GC I (Identical with Ento. 444)

445. Ecology and Evolution of Insect/Host Plant Associations (1) GC II (Identical with Ento. 445)


458. Comparative Vertebrate Anatomy (4) GC I (Identical with V.Sc. 458)

459. Comparative Vertebrate Histology (4) GC II (Identical with V.Sc. 459)

460. Plant Physiology (4) GC I (Identical with M.C.B. 460)

463a-463b. Human Physiology Laboratory (1-1) GC Lab. for 464a-464b. P, CR 464a-464b. (Identical with M.C.B. 463a-463b and Tox. 463a-463b)

464a-464b. Human Physiology (3-3) GC Basic principles and concepts of physiology applied to humans. P, 304; Chem. 241b, 243b. (Identical with M.C.B. 464a-464b and Tox. 464a-464b)

468R. Comparative Physiology (3) GC I The responses of physiological systems to the environment; energy exchanges, respiration, thermal and osmotic regulation, locomotion, behavioral regulation, and integration of responses. P, 181, 182.

468L. Comparative Physiology Laboratory (1) GC I Physiological measurement techniques in laboratory and field studies. P, CR 468R.

470. Plant Diversity and Evolution (4) GC I Survey of the plant kingdom, with emphasis on comparative structure and evolution of major plant divisions. 2R, 6L. Field trips. P, 4 units of bio. or p.l.s.

472. Systematic Botany (4) GC II Evolutionary relationships of orders and families of spermatophytes; systems of classification; collection and identification of local flora. 2R, 6L.

473. Legumes, Grasses, and Composites (2) GC I 1988-89 Identification and classification of the three largest flowering plant families of the Southwest. 6L.

475. Freshwater Algae (4) GC II 1987-88 Systematics, ecology, and evolution of planktonic and benthic species; field techniques and lab. culture. 2R, 6L. Field trips. P, 4 units of bio. or p.l.s.

477. Aquatic Plants (3) GC I Identification, ecology and economic importance of freshwater aquatic plants, as related to fisheries, wildlife management, limnology, plant ecology and aquatic biology. 2R, 3L. Field trips. P, 4 units of bio. or p.l.s.

480. Invertebrate Zoology (4) GC I Comparative morphology, physiology, and ecology of invertebrates. 2R, 6L. Field trips. P, 182.

482. Ichthyology (4) GC I Ecology, evolution and systematics of fishes, with field and lab. emphasis on Gulf of California and Arizona fishes. 2R, 6L. Weekend field trips. P, 182. (Identical with W.F.Sc. 482)

483. Herpetology (4) GC II Systematics, ecology, and evolution of the amphibians and reptiles. 2R, 6L or field work. P, 304.

484. Ornithology (4) GC II Natural history of birds and its bearing upon the problems of animal behavior, distribution, and evolution. 2R, 2L. Field trips. P, one basic biology course. (Identical with W.F.Sc. 484) Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

485. Mammalogy (4) GC I Systematics, ecology, and evolution of mammals. 2R, 6L or field work. P, 304. (Identical with W.F.Sc. 485)

487. Animal Behavior (3) GC I Concepts and principles of the evolution, development, causation and function of behavior, with emphasis on the adaptiveness of behavior; discussion and films. P, 8 units of bio. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


512. Insect Behavior (3) II 1987-88 (Identical with Ento. 512)
DEPARTMENTS AND COURSES OF INSTRUCTION

523. Cytogenetics (3) II Investigation into the structure and function of chromosomes and their role in heredity and evolution. 2R, 3L. P, 320. (Identical with Gene. 523)

524. Theoretical Population Genetics (3) I Mathematical theory of modern population genetics developed from first principles, with emphasis on evolutionary implications and the historical development of ideas. P, 320, Math. 223. (Identical with Anth. 524 and Gene. 524)

525. Speciation (2) [Rpt.] II Mechanisms of evolution in the formation of races and species of animals and plants. P, 320. (Identical with Gene. 525)


580. Selected Studies in Malacology (2 to 4) [Rpt.] II Recent advances in malacology. 2R, 6L. Field trips. P, 480.

584. Selected Studies of Birds (2) [Rpt.] I Recent advances in ornithology. 1R, 3L or field trip. P, 484. (Identical with W.F.Sc. 584)


596. Seminar
   a. Evolutionary Ecology (1 to 2) [Rpt./5] II
   b. Population Biology (1) [Rpt./6] I II Open to majors only.
   f. Sociology (2) [Rpt./3] GC I
   j. Plant Population Ecology (1 to 3) [Rpt./5] I

610a-610b. Research in Ecology and Evolution (1-1) I II Introduction to the research currently being pursued by faculty and staff in the department. Open to majors only.

620. Applications and Techniques of Human Genetics (3) [Rpt.] I (Identical with Gene. 620)

670. Recent Advances in Genetics (2) I (Identical with Gene. 670)

ECONOMICS

Professors Edward E. Zajac, Head, Gerald O. Bierwag, Phillip J. Bryson, John E. Buehler, James C. Cox, Helmut J. Frank (Emeritus), Bernard P. Herber, Jimmye S. Hillman (Agricultural Economics), Reka P. Hoff (Law), Philip G. Hudson (Emeritus), Robert H. Marshall, Leahmae McCoy (Emerita), Ronald L. Oaxaca, Kenneth R. Smith, Vernon L. Smith, Lester D. Taylor, Donald A. Wells

Associate Professors Michael K. Block (Management and Policy), David A. Conn, John Z. Drabicki, Donald G. Heckerman, R. Mark Isaac, Gary D. Libecap, James C. McBrearty, David E. Pingry, Gerald J. Swanson, Ronald J. Vogel (Management and Policy)

Assistant Professors Eskander Alvi, Kevin A. McCabe, Sharon B. Megdal, Michael R. Ransom, Stanley S. Reynolds, Fernando M. C. B. Saldanha, Barbara N. Sands

Lecturer R. Bruce Billings

The study of economics is designed for those who wish to concentrate in economic analysis to prepare for careers in business, government, teaching, or private research and consulting.

A Bachelor of Arts with a major in economics is available through the College of Arts and Sciences. The degrees of Bachelor of Science in Business Administration with a major in business economics, and Master of Arts and Doctor of Philosophy with a major in economics are also offered. The department participates in the Master of Business Administration and the Master of Public Administration degrees as well.

Two undergraduate minors are offered: a teaching minor and a general minor for nonbusiness students.

The department offers a structured honors program open to nonmajors as well as majors in economics. The program is normally entered in the junior year and consists of four courses: 332H, 361H, 422H, and an elective senior-level course such as 406H, 441H, 460H, 461H, or 481H. Additional information can be obtained by contacting the department.
The major in economics consists of a minimum of 30 units, including 201a-201b or 210, 330, 361, 439 (or M.A.P. 275 and 375, or Math. 461), 332 and 12 additional upper-division units of which at least 6 units must be selected from 401, 405, 406, 421, 422, 441, 460, 461, 481, 482 and 484. In addition, students contemplating graduate study in economics should take, at a minimum, Math. 125a-125b and 215, Econ. 401 and 422; additional courses in computer science, statistics and mathematics are strongly recommended.

The major in business economics: See the College of Business and Public Administration section of this catalog.

The teaching minor: 24 units, including 201a-201b, 300 or 361, 330, 3 additional upper-division units in economics and 9 additional upper-division units in another social science.

The nonbusiness minor consists of a minimum of 20 units in economics, including 201a-201b or 210, 300, 330 and other electives needed to meet minor requirements of the student’s college.

Honors: The department participates in the Honors Program of the University. Honors courses are open to both majors and nonmajors. Students can obtain information by contacting the Honors Program of the University and the honors advisor of the department.

201a-201b. Principles of Economics (3-3) GRD 201a: Nature of economics, price theory for the product market, factor prices, international economics. 201b: Introduction to the theory of national income and employment, money and banking, economic growth and stabilization. P, 2 units of high school algebra or Math. 116. Both 201a and 201b are offered each semester.

210. Survey of Economic Theory (3) I II Introduction to current economic theory. Not open to students with credit in 201a-201b. P, 6 units of calculus.

217. Resource and Environmental Economics (3) I (Identical with A.Ec. 217)

300.* Microeconomic Analysis for Business Decisions (3) I II GRD Examination of industrial structure; theory of prices under varying market conditions; applications to business problems. Not open to students with credit in 361. P, 201b or 210.

303.* History of Economic Thought (3) I The origins and evolution of contemporary economic doctrines; classical, socialist, Keynesian and neoclassical thought in past and present social contexts. P, 201b or 210.


308.* Economic History of Europe (3) I Europe's economic origins and development; process of industrialization; economic underpinnings of modern Europe. P, 201b or 210.

313.* Economics of Futures Markets (3) I II (Identical with A.Ec. 313)

330.* Money and Banking (3) I II GRD Nature of money and credit; commercial banking; Federal Reserve System; monetary theories; domestic and international monetary policies. P, 201b or 210.

332.* Aggregate Economic Analysis (3) I II Analysis of output, employment, interest rates, and the price level; the effects on these of changes in monetary and fiscal variables. P, 330.

339.* Economic Statistics (3) I II (Identical with A.Ec. 339)


382.* Labor and Public Policy (3) I Economic and legal analysis of the issues and problems arising out of executive, legislative, and judicial efforts to define the rights, duties, and responsibilities of labor and management in the field of industrial relations. P, 201b.

383.* Labor Arbitration (3) I 1988-89 Study of the place and function of arbitration in the field of labor management relations. P, 201b.


396H. Honors Proseminar (3) II

401.* Studies in Microeconomics (3) GC II Studies in microeconomics, such as the economics of imperfect information and uncertainty, externalities and public goods, and imperfect competition. P, 361, Math. 125b.

405.* Comparative Economic Systems (3) GC II Analysis of economic policy in market (capitalist) economies and of economic ideology and planning in command (Soviet-type) economies. P, 300 or 361.
406.* Introduction to Experimental Economics (3) GC II Lab. experimental studies of economic behavior; applications to monopoly, bilateral bargaining, and competitive markets under various exchange rules; speculation, voting processes, public goods. 2R, 3L. P, 210 or 300 or 361.

409.* Economic Anthropology (3) GC II (Identical with Anth. 409)

411.* Economic Development (3) GC II Analysis of the economic development process of newly developing nations. P, 201b or 210.

412.* Agricultural Economic Development in Latin America (3) GC II (Identical with A.Ec. 412)

421.* Introduction to Mathematical Economics (3) GC I Comparative statics, stability, classical optimization, the Kuhn-Tucker theory, calculus of variations, linear algebra, and game theory, and the application of these techniques in economic analysis. P, six upper-division units in econ.; Math. 125b.

422.* Introduction to Econometrics (3) GC II Statistical methods in estimating and testing economic models; single and simultaneous equation estimation, identification, forecasting, and problems caused by violating classical regression model assumptions. P, 439 or M.A.P. 375.

435.* Public Sector Economics (3) GC I The influence of governmental revenue and expenditure decisions on resource allocation, income distribution, and aggregate economic performance. P, 201b or 210.

436.* Economics of Fiscal Federalism (3) GC II Study of the economics of intergovernmental fiscal relationships in a federal system inclusive of allocational, distributional, and aggregate economic effects. P, 201b or 210.

441.* International Trade Theory (3) GC II General equilibrium analysis of product and input markets of international trade, tariffs, commercial policy, and growth and the welfare aspects of each. P, 300 or 361.

442.* International Economics (3) GC I Financial aspects of international trade relations and commercial policy. P, 300 or 330.

460.* Economic Organization and Governmental Policy (3) GC I Structure, conduct, and performance of American industry; governmental institutions and policies affecting business. P, 300 or 361; 439.

461.* Economics of Regulated Industries (3) GC II Economic analysis of the regulated sector of the American economy, including communications, transportation and energy industries; impact of existing and alternative public policies. P, 300 or 361.

476.* Natural Resource Economics (3) GC II (Identical with A.Ec. 476)

481.* Economics of Wage Determination (3) GC I Applications of economic theory and empirical methods to labor supply and demand, investment in human capital, minimum wages, union effects on relative wages, and labor market discrimination. P, 300 or 361.

482.* Labor and the Economy (3) GC II Macro aspects of labor economics: unemployment — causes and cures; unemployment and inflation; distribution of income. P, 300 or 361.

483.* Urban Economics (3) GC II Problems of metropolitan areas; evaluation of alternative solutions. P, 201b or 210. (Identical with B.S. 483)

484.* Regional Economics (3) GC I Location theory, regional growth, techniques of regional analysis. P, 300 or 361.

487.* Health Economics (3) GC II A study of pricing, allocation, and distribution in the health-care industry, with particular emphasis on the economic effects of current governmental policy. P, 201b.

497.* Workshop
   a. Economics Education Workshop (2) GC S Consult instructor before enrolling.
   b. Summer Institute on the American Economy (3) GC S Consult instructor before enrolling.
   c. Economic Issues for Teachers (3) GC S Consult instructor before enrolling.

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

500. Managerial Economics (3) I II S Microeconomic theory and applications. P, M.I.S. 400 or Math 119 and 123. Advanced degree credit available for nonmajors only. Open only to students admitted to a BPA graduate program.


504. Production Economics (3) I (Identical with A.Ec. 504)

510. **Macroeconomics** (3) I II S Theory of income, employment, interest rates, and the price level. P, 500. Advanced degree credit available for nonmajors only. Open only to students admitted to a BPA graduate program.

511. **Microeconomic Theory and Behavior** (3) I Microeconomic theory with an emphasis on the use of experimental laboratory and field methods for testing the behavioral implications of the theory. P, 520, Math. 125a and 125b.

512. **International Agricultural Economic Development** (3) II (Identical with A.Ec. 512)

513. **Agricultural Price and Marketing Analysis** (3) II (Identical with A.Ec. 513)

514. **Cost-Benefit Analysis** (3) II (Identical with A.Ec. 514)

515. **Operations Research in Applied Economics** (3) I (Identical with A.Ec. 515)

520. **Theory of Quantitative Methods in Economics** (3) II Introduction to the basic concepts of statistics and their application to the analysis of economic data. P, 521.


534. **Public Finance** (3) I II The study of public fiscal economics, with emphasis on relevant topics for public administration and urban planning grad. students: public goods, tax and nontax revenues, intergovernmental issues, benefit-cost analysis. P, 500a.

536. **Innovation and Economic Growth** (3) I (Identical with Mktg. 536)

553. **Business and Economic Forecasting** (3) II Forecasting techniques used in business; assembly, interpretation and use of economic data; analysis of business conditions; examination of related environmental factors; construction of actual industry sales forecasts. P, 510, M.A.P. 552. Advanced degree credit available for nonmajors only.

560. **Theory and Institutions in Industrial Organization** (3) I II Major issues in the field of industrial organization. Theoretical issues presented with complementary material dealing with specific American industries. P, 500.

568. **Environmental Scanning** (3) I Using information from the economy to develop a firm's competitive strategy. Multidisciplinary, with concepts from economics, marketing, and management. An MBA integrative course. Open only to students admitted to BPA graduate programs. P, 500, Fin. 511, Mktg. 500. (Identical with M.A.P. 568 and Mktg. 568)


576. **Advanced Natural Resource Economics** (3) I (Identical with A.Ec. 576)

577. **Natural Resource Economics and Public Policy** (3) II (Identical with A.Ec. 577)

597. **Workshop**

696. **Seminar**
   a. Experimental Economics I (3) II
   b. Experimental Economics II (3) I
   c. Economic Analysis of Organizations I (3) II
   d. Economic Analysis of Organizations II (3) I
   e. Econometric Modeling I (3) II
   f. Econometric Modeling II (3) I
   g. Monetary Economics (3) I
   h. Labor Economics I (3) II
   i. Labor Economics II (3) I
   j. Public Policy Analysis I (3) II
   k. Public Policy Analysis II (3) I
   l. International Economics I (3) II
   m. International Economics II (3) I
   n. Advanced Macroeconomic Theory I (3) II
   o. Advanced Macroeconomic Theory II (3) I
   p. Industrial Organization and Regulation I (3) II
   q. Industrial Organization and Regulation II (3) I
   r. Advanced Microeconomic Theory I (3) II
   s. Advanced Microeconomic Theory II (3) I
   t. Mathematical Economics (3) I II
   u. Game Theory (3) I II
DEPARTMENTS AND COURSES OF INSTRUCTION

697. Workshop
- d. Labor Economics (3) I P, 696i.
- e. Public Policy Analysis (3) I P, 696k.
- g. Advanced Macroeconomic Theory (3) I P, 696o.
- h. Industrial Organization and Regulation (3) I P, 696q.
- i. Advanced Microeconomic Theory (3) I P, 696s.

EDUCATIONAL FOUNDATIONS AND ADMINISTRATION


Associate Professors Sheila Slaughter, *Head*, Harley D. Christiansen, Sarah M. Dinham, Lee A. Droegemueller, Stanley Pogrow, Donal M. Sacken

Assistant Professors Sharon Conley, Marcello Medina, Gary Rhoades, Richard Ruiz

The division offers programs leading to the Master of Arts and Master of Education degrees with majors in educational administration, educational psychology, foundations of education, and higher education. The Educational Specialist degree is offered with majors in educational administration and educational psychology. The Doctor of Education degree is offered with majors in educational administration and higher education. The Doctor of Philosophy degree is offered with majors in educational psychology, foundations of education, and higher education. The availability of the educational psychology and the foundations of education majors for the Doctor of Education degree and the educational administration major for the Doctor of Philosophy degree were under review at the time of catalog production. Admissions to these programs have been withheld, pending review. For information on concentrations, graduate admission, and graduate degree requirements, please consult the Graduate Catalog.

At the time the catalog was being edited, many programs in the College of Education were being redesigned. All current and prospective students should check with the Office of Student Services in the College of Education or the Division of Educational Foundations and Administration for current admission and degree requirements in each major.

Educational Administration

226. Introduction to Education and Careers (3) II The educational system in the United States, including higher education, and a review of careers in education in addition to the classroom teacher.

350. Social Foundations of Education (3) I II Introduction to the cultural and social influences on educational theory and practice.

476. Philosophical Foundations of Education (3) GC II Introduction to philosophy as general educational theory; logic for teachers, major philosophic thinkers, value theory, and epistemology.

487. Microcomputers in Education (3) GC I II S The microcomputer as object, medium, and manager of instruction; emphasis on computer literacy, classroom uses, and hands-on instruction.

488. Microcomputer Application in Education (3) GC I II S The microcomputer as the object and medium of instruction and as a management tool in the school setting; special emphasis on advanced programming techniques, Disk Basic, and Disk Operating Systems. P, 487.

567. Law for Teachers and Student Personnel Workers (3) I II Law in the school and university setting; nature of the legal process; forces behind law and education; law and education as social processes and institutions; legal rights and responsibilities.

601. Current Problems in Education (3) I II The problems found in current educational literature, research studies, and school reports.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>604</td>
<td>Educational Administration in Anthropological Perspective (3)</td>
<td>The application of anthropological field techniques and theory to specific educational problems associated with school administration.</td>
</tr>
<tr>
<td>605</td>
<td>Social/Cultural Perspectives of School Administration (3)</td>
<td>The use of social science theory and methodology in analyzing school administration problems and solutions.</td>
</tr>
<tr>
<td>606</td>
<td>Comparative Education (3)</td>
<td>Emphasis on comparative education methodology; analysis of selected national education systems, with focus on sociocultural foundations; curriculum and instruction; teacher education; contemporary trends and issues; implications for education in the United States.</td>
</tr>
<tr>
<td>607</td>
<td>Pragmatic Philosophies of Education (3)</td>
<td>Intensive analysis of modern philosophies and their relationships to American educational thought; the emergence of the &quot;pragmatic&quot; curriculum.</td>
</tr>
<tr>
<td>610</td>
<td>Philosophy of Education (3)</td>
<td>Analysis of values and conflicts in American culture as these direct educational policy; critical examination of contending philosophies in the light of democratic ideals.</td>
</tr>
<tr>
<td>611</td>
<td>History of Western Education (3)</td>
<td>The historical development of western educational thought from its origins to the present.</td>
</tr>
<tr>
<td>612</td>
<td>History of Education in the United States (3)</td>
<td>The development of American educational thought from its colonial origin to the present.</td>
</tr>
<tr>
<td>614</td>
<td>State School Systems and School Law (3)</td>
<td>Legal provisions for the government of state school systems; legal basis of local, state and federal relations in education; legal principles relating to pupils, teachers, and school administrators.</td>
</tr>
<tr>
<td>616</td>
<td>General School Administration (3)</td>
<td>Organization structures and purposes through which societal demands for education are met; administrative competencies and skills.</td>
</tr>
<tr>
<td>647</td>
<td>The Principalship (3)</td>
<td>Functions and activities of building-level administrators, with emphasis on instruction, staff development, student services evaluation, and operational services.</td>
</tr>
<tr>
<td>648</td>
<td>The Superintendency (3)</td>
<td>Functions and responsibilities of the chief school executive and central office staff, with emphasis on external and internal system relationships in policy formation and decision-making.</td>
</tr>
<tr>
<td>664</td>
<td>Theory and Behavior in School Administration (3)</td>
<td>Theory in administration: patterns of theory classifications; relationships of theory to administrative function and organizational dynamics. P, 9 graduate units in educational administration.</td>
</tr>
<tr>
<td>670</td>
<td>Personnel Administration in Education (3)</td>
<td>Composition of school staffs and the functions of various personnel; patterns and practices in school personnel management; issues, trends, and prospects in personnel management. P, 15 graduate units in education or CR.</td>
</tr>
<tr>
<td>671</td>
<td>School Finance (3)</td>
<td>Historical background of the financing of education in the United States; economics and principles; sources and distribution of funds for education; budgeting, accounting, and reports.</td>
</tr>
<tr>
<td>672</td>
<td>School Business Management (3)</td>
<td>The general management of school business; administration and accounting of school funds; administration of equipment and supplies; other business operations. P, 9 graduate units in school administration.</td>
</tr>
<tr>
<td>675</td>
<td>The Law and American Education (3)</td>
<td>The analysis of educational questions as influenced by legal principles and the case law; effect of legal provisions upon administrative and other educational decisions and upon social policy.</td>
</tr>
<tr>
<td>676</td>
<td>Supervision of the Instructional Program (3)</td>
<td>Purposes of instructional supervision: organization, techniques and skills for supervisory competency.</td>
</tr>
<tr>
<td>678</td>
<td>Educational Sociology (3)</td>
<td>The school as a social institution; social functions of the school; social processes, socialization, and stratification in education; informal and formal systems and the bureaucratic structure of the school.</td>
</tr>
<tr>
<td>680</td>
<td>Administrative Leadership (3)</td>
<td>Explores the leadership process in education, including the use of power and authority in relation to existing social, organizational, and behavioral theories. P, 15 graduate units in educational administration.</td>
</tr>
<tr>
<td>684</td>
<td>Administration of Bilingual Education Programs (3)</td>
<td>Dynamics of the administration of educational programs for the bilingual learner including socio-political realities, mandated federal and state funded educational programs, and effective community participation.</td>
</tr>
<tr>
<td>694</td>
<td>Practicum</td>
<td>a. Educational Administration (1 to 3) [Rpt./12 units]</td>
</tr>
<tr>
<td>695</td>
<td>Colloquium</td>
<td>a. Issues in Educational Administration (1 to 3) [Rpt./12 units]</td>
</tr>
<tr>
<td>696</td>
<td>Seminar</td>
<td>a. Topics in Educational Administration (1 to 3) [Rpt./12 units]</td>
</tr>
</tbody>
</table>
### DEPARTMENTS AND COURSES OF INSTRUCTION

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>2.40</td>
<td><strong>DEPARTMENTS AND COURSES OF INSTRUCTION</strong></td>
<td></td>
</tr>
<tr>
<td>697.</td>
<td>Workshop</td>
<td><strong>Educational Psychology</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Workshop</strong></td>
<td>a. Problems in Educational Administration (1 to 3) [Rpt./12 units] II</td>
</tr>
<tr>
<td>300.</td>
<td>Development Throughout Life (3)</td>
<td>II Life span development within the context of physical, intellectual, social, emotional, and moral development; emphasis on the dynamics of personal growth.</td>
</tr>
<tr>
<td>301.</td>
<td>Child Development (3)</td>
<td>II Human growth and development from conception through early adolescence; integration of behavioral principles into the elementary school setting.</td>
</tr>
<tr>
<td>302.</td>
<td>Adolescent Development (3)</td>
<td>II Concepts of human development from early adolescence through young adulthood; consideration of major influences on physical, cognitive, and social development with emphasis within the school environment.</td>
</tr>
<tr>
<td>310.</td>
<td>Learning in the Schools (3)</td>
<td>II Psychological principles applied to learning and instructional design in the educational setting, emphasizing learning and instructional variables and their applications.</td>
</tr>
<tr>
<td>311.</td>
<td>Learning and Development in the Secondary School (3)</td>
<td>II S Psychological and developmental principles relevant to learning in the secondary school setting. Credit is allowed for this course or 310, but not for both. Open to secondary education majors only.</td>
</tr>
<tr>
<td>340.</td>
<td>Statistics and Measurement for Research in Education (3)</td>
<td>II Basic concepts essential to the comprehension of research in education, including measurement principles and descriptive statistics.</td>
</tr>
<tr>
<td>358.</td>
<td>Psychological Measurement in Education (3)</td>
<td>II Psychometric methods as applied to the assessment of achievement, mental ability, and attitudes.</td>
</tr>
<tr>
<td>500.</td>
<td>Life Span Development (3)</td>
<td>II Dynamics of development, social integration and roles across the life span. Special emphasis on cognitive, emotional, and personality development with concentration on the antecedent events to adult life experiences. (Identical with C.D.F.R. 500)</td>
</tr>
<tr>
<td>501.</td>
<td>Advanced Child Development (3)</td>
<td>II Aspects of growth and development which influence behavior of the school-age child; emphasis on current research findings. P, 301.</td>
</tr>
<tr>
<td>502.</td>
<td>Advanced Preadolescent Development (3)</td>
<td>II Focus on ages 10 to 14. Emphasis on the physical, cognitive, and social development within multiple contexts.</td>
</tr>
<tr>
<td>503.</td>
<td>Advanced Adolescent Development (3)</td>
<td>II Major developmental issues within the adolescent years; emphasis on the importance and design of adolescent research. (Identical with C.D.F.R. 503)</td>
</tr>
<tr>
<td>504.</td>
<td>Adult Learning and Development (3)</td>
<td>II Analysis of adult education and development; characteristics of adult learners and behavior and the consideration of life-long learning.</td>
</tr>
<tr>
<td>510.</td>
<td>Learning Theory in Education (3)</td>
<td>II Major theories of learning and motivation; emphasis on relationships between theory and practice in the schools.</td>
</tr>
<tr>
<td>517.</td>
<td>Classroom Application of Behavior Modification Techniques (3)</td>
<td>II Application of behavior principles and techniques to promote learning and social development of school-related behavior. 2R, 3L. P, 510 or CR.</td>
</tr>
<tr>
<td>530.</td>
<td>School Psychology (3)</td>
<td>II Roles of the school psychologist; implementing programs in the public schools; legal and ethical issues in school psychology. 2R, 3L.</td>
</tr>
<tr>
<td>541.</td>
<td>Statistical Methods in Education (3)</td>
<td>II Descriptive, correlational, and inferential procedures for presenting and analyzing school and research data. For students in all fields.</td>
</tr>
<tr>
<td>557.</td>
<td>Design of Questionnaires and Scales (3)</td>
<td>II Emphasis on theoretical and methodological issues related to the development of survey and rating scales, sampling procedures, and response bias.</td>
</tr>
<tr>
<td>558.</td>
<td>Educational Tests and Measurements (3)</td>
<td>II Theoretical and practical application of psychometric techniques to test construction, analysis, and interpretation of test results. P, 541.</td>
</tr>
<tr>
<td>559.</td>
<td>Testing of Minorities (3)</td>
<td>II Current theoretical, social, and practical issues in the use of norm-referenced tests with individuals from minority cultures.</td>
</tr>
<tr>
<td>560.</td>
<td>Disciplined Inquiry in Education (3)</td>
<td>II Research techniques in education, interpretation of data and the reporting of results.</td>
</tr>
<tr>
<td>600.</td>
<td>Theories of Human Development (3)</td>
<td>II History and analysis of psychological theories of human development and a comprehensive overview of major theoretical systems. P, 500 or 501.</td>
</tr>
</tbody>
</table>
613. **Psychological Theory in Educational Practice** (3) I Major theories of psychological thought; strategies for utilizing such theories in educationally relevant research. P, 510.

615. **Cognitive Development** (3) II Cognitive theory and research as they bear upon developmental and educational processes. P, 500 or 501.

619. **Design of Instruction** (3) II Historical and theoretical bases for developing instructional design; emphasis on relationship between learning theory and instructional design. P, 510.

638. **Behavioral Consultation in Educational Settings** (3) II Principles and techniques of conducting behavioral consultation in educational settings to promote learning and development of children and youth. 2R, 3L. P, 517.

640. **Advanced Statistical Methods in Education** (3) I II Inferential procedures for analyzing educational data; includes nonparametric methods and introduction to multivariate and causal procedures. P, 541.

646. **Multidimensional Methods in Educational Research** (3) II Provides an understanding of and facility with research application of multivariate correlational techniques, such as multiple regression, discriminant function, canonical correlation, and factor analysis. P, 640.

655. **Evaluating Standardized Tests** (3) I Technical standards for evaluating standardized tests and manuals with emphasis on the contemporary state of the field. P, 541 and 558 or CR.

658. **Theory of Measurement** (3) II Advanced topics in theoretical and practical issues in psychometrics. P, 558; 640 or CR.

667. **Theories of Intellectual Assessment** (3) I II Various theories and models of human ability and their implications for intellectual assessment. P, 558 or CR.

674a-674b. **Field Experience in Intellectual Assessment in Education** (3) Supervised field experience in the administration, scoring and interpretation of various intellectual assessment devices. 674a: Wechsler Adult Intelligence Scale. 674b: Intellectual assessment techniques. 1R, 3L. Open to majors and minors only. Credit allowed for 674a or 674b, but not for both. P, 673 or CR.

677. **Individual Assessment Techniques in the Schools** (3) II Techniques for assessing personality and social behavior; practice in implementing programs derived from assessment techniques. 2R, 3L. Open to majors and minors only. P, 674b.

679. **Psychoeducational Assessment in the Schools** (3) I Psychoeducational assessment techniques; practice in prescribing remedial programs. 2R, 3L. Open to majors and minors only. P, 673, 674b.

682. **Educational Program Evaluation Principles and Techniques** (1 to 3) I Development and current viewpoints, political context, illustrative cases, technical skills for determining merit or making decisions about educational and social programs. P, 541, 558.

685. **Child Behavior Disorders and Adjustment** (3) I II The diagnostic and assessment practices, theories, and research related to child behavior disorders. P, 530.


693. **Internship**
   - b. School Psychology (1 to 3) [Rpt./12 units] I II

694. **Practicum**
   - b. School Psychology (1 to 3) [Rpt./12 units] I II

695. **Colloquium**
   - b. Issues in Educational Psychology (1 to 3) [Rpt./12 units] I II

696. **Seminar**
   - b. Topics in Educational Psychology (1 to 3) [Rpt./12 units] I II

**Higher Education**

497. **Workshop**
   - a. Fiscal Stress in Higher Education (3) GC I

561. **The Community College** (3) I The scope, objectives, and educational functions of the community college, patterns of community college programs.

601. **Higher Education in the United States** (3) I The scope of higher education in the United States; brief survey of historical developments and philosophic bases; public policy issues at the state and federal level; types of institutions and their purposes; characteristics of faculty, students and curricula.
602. Foundations of Student Personnel Work in Higher Education (3) I Orientation to student personnel work in colleges and universities; interdisciplinary foundations; professional aspects; integrated lab. experience in selected campus settings.

608. The College Student (3) I History and characteristics of the college student; interactions with campus environmental influences; developmental and normative trends; major research findings.

609. Organization and Administration in Higher Education (3) I Organizational theory, structures, systems, and administrative procedures in varied higher education institutions; patterns of governance and policy development.

617. Student Personnel Services in Higher Education (3) II Student personnel services, purposes, procedures, representative programs, current trends.

621. Curriculum in Higher Education (3) II Early classical curriculum; development and administration of general education and professional studies; modern curriculum developments and innovations.

622. Teaching in Higher Education (3) II Planning, organizing, and evaluating learning experiences for mature students.

641. Institutional Research and Planning (3) I Development of institutional research programs for short-term and long-term planning; input and output measures.

650. Higher Education Finance (3) I Historical patterns of financing private and public higher education; current sources and types of financial support; alternative methods of financing; social benefits and consumer theories. Field trips.

651. Higher Education Business Management (3) II Budget planning and execution; systems of resource allocation; personnel management; physical plant planning and construction; information systems and use in management.

661. Higher Education and the Law (3) II Critical court decisions, past and present, affecting higher education; increasing role of the courts in decision making and policy development. Field trips. P, 601, 609, 621 or 650.

693. Internship
   c. Higher Education (1 to 3) [Rpt./12 units] II

695. Colloquium
   c. Issues in Higher Education (1 to 3) [Rpt./12 units] II

696. Seminar
   c. Topics in Higher Education (1 to 3) [Rpt./12 units] II

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ELECTRICAL AND COMPUTER ENGINEERING


Assistant Professors Randall K. Bahr, Keith D. Paulsen, Jerry Rozenblit, Ronald D. Schrimpf, Robin N. Strickland

The Department of Electrical and Computer Engineering in the College of Engineering offers the degrees of Bachelor of Science in Electrical Engineering and in Computer Engineering, and Master of Science and Doctor of Philosophy with a major in electrical engineering.

Both undergraduate curricula have the goal of educating immediately productive engineers who are also qualified to pursue further education as necessary to keep pace with these rapidly changing areas. The electrical engineering program prepares students for careers in such areas as electronics, microelectronics, communications, control, electromagnetics, and instrumentation.
The computer engineering program prepares students for careers in the dynamic and rapidly expanding field of computer technology. (See the College of Engineering and Mines section of this catalog for specific undergraduate program requirements.)

For information regarding the clinical engineering option, please see the College of Engineering section of this catalog. For graduate admission and degree requirements, consult the Graduate Catalog.

101. Introduction to Electrical Engineering (3) I II S CDT Introduction to selected fundamental concepts and techniques encountered in the practice of electrical engineering. Not open to students who have completed 221. 2R, 3L. P, 1/2 entrance unit trigonometry or Math. 118.

207. Elements of Electrical Engineering (3) I II S CDT Introductory survey of electrical engineering, with emphasis on electric power. P, Math. 125a, Phys. 103b or 116.


210. Geometrical Optics (3) I (Identical with Opti. 210)

220a-220b. Basic Circuits and Electronics (3-3) I II S CDT 220a: Analysis of elementary linear and nonlinear circuits, characteristics of common electronic devices. P, CR Phys. 116, Math. 223. 220b: Transient and sinusoidal analysis, electronic circuit applications. P, CR Math. 254. Both 220a and 220b are offered each semester. Credit will be allowed for only one of the following sequences of courses: 220a-220b or 207 and 208.

226. Physical Optics (3) II (Identical with Opti. 226)

271a-271b. Digital Systems and Microprocessors (3-3) I II S CDT 271a: Number systems and coding, logic design, sequential systems, computer organization. P, CR Phys. 116. 271b: Microprocessor programming, assembly language, input/output, stacks and interrupts. Both 271a and 271b will be offered each semester.

301. Electrical Engineering Laboratory (3) I II S CDT Emphasis on measurement techniques, lab. procedures, and operating principles of basic instruments. Experiments deal primarily with basic circuit and electronic concepts. P, CR 321a, 351a.


350. Radiometry, Sources, and Detectors (3) I (Identical with Opti. 350)


370. Lasers and Electro-Optical Devices (3) II (Identical with Opti. 370)


372. Computer System Hardware (3) I II Computer components and circuits, random and sequential memory devices, peripherals and interface design, case studies of computer systems. 2R, 3L. P, 371.

381. Introductory Electromagnetics (3) I Quasi statics, potential field concepts. Maxwell’s equations, plane waves, antennas, waveguides, transmission lines. P, Math. 322.

411. Electronic Instrumentation (1 to 3) GC I Individualized instructional units in specific areas: light, temperature, psychometry, reference electrodes, gas analysis, basic electric circuits, signal processing. P, college physics.

412. Optical Instrumentation (3) I (Identical with Opti. 412)

415. Medical Instrumentation (3) GC I Basic concepts of instrumentation and measurement; principles of transducers, operational amplifiers and instrument systems, with emphasis on biomedical measurements; lab. experiments with transducers and medical equipment. 2R, 3L. P, sr. engineering.

416. Optical Design, Fabrication and Testing (3) II (Identical with Opti. 416)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>417</td>
<td>Clinical Engineering (3) GC II</td>
<td>Activities and responsibilities of clinical engineers; hospital facilities,</td>
<td>P, 208 or 351b</td>
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<tr>
<td></td>
<td></td>
<td>medical equipment specifications and control, safety, management and health</td>
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<td></td>
<td></td>
<td>care. (Identical with A.M.E. 417)</td>
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<tr>
<td>418</td>
<td>Physiology for Engineers (4) GC I</td>
<td>(Identical with Psio. 418)</td>
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<tr>
<td>419</td>
<td>Physiology Laboratory (2) GC I</td>
<td>(Identical with Psio. 419)</td>
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<tr>
<td>420-421</td>
<td>Active and Passive Filter Design (3) GC I</td>
<td>Methods for realizing Butterworth, Chebychev, Thomson and Elliptic filters;</td>
<td>P, 321b</td>
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<td></td>
<td></td>
<td>verification and testing of realizations. P, 321b</td>
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<tr>
<td>422</td>
<td>Modern Filtering and Signal-Processing Techniques (3)</td>
<td>GC II Operational amplifier circuits; basic active RC filter design;</td>
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<td></td>
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<td>nonlinear wave shaping; analog switches; A/D and D/A conversion. P, 321b</td>
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<tr>
<td>423</td>
<td>Digital Signal Processing (3) GC I</td>
<td>Discrete-time signals. Z-transforms. DFT and FFT. Digital filter design.</td>
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<tr>
<td>424-425</td>
<td>Principles of Communication Systems (3) GC I II</td>
<td>Signal analysis techniques associated with modulation and demodulation in</td>
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<td></td>
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<td>systems such as AM, FM, and PCM, with special emphasis on digital</td>
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<td>communication. P, 305, 351b</td>
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<tr>
<td>426</td>
<td>Noise in Communication Systems (3) GC II</td>
<td>Principles of communication in the presence of noise; discussion of basic</td>
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<td>361.</td>
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<td>427</td>
<td>Electrical and Optical Properties of Semiconducting</td>
<td>Materials (3) GC I (Identical with M.S.E. 434)</td>
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<td>428</td>
<td>Introduction to Coding Techniques (3) GC II</td>
<td>Error-correcting codes used in modern digital communications systems, with</td>
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<td></td>
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<td>emphasis on hardware implementations and performance on real channels. P,</td>
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<td>271a and Stat. 361.</td>
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<tr>
<td>429</td>
<td>Automatic Control (3) GC I II</td>
<td>Linear control system representation in time and frequency domains, feedback</td>
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<td></td>
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<td>control system characteristics, performance analysis and stability, design</td>
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<td>of control. P, 305, 321b</td>
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<tr>
<td>430</td>
<td>Digital Control Systems (3) GC II</td>
<td>Modeling, analysis, and design of digital control systems; A/D and D/A</td>
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<td>conversions, Z-transforms, time and frequency domain representations, stability,</td>
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<td>microprocessor-based designs. P, 44l.</td>
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<td>431</td>
<td>Direct Energy Conversion (3) GC II</td>
<td>(Identical with N.E.E. 445)</td>
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<td>432</td>
<td>Introduction to Physical Electronics (3) GC II</td>
<td>Basic principles governing the operation of electronic devices. Particles</td>
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<td>in fields, microsystems, statistics, elements of quantum mechanics, emission,</td>
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<td>vacuum, plasmas, solid state, lasers. P, 381, senior standing.</td>
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<td>433</td>
<td>Solid-State Device Design (3) GC II</td>
<td>Properties of semiconductors, impurity behavior, solid-state effects; the</td>
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<td>operation of p-n junctions, transistors, photocells, tunnel diodes, surface</td>
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<td>devices. P, 381.</td>
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<tr>
<td>434</td>
<td>Electronic Packaging Principles (3) GC I II</td>
<td>Introduction to problems encountered at all levels of packaging: thermal,</td>
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<tr>
<td></td>
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<td>mechanical, electrical, reliability, materials and system integration. Future</td>
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<td>trends in packaging. P, senior standing in engineering or science.</td>
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<td>435</td>
<td>Elementary Digital Circuit Design (3) GC II</td>
<td>Emphasis on first-order analysis and design; integrated bipolar digital and</td>
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<td></td>
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<td>MOS logic circuits. P, 351b</td>
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<tr>
<td>436</td>
<td>Optoelectronics (3) GC I</td>
<td>Properties and applications of optoelectronic devices and systems. Topics</td>
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<td>include radiation sources, detector circuits, fiber optics, and electro-optical</td>
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<td>components. P, 351b and 381</td>
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<td>437</td>
<td>Integrated Circuit Technology Laboratory (3) GC I II</td>
<td>Theory of and experiments in diffusion, oxidation, etc.; fabrication of an</td>
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<td></td>
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<td>integrated circuit. (Identical with M.S.E. 457)</td>
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<tr>
<td>438</td>
<td>Solid-State Circuits (3) GC I</td>
<td>Intermediate level circuitry and devices, with applications ranging from</td>
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<td>DC to the microwave and optical regions; consideration of discrete and</td>
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<td>integrated circuits. P, 321b, 351b</td>
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<tr>
<td>459a-459b</td>
<td>Laser Engineering (3-3) GC . 459a: Introduction to</td>
<td>lasers, laser radiation and laser applications (radar, communications and</td>
<td>P, 351a, 381.</td>
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<tr>
<td></td>
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<td>holography). P, 381. 459b: Exciting laser media, intermediate level classical</td>
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<td>and quantum laser physics, relativistic laser engineering, including laser</td>
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<td>and particle beam weapons, and conventional laser engineering (both thermal</td>
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<td>460</td>
<td>Energy Conversion (3) GC I Principles and operating</td>
<td>characteristics of rotating machinery and electromagnetic transducers,</td>
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<td>single-phase and polyphase transformer operation, laboratory demonstrations</td>
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<td>and tests of transformers and rotating machinery. P, 321b, 381.</td>
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<tr>
<td>461</td>
<td>Symmetrical Components (3) GC I Three-phase circuit</td>
<td>analysis; analysis of fault conditions in power systems. Field trip. P, 321b.</td>
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</tr>
<tr>
<td>462</td>
<td>Electric Power Systems (3) GC II Analysis of a</td>
<td>balanced utility power network; load flow and economic dispatch solutions by</td>
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<td>interactive computer systems. P, 321b.</td>
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<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Description</td>
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<tr>
<td>465</td>
<td>Current Problems in Energy and Power (1 to 4)</td>
<td>4</td>
<td>[Rpt./1] GC II (Identical with N.E.E. 465)</td>
</tr>
<tr>
<td>466</td>
<td>Power Plant Electrical Design (3)</td>
<td>3</td>
<td>GC II Basic elements of power plant electrical design for both the generating system and the plant auxiliary system, including selection and sizing of major electrical equipment. P, 461 or 462. (Identical with N.E.E. 466)</td>
</tr>
<tr>
<td>467</td>
<td>Solar Energy Engineering (3)</td>
<td>3</td>
<td>GC I (Identical with N.E.E. 467)</td>
</tr>
<tr>
<td>470a-470b</td>
<td>Optics Laboratory (3-3)</td>
<td>3</td>
<td>[Identical with Opti. 470a-470b]</td>
</tr>
<tr>
<td>472</td>
<td>Continuous-System Simulation (3)</td>
<td>3</td>
<td>GC I Interdisciplinary introduction to continuous-system simulation, mainly digital; modeling, state equations, languages, sensitivity and optimization. P, 305. (Identical with C.Sc. 472)</td>
</tr>
<tr>
<td>473</td>
<td>Software Engineering Concepts (3)</td>
<td>3</td>
<td>GC II In-depth consideration of each of the phases of the software project life cycle. Includes a large-scale software development project involving groups of students. 2R, 3L. P, 371 or C.Sc. 227.</td>
</tr>
<tr>
<td>474</td>
<td>Digital Logic Design (3)</td>
<td>3</td>
<td>GC I II Truth-functional calculus, Boolean algebra, map tabular minimization, coding, synthesis of sequential circuits, computer-aided engineering of digital circuits, selected laboratory exercises. 3R, 3L. P, 271b. (Identical with C.Sc. 474)</td>
</tr>
<tr>
<td>475</td>
<td>Microcomputer-Based Design (3)</td>
<td>3</td>
<td>GC I II Design of microprocessor-based real-time test and control systems, use of development systems and emulators. 2R, 3L. P, 372.</td>
</tr>
<tr>
<td>476</td>
<td>Computer Architecture (3)</td>
<td>3</td>
<td>GC I (Identical with C.Sc. 476)</td>
</tr>
<tr>
<td>477</td>
<td>Environmental Impact of Energy-Related Systems (3)</td>
<td>3</td>
<td>GC II (Identical with C.E. 477)</td>
</tr>
<tr>
<td>478</td>
<td>Data Communications Networks (3)</td>
<td>3</td>
<td>GC I Characteristics of ISO Open Systems Interconnection Reference Model; design of broad band and baseband network interfaces; features of network, transport, session, and presentation layers; Ethernet and IEEE 802 interface. P, 371, 372 or equivalent.</td>
</tr>
<tr>
<td>479</td>
<td>Introduction to Knowledge Engineering (3)</td>
<td>3</td>
<td>GC I Heuristic search procedures, minimaxing, alpha-beta pruning. Knowledge acquisition, representation and utilization. Methodology of building expert systems. Introduction to Prolog and LISP. Each student is required to produce and implement a simple expert system. P, competence in some computer language.</td>
</tr>
<tr>
<td>481</td>
<td>Microwave Measurements (3)</td>
<td>3</td>
<td>GC II Measurement techniques and the application of hardware and test equipment in the modern microwave laboratory. 2R, 3L. P, 381.</td>
</tr>
<tr>
<td>482</td>
<td>Electromagnetics (3)</td>
<td>3</td>
<td>GC I Electrostatics and magnetostatics, review of Maxwell's equations, plane waves, rectangular and circular waveguides, resonators, and antennas. P, 381 or Phys. 415a.</td>
</tr>
<tr>
<td>484</td>
<td>Radio Waves (3)</td>
<td>3</td>
<td>GC II 1988-89 Geometrical ray tracing, diffraction and scattering, ground waves propagation, magneto-ionic theory, random media effects, topographic influences, satellite communications, and fiber optic transmission. P, 381.</td>
</tr>
<tr>
<td>493</td>
<td>Internship</td>
<td>3</td>
<td>a. Manufacturing (3) I II S P, junior standing.</td>
</tr>
<tr>
<td>495</td>
<td>Colloquium</td>
<td>3</td>
<td>a. Technical Communications (1) I II P, CR 494a and senior standing. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see &quot;Writing-Emphasis Courses&quot; in the Academic Guidelines section of this catalog).</td>
</tr>
<tr>
<td>501</td>
<td>Linear Systems Theory (3)</td>
<td>3</td>
<td>I Mathematical descriptions of linear systems, state-variable models, analysis methods-stability, controllability and observability, state feedback techniques, design of feedback controllers and observers.</td>
</tr>
<tr>
<td>502</td>
<td>Analytical Methods in Electrical Engineering (3)</td>
<td>3</td>
<td>I Linear vector spaces, analytic function theory, Green's functions, eigenfunction, expansions.</td>
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</tbody>
</table>
515. Advanced Medical Instrumentation (3) II Concepts and design of transducers, instrumentation and measurement systems, with emphasis on biomedical technology; research project on lab. computer. 2R, 3L.

521. Network Synthesis (3) I Synthesis of passive low-, high-, and band-pass network functions, time and frequency domain approximation, use of optimization techniques, properties of distributed elements.

522. Active RC Filters (3) II Modern techniques for realizing active RC filters, using lumped and distributed elements and operational amplifier gain blocks; determination of sensitivity.


531. Image Processing Laboratory (3) I Introduction to hardware and software used in image processing: image sampling and display systems, principles and applications; image processing software for image enhancement and information extraction; applied problems in natural resources, remote sensing. 3R, 3L. (Identical with Opti. 531)

532. Pattern Recognition and Computer Vision (3) II Computer pattern recognition and scene analysis. Theory, algorithms, and applications of computer vision and artificial intelligence. P, 531, 533. (Identical with Opti. 532)

533. Image Processing: Devices, Systems and Applications (3) II 1987-88 (Identical with Opti. 533)

534. Electronic, Magnetic and Optical Materials (3) II (Identical with M.S.E. 534)

539. Algebraic Coding Theory (3) II 1987-88 (Identical with Math. 539)


545. Decentralized Control and Large-Scale Systems (3) II 1987-88 Introduction to large-scale systems, definitions and special problems, modeling and model reduction, structural properties, decentralization of control and information, hierarchical and multi-level controllers. P, 501.


552. Linear Circuit Design (3) I Design of discrete and integrated solid-state circuits for small-signal applications; flow graph analysis; DC operational and wide-band amplifier design; power amplifier design.

553. Active Linear Circuit Design (3) II I.F. and R.F. band-pass amplifier design using solid-state devices; stagger-tuned I.F. amplifier and UHF band-pass amplifier design methods; fundamental concepts of design engineering. P, 552.


555. Layout Engineering for Integrated Circuits (3) I Development of layout ground rules; circuit design and layout methods for low sensitivity to parameter variations; use of SPICE and UAMASK programs for circuit simulation and layout. P, 457 or 458.

556. General Physical Electronics (3) I General overview of the physical principles of vacuum, plasma, solid-state and optical electronics. Topics include particle beams, magnetic properties of matter, holography.

558. Advanced Integrated Circuits Laboratory (3) II All phases of design and fabrication of a modern integrated circuit are considered and applied in the fabrication from concept to final test. 1R, 6L. P, 457, consult dept. before enrolling.
559. Microlithography and Optics (3) II Theory and practice of semiconductor microlithography materials, processes and optical instruments used in image formation and evaluation. 3R, 3-4L. P, 457.

560. Aerosol Science (3) I II (Identical with Atmo. 560)

567. Advanced Solar Engineering (3) II (Identical with N.E.E. 567)

569. Energy Use: Analysis and Management (3) I I (Identical with N.E.E. 569)

571. Digital Systems Design (3) I II Computer organization, memory systems, AHPL, control unit design, microprogramming, input-output, computer arithmetic, features of large computers, time sharing. P, computer programming. (Identical with C.Sc. 571)


574. Distributed Discrete Event Simulation (3) I Introduction to simulation methodology and its implementation on multi-processors. Modular hierarchical discrete event model design and mapping onto distributed simulator architectures. Prior course in simulation recommended.


577. Computer Aided Engineering for Integrated Circuits (3) I Industrial CAD systems for integrated circuits; programs for process and device simulation; terminal models of bipolar and MOS devices, automated circuit analysis, methods, programs, use of computer graphics. P, 452, 455.

578. Advanced Topics in Computer Networks (3) II Analysis and design of computer networks using advanced protocols, data encryption, internet gateways, artificial intelligence-based filters, and mixed transmissions media. Applications to local area networks, long haul networks, and metropolitan area networks. Open to majors only. P, 478.


581. Electromagnetic Field Theory (3) II Methods used in solving electromagnetic problems of current importance such as appearing in IEEE transactions on microwave theory and techniques, antennas and propagation, and electromagnetic compatibility, and radio science. P, 502 or Math. 422b, E.C.E. 482 or Phys. 415b.

583. Remote Sensing Instrumentation and Techniques (3) II Development of instrumentation, measurement and signal processing techniques required for electromagnetic remote sensing applications with emphasis on atmospheric remote sensing. P, 482a or other introductory electromagnetic course.

584. Advanced Antenna Theory and Design (3) II 1988-89 Electromagnetic radiation and diffraction; dipoles, slots, open wave guides, and horns; apertures, reflectors, and arrays; mechanical and electronic scanning; applications to practical radar and communications problems. P, 581.

585. Plasma Etching (3) II Practical methodology of basic etch processes in silicon, silicon oxide and nitride, and aluminum. Plasma physics and chemistry, computer simulation. P, 482, familiarity with processing techniques, or consult department before enrolling.

586. Geo-Electromagnetism (3) I 1987-88 Earth resistivity principles, induced polarization, electromagnetic induction and loop-loop coupling, earth conduction effects in power systems, well logging, geomagnetics, magnetotellurics and tunnel transmission. P, 482; 502 or Math. 422b; Phys. 415b. (Identical with Geos. 586)

589. Atmospheric Electricity (3) II 1987-88 (Identical with Atmo. 589)

636. Information Theory and Coding (3) II 1988-89 Definition of a measure of information and study of its properties; introduction to channel capacity and error-free communications over noisy channels; encoding and decoding systems, with emphasis on error correcting and error detecting codes for noisy binary channels. P, 503. (Identical with Math. 636)

639. Methods of Communication and Detection Theory and Signal Extraction (3) II 1987-88 Communication, detection and measurement as statistical decision problems; principles of communication in the presence of noise; discussion of AM, FM, and PCM; matched filter and correlation detection; coherent detection. P, 503.
652. Analysis and Design of Semiconductor Junction Devices (3) II Analysis of physical phenomena in semiconductors, including carrier transport, injection, and lifetime, with emphasis on how these phenomena affect design and operation of junction devices. P, 458 or 556.

653. Advanced Device Engineering (3) I Consideration of the design of devices: photoconduction, photovoltage, tunneling, surface effects, junction avalanche, solid-state microwave generation, thermosemiconductors and Hall effect.


674. Sequential Circuits and Automata (3) I Analysis and synthesis of sequential circuits, partitioning and state assignment, linear sequential circuits, iterative networks, fault test generation and design automation. P, 474. (Identical with C.Sc. 674)


685. Inertial Confinement Controlled Fusion (3) I (Identical with N.E.E. 685)

687. Magnetic Confinement Controlled Fusion (3) II (Identical with N.E.E. 687)


693. Internship
   c. Clinical Engineering (1 to 3) I II P, enrollment in clinical engineering option.

ELEMENTARY EDUCATION

(See Teaching and Teacher Education)

ENGLISH

Professors Gerald Monsman, Head, Barbara Babcock, J. Douglas Canfield, Jr., L. D. Clark (Emeritus), Mary Jane Cook (Emerita), Roger Dahood, Edgar Dryden, Sigmund Eisner, Lawrence J. Evers, Dorothy V. Fuller (Emerita), Albert F. Gegenheimer, Frances Gillmor (Emerita), Byrd H. Granger (Emerita), Nils Hasselmo, Richard Hosley, Robert W. Houston, Billie Jo Andrew Inman, Carl F. Keppler (Emeritus), Carl H. Ketcham, John H. McElroy, Gerald M. McNiece, N. Scott Momaday, A. Laurence Muir (Emeritus), Stephen L. Orien, Charles E. Poverman, Suressh Raval, Harry F. Robins (Emeritus), Paul Rosenblatt, Herbert Schneidau, Charles W. Scruggs, Richard Shelton, Oliver F. Sigworth (Emeritus), Melvin T. Solve (Emeritus), John C. Ulreich, J.P. Wearing, Peter Whyd


Assistant Professors Donna Johnson, Dhira Mahoney, Tenney Nathanson, Duane Roen, Alice M. Senob (Emerita), Charlotte Thompson, Thomas Willard, Lynda Zwinger

Lecturers Edward Abbey, Christopher Carroll, Tom J. Collins, Dorothy N. Fuller, Ruth M. B. Gardner

The Department of English offers instruction in language and literature, leading to the Bachelor of Arts degree with a major in literature, creative writing, or English education. Courses are offered in a number of topics which will allow the undergraduate to experience a wide variety of approaches to and kinds of literature. As well as courses in the traditional fields of English and American literature, composition, and creative writing, the Department offers courses in such areas as film and literature, folklore, American Indian studies, fantasy, and the oral tradition. Students may participate in the study-abroad program in London. Undergraduate majors in English can expect to attain writing, organizational, and analytical skills which will allow them to pursue careers in professional graduate studies in literature, or in business, law, medicine, and a number of fields of endeavor which demand these skills.
Departmental programs lead to the following degrees: Bachelor of Arts with majors in English and creative writing, Bachelor of Arts in Education with teaching majors in English and extended English, Master of Arts in Education with a major in English, Master of Fine Arts, and Doctor of Philosophy. For further information regarding the graduate programs, please see the Graduate Catalog.

The major in English for the B.A.: 36 units of upper-division English and American literature, including 370a-370b; one proseminar (496); one course from each of the following periods: (1) Medieval Literature (426, 427); (2) Renaissance Literature (432, 434a, 434b, 444); (3) Restoration and Eighteenth-Century Literature (446, 450a, 450b, 458a); (4) Nineteenth-Century Literature (458b, 460a-460b, 465, 466); (5) American Literature (482, 483, 484a, 486, 487, 488a); and 12 elective units in upper-division literature courses. Majors are also required to take Hum. 250a as part of their college humanities requirement and to fulfill the college language requirement in a single language.

The supporting minor for majors in English: Recommended subjects are classics, drama, philosophy, modern languages, history and theory of art or of music, journalism, communication, anthropology, government, economics, history, linguistics, psychology, sociology; other subjects as may be individually justified.

The major in creative writing: 36 units, including 209, 210, 370a-370b; 3 units from 261, 265, 267a-267b, 380; 6 units from 301, 304, 309; 6 units from 401, 404, 409, 413, Dram. 460a-460b; 9 units of upper division (300 level or above) literature courses in the English Department, to include 3 units from the following: 473a-473b, 475, 484b, 488b.

The minor in creative writing: 24 units, including 209, 210, 370a-370b; 3 units from 301, 304, 309; 3 units from 401, 404, 409, 413, Dram. 460a-460b; 3 units from 261, 265, 267a-267b, 380; 3 units from 473a-473b, 475, 484b, 488b.

The teaching major in English (for students who are candidates for a B.A. in Education with secondary teaching certification): 36 units, including 306, 370a-370b, 380, 405, 406, 410, 411, 412, 496, one course in Shakespeare, and one course in American literature. Engl. 107 and 108 may not be used to satisfy the freshman composition requirement. The teaching minor in English (for students majoring in subjects other than English who are candidates for a B.A. or B.S. in Education): 21 units, including 306, 370a or 370b, 380, 406, 410, 411, and one course in American literature. Engl. 107 and 108 may not be used to satisfy the freshman composition requirement.

The teaching major in extended English: In place of one of the minor fields listed under “Program for Secondary Education” in the College of Education section of this catalog, a student may combine the English teaching major listed above with additional courses in classics, drama, English, linguistics, journalism, reading, or communication to make a total of 50 units. One course must be in communication.

Courses taken to fulfill the university requirement in freshman composition may not be used as part of any English major or minor. Satisfaction of the freshman composition requirement is prerequisite to all other courses in English.

Students may fulfill the English requirement for graduation by completing one of the following sequences: Engl. 100, 101, and 102; 101 and 102; 103H and 104H; for ESL students: 106, 107, and 108. Students are placed in Freshman Composition by scores on the American College Test (ACT) or the Scholastic Aptitude Test (SAT) and a written placement essay.

The Center for English as a Second Language: The center offers an intensive, noncredit program for students who are not native speakers of English. Brochures describing the program are available from the Center for English as a Second Language.

Honors: The department participates in the Honors Program.

100. Freshman Composition (3) I II Exposition, review of syntax and usage.
101. Freshman Composition (3) I II Exposition, emphasis on essays.
102. Freshman Composition (3) I II Critical papers on selected subjects.
103H. Freshman Composition (3) I II Exposition for superior students.
104H. Freshman Composition (3) I II Critical papers for superior students. P, 103H.
106. English Composition for Foreign Students (3) I II Exposition, syntax and usage for ESL students.
107. English Composition for Foreign Students (3) I II Exposition, emphasis on essays, for ESL students.
108. English Composition for Foreign Students (3) I II Exposition, critical papers, for ESL students.
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Prerequisites and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>Sophomore Composition (3)</td>
<td>Exposition and narration.</td>
</tr>
<tr>
<td>209</td>
<td>Introduction to Poetry Writing (3)</td>
<td>Beginning techniques of poetry writing. P, 102.</td>
</tr>
<tr>
<td>210</td>
<td>Introduction to Fiction Writing (3)</td>
<td>Beginning techniques of fiction writing. P, 102.</td>
</tr>
<tr>
<td>260</td>
<td>Major British Writers (3)</td>
<td>Intensive study of selected works by major British writers.</td>
</tr>
<tr>
<td>261</td>
<td>Introduction to Fiction Writing (3)</td>
<td>Beginning techniques of fiction writing. P, 102.</td>
</tr>
<tr>
<td>265</td>
<td>Major American Writers (3)</td>
<td>Intensive study of selected works by major American writers.</td>
</tr>
<tr>
<td>267a-267b</td>
<td>World Literature (3-3)</td>
<td>267a: Dramatic literature; great plays of the western literary tradition with emphasis on genre, theme and structure. 267b: Narrative literature; great narrative works of the western literary tradition with emphasis on form, theme and culture context.</td>
</tr>
<tr>
<td>268</td>
<td>Introduction to the Literature of the Americas (3)</td>
<td>Major literary works and movements throughout the English-, Spanish-, Portuguese-, and French-speaking Americas, in translation.</td>
</tr>
<tr>
<td>270</td>
<td>Politics and the Novel (3)</td>
<td>(Identical with Pol. 290)</td>
</tr>
<tr>
<td>300a-300b</td>
<td>Literature and Film (3-3)</td>
<td>Aesthetic relationships between literature and film. 300a: The art of translating literature into film as aesthetic expression. 300b: The artistic medium of the narrative film. 2R, 3L.</td>
</tr>
<tr>
<td>301</td>
<td>Non-fiction Writing (3)</td>
<td>P, 207 or 210.</td>
</tr>
<tr>
<td>306</td>
<td>Advanced Composition (3)</td>
<td>Study of rhetorical theory; practice in writing exposition and argument. Writing-Emphasis Course for English education majors.*</td>
</tr>
<tr>
<td>307</td>
<td>Business Writing (3)</td>
<td>Practice in writing business letters and reports.</td>
</tr>
<tr>
<td>308</td>
<td>Technical Writing (3)</td>
<td>Analysis and presentation of scientific and technical information.</td>
</tr>
<tr>
<td>324</td>
<td>Literature of the Southwest (3)</td>
<td>The last frontier in fact and fiction, the accounts of early travelers, the development of the &quot;Western story,&quot; the regional novel; useful bibliography.</td>
</tr>
<tr>
<td>331</td>
<td>Shakespeare's Major Plays (3)</td>
<td>A close reading of six to eight plays, including a comedy, a history, a tragedy, and a tragicomedy.</td>
</tr>
<tr>
<td>370a-370b</td>
<td>English Literature (3-3)</td>
<td>A survey, with emphasis on major writers in their literary and historical contexts. 370a: From Old English to Renaissance literature. 370b: From Restoration to modern literature. 370a is not prerequisite to 370b. Both 370a and 370b are offered each semester.</td>
</tr>
<tr>
<td>371a-371b</td>
<td>American Literature (3-3)</td>
<td>A survey with emphasis on writers in their literary and historical contexts. 371a: From the Revolutionary Period to 1900. 371b: From 1900 to the present.</td>
</tr>
<tr>
<td>380</td>
<td>Literary Analysis (3)</td>
<td>Introduction to the various modes, techniques, and terminology of practical criticism.</td>
</tr>
<tr>
<td>397</td>
<td>Workshop</td>
<td>a. Writing Workshop(1) [Rpt./3 units] I II S Intended for students whose performance on the upper-division writing-proficiency examination is unsatisfactory. b. Writing Workshop for International Students (1) I II S P, completion of upper-division writing-proficiency examination.</td>
</tr>
<tr>
<td>401</td>
<td>Advanced Nonfiction Writing (1 to 4)</td>
<td>[Rpt./3 units] GC I II P, 301. Writing-Emphasis Course for creative writing majors.*</td>
</tr>
<tr>
<td>402</td>
<td>Business Report Writing (3)</td>
<td>GC I II Study and development of written reports in business.</td>
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<tr>
<td>403</td>
<td>Advanced Scientific Writing (3)</td>
<td>GC I II Preparation of professional literature for publication.</td>
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<tr>
<td>404</td>
<td>Advanced Fiction Writing (1 to 4)</td>
<td>[Rpt./3 units] GC I II P, 304. Writing-Emphasis Course for creative writing majors.*</td>
</tr>
<tr>
<td>405</td>
<td>History of the English Language (3)</td>
<td>GC I II The evolution of English sounds, inflections, and vocabulary from earliest times to the present, with attention to historical conditions. (Identical with Ger. 405)</td>
</tr>
</tbody>
</table>
406. **Modern Grammar and Usage** (3) GC I II Current American English structure according to major types of grammar and current American English usage, both with reference to standard British English.


408. **English as a Second Language In Bilingual Education** (3) GC I II Methodology for the teaching of English as a component of bilingual education; grammar, phonology, and syntax as they apply to the teaching of language skills. (Identical with T.T.E. 408)


411. **Teaching of Literature** (3) GC I II Theory and practice of teaching literature, with intensive study of genres and works commonly taught in secondary schools. P, nine units of lit. (Identical with T.T.E. 411)


413. **Poetry in Forms** (1 to 4) GC II Explores English prosody through discussing and writing of major forms, research paper. Open to creative writing majors only. P, 309

414. **The Nature of Literature** (3) I What literature is and does, as exposed in theories of writing and in self-conscious literary works.

415. **Women Authors** (3) I Analysis of selected writings by women in the context of the authors’ lives and social milieux. (Identical with W.S. 417)

416. **Women in Literature** (3) II Analysis of the representations of women in selected literary texts. (Identical with W.S. 418)

419a-419b. **Non-fiction Prose** (3-3) GC 419a: The essay in English. 419b: Other prose forms. P, Freshman Composition; upper division or graduate standing

420. **Contemporary American Usage** (3) GC I II S Consideration of the varieties of contemporary American language usage, social and regional, written and oral. P, upper division or graduate standing.

426. **English Medieval Literature** (3) II Survey of Old and Medieval English literature (exclusive of Chaucer), chiefly in modern versions.

427. **Chaucer** (3) I II *The Canterbury Tales* and other poems, read in Middle English.

430. **The Anthropology of Visual Art** (3) I II 1988-89 (Identical with Anth. 430)

431a-431b. **Shakespeare** (3-3) 431a: Twelve comedies, histories and tragedies from the period 1590-1600 (including Hamlet). 431b: Ten comedies, tragedies and tragicomedies from the period 1601-1613. 431a is not prerequisite to 431b.

432. **Renaissance Drama** (3) II Critical and historical study of Marlowe, Jonson, Middleton, Webster, and other contemporaries of Shakespeare.

434a-434b. **Renaissance Literature** (3-3) 434a: Critical and historical survey of major authors, including More, Skelton, Wyatt, Sidney, and Spenser. 434b: Bacon and Hobbes; Ben Jonson and his Tribe; Donne and the Metaphysicals; Milton.

444. **Milton** (3) I Survey of Milton’s English poetry, with emphasis on *Paradise Lost*.

445. **Introduction to TESL: An Overview** (2) GC I The development of English as a second language with emphasis on current trends, the influence of linguistic theory, and the international role of English.

446. **Restoration Drama** (3) I Critical and historical study of major plays from Dryden to Sheridan (1660-1780).

449a-449b. **Folklore** (3-3) GC 449a: Forms of Verbal Folklore: myth, legend, folktale, riddle, proverb, jokes, folksong, ballad, etc. 449b: Non-verbal Folklore: custom, belief, folk art and craft, food, medicine, dress, festival, and drama. (Identical with A.In.S. 449a-449b and Anth. 449a-449b)

450a-450b. **Literature of Restoration and Eighteenth Century** (3-3) 450a: Survey of Restoration and early 18th-century literature (1660-1745). 450b: Poetry, fiction, drama, and essays from 1745 to 1800.

458a-458b. **The English Novel** (3-3) 458a: Defoe, Richardson, Fielding, Sterne, Smollett, and Austen. 458b: Scott, the Brontes, Dickens, Thackeray, Eliot, Trollope, and Hardy.

460a-460b. **Romantic Literature** (3-3) 460a: Wordsworth, Coléridge, Keats, and essayists. 460b: Blake, Byron, Shelley, and essayists. 460a is not prerequisite to 460b.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
<th>Prerequisites</th>
<th>Notes</th>
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<tbody>
<tr>
<td>461</td>
<td>Linguistics and the Study of Literature</td>
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<td>465</td>
<td>Victorian Literature</td>
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<td>466</td>
<td>Themes in Victorian Literature</td>
<td>3</td>
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<tr>
<td>469a-469b</td>
<td>Germanic Folklore: An Introduction to Nonliterary Forms</td>
<td>3</td>
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<tr>
<td>472</td>
<td>Modern Fiction</td>
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<tr>
<td>473a-473b</td>
<td>Modern British Literature</td>
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<td>475</td>
<td>Modern Continental Drama</td>
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<td>477</td>
<td>Ethnic Literature</td>
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<td>482</td>
<td>American Romanticism</td>
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<td>483</td>
<td>American Realism</td>
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<tr>
<td>484a-484b</td>
<td>The American Novel</td>
<td>3</td>
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<tr>
<td>485</td>
<td>Modern British and American Drama</td>
<td>3</td>
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<td>487</td>
<td>Major American Author</td>
<td>3</td>
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<tr>
<td>488a-488b</td>
<td>American Poetry</td>
<td>3</td>
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<tr>
<td>503a</td>
<td>Introduction to Comparative Literature and Literary Theory</td>
<td>3</td>
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<td>515a-515b</td>
<td>History of Criticism</td>
<td>3</td>
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<td>516a-516b</td>
<td>Theories of Linguistic Structure</td>
<td>3</td>
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<tr>
<td>520</td>
<td>History of the German Language</td>
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<td>525</td>
<td>Beowulf</td>
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<tr>
<td>526</td>
<td>Advanced Studies in Chaucer</td>
<td>3</td>
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<tr>
<td>527a-527b</td>
<td>Studies in Medieval Language and Literature</td>
<td>3</td>
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<tr>
<td>531</td>
<td>Advanced Studies in Shakespeare</td>
<td>3</td>
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<tr>
<td>533</td>
<td>Studies in the Renaissance</td>
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<tr>
<td>534</td>
<td>Advanced Studies in Milton</td>
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<tr>
<td>541</td>
<td>Studies in the Restoration and Eighteenth Century</td>
<td>3</td>
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</tbody>
</table>


561. History of Children's Literature (3) II (Identical with Li.S. 561)


591. Preceptorship
   a. Methodology of Essay Writing (1) I II Designed for graduate teaching assistants in English.
   b. Methodology in Critical Reading and Writing (1) I II Designed for graduate teaching assistants in English.

595. Colloquium
   a. Rhetoric of Exposition (1) I II Designed for graduate teaching assistants in English.
   b. Rhetoric of Literature and Critical Writing (1) I II Designed for graduate teaching assistants in English.

596. Seminar
   a. Medieval Literature (3) [Rpt.] I II
   b. Renaissance Literature (3) [Rpt.] I II
   c. Restoration and Eighteenth-Century Literature (3) [Rpt.] I II
   d. Nineteenth-Century British Literature (3) [Rpt.] I II
   e. Twentieth-Century British Literature (3) [Rpt.] I II
   f. American Literature (3) [Rpt.] I II
   g. Comparative Literature (3) [Rpt.] I II
   h. Modern Literature (3) [Rpt.] I II Open to creative writing majors only.
      i. Germanic Linguistics (3) [Rpt.] I II (Identical with Ger. 596i)
      j. Linguistics for ESL (3) [Rpt.] I II
   k. Methods and Materials of Literary Research (3) [Rpt.] I II
   l. Theories of Criticism (3) [Rpt.] I II
   m. Studies in the Oral Tradition (3) [Rpt./9 units] I II (Identical with A.In.S. 596m)

597. Workshop
   a. Southern Arizona Writing Project (3-9) [Rpt./12 units] I II S (Identical with L.R.C. 597a, which is home)
   b. The Teaching of English (3) I II S [Rpt.] (Identical with L.R.C. 597o)

604. Writing Project in Fiction (1 to 6) [Rpt.] I II For M.F.A. candidates working on the book-length writing project in fiction.

609. Writing Project in Poetry (1 to 6) [Rpt.] I II For M.F.A. candidates working on the book-length writing project in poetry.


613. Teaching of ESL (3) I Basic approaches to the teaching of English as a second language, with emphasis on the aural-oral method. P, 612 or CR. (Identical with L.R.C. 613)

693. Internship

696. Seminar
   b. Linguistics (2 to 4) I II (Identical with Ger. 696b, which is home)
   c. Folklore (2 to 4) I II (Identical with Ger. 696c, which is home)

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

ENTOMOLOGY

Professors William S. Bowers, Head, Paul D. Gerhardt (Emeritus), Harry H. Graham (Adjunct), John G. Hildebrand, Roger T. Huber, Marshall D. Levin (Adjunct), Leon Moore, William L. Nutting (Emeritus), Donald M. Tuttle (Emeritus), George W. Ware, Theo F. Watson, Floyd G. Werner
DEPARTMENTS AND COURSES OF INSTRUCTION

Associate Professors Dave T. Langston (Adjunct), Robert L. Smith, Gordon D. Waller (Adjunct)
Assistant Professors Stephen L. Buchmann (Adjunct), David N. Byrne, Allen C. Cohen (Adjunct),
Richard C. Collins (Adjunct), Nancy A. Moran, L. Irene Terry, Thomas R. Tobin (Adjunct)

The Department of Entomology provides instruction to students planning careers in entomology and for those specializing in related fields including plant and animal protection. Career opportunities in entomology include teaching, research and technical positions with colleges and universities, experiment stations, governmental agencies, military services, private and industrial organizations.

Undergraduate studies lead to the Bachelor of Science in Agriculture degree under the agricultural sciences curriculum. The department also offers opportunities for study toward the degrees of Master of Science and Doctor of Philosophy. For graduate admission and degree requirements, consult the Graduate Catalog.

**Agricultural sciences curriculum:** Minimum of 16 units in entomology, including the following suggested courses selected in consultation with the student's adviser: 201R, 404, 407; Ecol. 204, P.I.S. 100; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; 3 units each of physics, ecology, and genetics.

**151. Insects and Man (3) I** Introduction to the biology, ecology, and management of insects affecting man and his interests. Intended for non-majors. Olson

**201R. Fundamentals of Entomology (3) II** Insects and other land arthropods, their functional anatomy, perception of the environment, relationship to plants and other animals, and importance to man. Classification to orders and most important families. Werner

**201L. Fundamentals of Entomology Laboratory (1) II** Classification of insects and other land arthropods to the level of families, with emphasis on recognition; collection. Field trips. P, 151 or CR 201 R.

**214. The Honey Bee (2) II** Biology and social behavior, pollination, ecology, and management.

**402. Introduction to Pesticides and Their Use (2) GC II** (Identical with P.I.P. 402)

**403R. Biology of Animal Parasites (3) GC I** (Identical with V.Sc. 403R)

**404. Insect Morphology (4) GC I 1988-89** External and internal anatomy as related to identification, function and phylogeny of insects and other arthropods; modifications in development and habits peculiar to the insects. 2R, 6L. P, 3 units of entomology or invertebrate zoo.


**407. Insect Physiology (4) GC II 1988-89** Principles of the physiological systems of insects and lab. methods for their study, with emphasis on the functioning of these systems in the environment. 2R, 6L. P, 3 units of organic chemistry or biochemistry. Writing-Emphasis Course for agricultural sciences curriculum students. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

**412. Cultural Control and Host Plant Resistance (1) GC I** Analysis of cultural practices used for insect management in crop systems. Principles of insect-plant relationships pertaining to resistance in crop plants, and the methods used to develop resistant crop varieties. 2R, P, one unit in entomology. Terry.

**416. Biological Control (2) GC II** Principles of the biological control of arthropod pests, with emphasis on their application to agricultural entomology. 2R. P, 444 or a course in population ecology. Watson

**418. Insect Vectors of Plant Pathogens (1) GC II** Examination of the relationships between insect vectors, plant pathogens, and host crops. 2R. P, one unit in entomology. Byrne

**420. Urban Entomology (3) GC II 1987-88** Biology of insects, other arthropods and vertebrates, beneficial and pestiferous, that impact humans in the urban ecosystem. Identification of species and management of pests. 2R, 3L. Field trips. Smith

**422. Insect Population Sampling (1) GC I** Development of sampling methods for both research purposes and pest management decision making. Comparison of the efficiency of sampling methods and programs for sampling data analysis. 1R, 3L. Field trips. P, 3 units of statistics. Terry

**424. Biorational Strategies for Insect Control (1) GC I** History, current status, and methods for the discovery of intrinsically non-toxic chemicals targeted to interfere with processes unique to insects including growth, development, reproduction, diapause, and behavior. 2R. P, one unit in entomology, 3 units of organic chemistry or biochemistry. Bowers

**430. Chemical Control (1) GC I** Examination of the history, methods, externalities and benefits of the use of insecticides and acaricides. 2R. P, one unit in entomology. Byrne

444. **Insect Ecology** (3) GC I Determinants of population size and distribution, including processes occurring within and between populations, abiotic factors. Techniques for evaluating population parameters. 2R, 3L. Field trips. P, one course in entomology or Ecol. 182. (Identical with Ecol. 444) Moran

445. **Ecology and Evolution of Insect/Host Plant Associations** (1) GC II Theoretical and empirical evidence on the role of hosts in insect radiation, the evolution of defenses in plants, insect adaptations to plants, the evolution of host specificity. P, one course in entomology or Ecol. 182. (Identical with Ecol. 445) Moran

449. **Crop Insect Biology** (1) GC I The biology and recognition of both pestiferous and beneficial arthropods found in Arizona’s principal agricultural crops. Analysis of methods used to manage their populations. 1R, 3L. Field trips. P, 151 or 201 R. Byrne

495. **Colloquium**  
   a. Senior Report (1) I II Writing-Emphasis Course. P, Satisfaction of the upper-division writing proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

508. **Insecticide Toxicology** (3) II 1987-88 Insecticides and related chemicals; their modes of action, detoxication, resistance in arthropods, and environmental distribution and effects. P, 3 units of organic chemistry or biochemistry. (Identical with Tox. 508)

512. **Insect Behavior** (3) II 1987-88 The evolution of arthropod behavior in ecological context. Ultimate causation with some consideration of physiological and morphological constructs. 2R, 3L. Field trips. (Identical with Ecol. 512) Smith

516. **Applied Insect Taxonomy** (4) I 1987-88 Principles and methods in the classification of animals. Practice in developing practical classifications of insects that are of significance to crop protection in local areas. Classification of immature stages of terrestrial insects. 3R, 3L. Field trips. Werner

576. **Environmental Toxicology** (3) I (Identical with Tox. 576)

659. **Electron Microscopy** (4) I (Identical with Pl.P. 659, Micr. 659, and V.Sc. 659)

696. **Seminar**  
   a. Entomology (1) [Rpt./6] I II

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**ENVIRONMENT AND BEHAVIOR**

Committee on Environment and Behavior (Graduate)

Professors Robert Bechtel, Chairperson (Psychology), Charles Albanese (Architecture), Terry Daniel (Psychology), William Havens (Renewable Natural Resources), Helen Ingram (Political Science), William Ittelson (Psychology), David King (Renewable Natural Resources), Kirby Lockard (Architecture), William Rathje (Anthropology), Thomas F. Saarinen (Geography), Lawrence Wheeler (Psychology), Ervin H. Zube (Renewable Natural Resources)

Associate Professors Dennis Doxtater (Architecture), William Shaw (Renewable Natural Resources)

Assistant Professors Robert Itami (Renewable Natural Resources), Chet Ross (Family and Consumer Resources)

The Committee on Environment and Behavior functions to coordinate and further develop study of the relationship between physical settings and human activities. This multi-disciplinary group of teachers and researchers will assist students in the integration of such specialization into their chosen fields. Undergraduate students interested in combining an environment and behavior emphasis into majors such as psychology, architecture, landscape architecture, interior design, geography, renewable natural resources, political science, and water resources administration should consult their department advisors and appropriate members of the Committee on Environment and Behavior.

While the Committee does not offer any degrees at present, it does offer a doctoral minor (see the Graduate Catalog). Environment and Behavior may serve as a possible Subject Area III for the undergraduate General Studies major in the College of Arts and Sciences. See an adviser in the college for current status.
DEPARTMENTS AND COURSES OF INSTRUCTION

Current information on studies in environment and behavior can be obtained from the Chairperson, Committee on Environment and Behavior, Department of Psychology. Courses identified as having content which deals specifically with environment and behavior include: Arch. 287, 429, 474, 497i; Art 434; Geog. 275, 360,407, 561, 563; Idis. 596u, L.Ar. 533, 595a; N.R.R. 470; Pol. 481; Psyc. 371, 428,521a-521b; R.N.R. 595c.

ETHNIC STUDIES
(See American Indian Studies, Black Studies, and Mexican American Studies)

EXERCISE AND SPORT SCIENCES

Professors Charles M. Tipton, Head, Anne E. Atwater, Timothy G. Lohman, Donna Mae Miller, Frederick B. Roby, Mary P. Roby, David H. Strack
Assistant Professors Theresa E. Boggess, Joy C. Bunt, Roger M. Enoka, Douglas R. Seals, Roy A. Tatum
Lecturers James M. Clemons, Judy A. Sorensen, Ronald A. Sutherland

The Department of Exercise and Sport Sciences is concerned with advancing the body of knowledge in the exercise and sport sciences and preparing professionals for careers in applied exercise science, teaching, coaching, research. The department participates with the College of Education in programs leading to the Bachelor of Science in Education degree with a teaching major in physical education for the secondary-school level or for K-12 certification. Undergraduate minors are available in athletic coaching and physical education. General Studies majors in the College of Arts and Sciences may elect to take at least 20 units of course work in exercise and sport sciences within Subject Area III.

The Department offers programs leading to the Master of Science and the Master of Arts degrees with a major in exercise and sport sciences. Students wishing to specialize in exercise physiology at the doctoral level may do so through an interdisciplinary animal physiology program. For admission and degree requirements for the graduate programs, please see the Graduate Catalog.

The physical education teaching major (secondary emphasis): 276, 279, 285, 286 (2 units), 288, 354 (2 units); an additional 2 units from 260, 354, 357 or professional activities; 370, 371, 373, 374, 377, 380, 381, 388, 394b; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of a minimum of ten courses and 15 units from Professional Activity courses.

The physical education teaching major (K-12 emphasis): 261, 276, 279, 285, 286 (2 units), 288, 294a, 352, 354 (2 units); an additional 2 units from 260, 354, 357 or professional activities; 358, 370, 371, 373, 374, 377, 380, 381, 388, 394b, 486; T.T.E. 493a; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of a minimum of ten courses and 15 units from Professional Activity courses.

The athletic coaching minor (not available to physical education majors): 276, 370, 373, 374, 377, 394a; 4 units from 385, 386, 408, 485; 4 units from 286 and 354, to include a minimum of 4 units in 354.

The physical education teaching minor: 261 or 377; 285, 288, 370, 371, 373, 374, 380, 381; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of a minimum of eight courses and 12 units from Professional Activity courses.

Courses without an “a”, “b”, “c”, or “d” designation are considered to be beginning-level courses.

Activity Courses

Students who have completed a beginning-level course, but who do not meet the intermediate prerequisites may repeat the beginning course for credit. Intermediate- and advanced- level courses may be repeated once for credit.
The department offers a free locker for students registered in activity courses. Failure to return the lock will result in a financial encumbrance.

100. Adapted Physical Activities (1) I II

103. Aerobic Dance (1) I II S*
   a. Beginning Aerobic Dance*

109. Backpacking (1) I II S Two-day field trip.

110. Badminton (1) I II*
   a. Beginning Badminton*

114. Basketball (1) I II*
   c. Intermediate Basketball

116. Body Dynamics (1) I II S

123. Country Swing (1) I II S

125. Cycling (1) I II

128. Diving (1) I II

132. Fencing (1) I II S*
   a. Beginning Fencing*
   c. Intermediate Fencing

137. Golf (1) I II S*
   a. Beginning Golf*
   c. Intermediate Golf*
   d. Advanced Golf

138. Gymnastics (1) I II*
   a. Beginning Gymnastics*
   c. Intermediate Gymnastics

141. Hiking (1) I II S Field trips.

145. Jogging (1) I II S

148. Karate (1) I II S*
   a. Beginning Karate*
   c. Intermediate Karate P, 148a*
   d. Advanced Karate P, 148c

150. Lifesaving (1) I II S P, 169d.

157. Personal Defense (1) I II S

159. Racketball (1) I II S*
   a. Beginning Racketball*
   c. Intermediate Racketball*
   d. Advanced Racketball P, 159c

161. Scuba Diving (2) [Rpt./1] I II S P, 169c

164. Soccer-Speedball-Speed-A-Way (1) I II*
   a. Beginning Soccer-Speedball-Speed-A-Way*

166. Softball (1) I II*
   c. Intermediate Softball

169. Swimming (1) I II S*
   a. Beginning Swimming*
   b. Swimming for Beginners with Limited Experience*
   c. Intermediate Swimming*
   d. Advanced Swimming

170. Swimming for Fitness (1) I II S P, 169c.

173. Tennis (1) I II S*
   a. Beginning Tennis*
   b. Tennis for Beginners with Limited Experience*
   c. Intermediate Tennis*
   d. Advanced Tennis

176. Touch Football (1) I II
177. **Triathlon Training** (1) [Rpt./1] I II S P, 169c
181. **Volleyball** (1) I II S*
   a. Beginning Volleyball*
   c. Intermediate Volleyball*
   d. Advanced Volleyball
183. **Weight Control** (1) I II P, for students who are a minimum of 20% overweight.
184. **Weight Training** (1) I II S
187. **Yoga for Health and Fitness** (1) I II S

**Professional Activity Courses**

Open to physical education majors and minors only.

208. **Aerobic Dance Fitness** (1) I II*
211. **Badminton** (1) I II*
213. **Basketball** (2) I II†
214. **Fencing** (2) II*
217. **Folk Dance** (1) I II*
218. **Football** (1) I II†
219. **Golf** (1) II†
221. **Women’s Gymnastics** (2) I*
223. **Handball-Racketball** (1) I II*
224. **Modern Dance** (1) I*
225. **Soccer-Speedball-Speed-A-Way** (2) I II*
226. **Social Dance** (1) II*
227. **Softball** (1) I II†
229. **Swimming-Lifesaving** (2) I II†
230. **Tennis** (2) I II†
231. **Track and Field** (2) I*
232. **Volleyball** (2) I II†

* Development of knowledge and skill competencies necessary for teaching each activity, with emphasis on skill progressions, practice opportunities, and error diagnosis and correction.
† Enrollment by proficiency demonstrated by passing beginning course or by meeting equivalent skill and knowledge requirements.

**Professional Preparation Courses**

260. **Water Safety Instructor** (2) I II American Red Cross Water Safety Instructor Certificate will be issued to those students qualifying. P, current advanced lifesaving certificate.
261. **Advanced First Aid and Emergency Care** (2) I II Instruction in first-aid and emergency care procedures. The American Red Cross Advanced First Aid and Emergency Care Certificate will be awarded to those students qualifying.
267. **Controlling Stress and Tension** (2) I II S Psychophysiology of stress and its relationship to health, with emphasis on identifying and understanding personal stress patterns and learning appropriate stress management techniques such as relaxation, cognitive intervention strategies, meditation, autogenic training, and physical activity.
276. **Designed Exercise Programs** (2) I II Instruction and practice in various types of formal exercise programs. Munroe/Simko
279. **Motor Development** (2) I II Developmental changes in motor patterns of children and adults; methods of diagnostic evaluation of motor skill performance and the selection of appropriate movement experiences.
285. **Principles of Teaching Physical Activities** (3) I II General principles and practical experiences related to analysis of movement skills, correction of movement errors, and preinstructional planning applied specifically to teaching physical activities.
286. **Sports Officiating** (1) Guiding principles and standards; rules, mechanics and procedures for officiating sports common to secondary school interscholastic and community club programs. Consult department before enrolling.
   a. Basketball (Men and Women's Rules) II
   b. Baseball-Softball I
   c. Football II
   d. Soccer I
   e. Volleyball II

288. **History of Sport and Physical Education** (2) Development of physical education from ancient societies through the 20th century; its influence on current practices.

294. **Practicum**

351. **Elementary School Physical Education** (3) Purposes and practices of physical education at the elementary school level; instruction in recommended activities; teaching and evaluation techniques; class organization.


354. **Theory of Coaching** (2) Advanced instruction in sports common to secondary school curricula; teaching and coaching principles, advanced techniques, and organizational and practice methods.
   a. Aquatics (2) II 1988-89 P, 169d, 229 or 285 (not required for athletic coaching minor).
   c. Basketball (2) II P, 218, 285 (not required for athletic coaching minor).
   g. Track and Field/Cross Country (2) II P, 231, 285 (not required for athletic coaching minor).

358. **Dance for Children** (2) Basic methods, materials and activities for teaching dance to children.

370. **Kinesiology** (3) Designed to provide the knowledge and experience necessary for the physical education and recreation of persons having various handicaps. Three hours per week of related experiences by arrangement required. P, Ecol. 159a-159b.

371. **Special Physical Education** (3) Study of various physiological and environmental factors which affect the performance of exercise and sport during acute exercise and the physiological adaptations to chronic exercise. P, Ecol. 159a-159b.

373. **Exercise Physiology** (2) Study of various physiological and environmental factors which affect the performance of exercise and sport during acute exercise and the physiological adaptations to chronic exercise. P, Ecol. 159a-159b.

374. **Exercise Physiology Laboratory** (1) P, CR 373, Roby

377. **Techniques in Prevention and Treatment of Athletic Injuries** (3) Prevention, treatment, and rehabilitation of athletic injuries; practical experience in application of preventive taping and bandaging. P, Ecol. 159a-159b.

380. **Scientific Foundations of Motor Learning** (3) Introductory investigation of the nature of motor skill learning, including topics such as learning theory, neural basis, models of motor skill acquisition and factors which affect motor performance and learning. P, 370, Psyc. 101. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog). Russell

381. **Measurement and Evaluation** (3) Tests and measurements in physical education; data analysis techniques for test evaluation, test construction, and grading; experience with tests of fitness, sport skills, and sociometric measurements. Munroe

383. **Governance and Fiscal Aspects of Amateur Athletics** (3) Examination of the structure, function, and fiscal aspects of organizations which govern amateur athletics in the U.S.A.

385. **Principles and Problems of Athletic Coaching** (2) Examination of the duties, ethics and responsibilities of a coach; application of principles from psychology, sociology and other related fields; discussion of typical problems that confront the coach. Baker

386. **Administration of Interscholastic Athletics** (2) Role of athletics in secondary education, with emphasis on administrative philosophy, staff relations, business procedures, facilities, and the conduct of athletic events. Baker

388. **Administration of Physical Education Programs** (3) Principles and practices characteristic of programs of physical education; organizational models and theories, curriculum development, contemporary economics, innovations and issues. Baker/Miller
DEPARTMENTS AND COURSES OF INSTRUCTION

393. Internship
   b. Fitness Programs (2 to 3) [Rpt./1] I II P, 373, 374, 394d.

394. Practicum
   b. Physical Education Teaching Techniques on the College Level (1) I II S 1R, 8L P, 276, Ecol. 159a.
   d. Exercise Leader (2) [Rpt./2] I II S 1R, 8L P, 373, 374, 394d.

402. Principles of Neuroanatomy (4) GC II (Identical with Anat. 402)

470. Biomechanics of Human Movement (3) GC I Analysis of human motion focusing on the mechanical interaction between the human body and the external environment. 2R, 3L. P, 370, Ecol. 159a-159b. Atwater/Enoka

485. Sport In Contemporary Society (3) GC I Study of contemporary sport from the perspectives of its personal, social, cultural, economic and educational dimensions. Miller


496. Proseminar
   b. Analysis of Data in Human Motion Studies (1) GC I II Atwater

515. Philosophy of Physical Education and Sport (3) I Designed to help the student examine philosophic foundations, to explore the philosophic process, and to analyze, formulate, and apply principles as guides to action. P, 12 upper-division units of Ex.S.S. Miller

525. Motor Learning and Human Performance (3) I Neuropsychological approach to the study of motor skill acquisition and learning variables affecting human potential for physical performance. Fairchild

526. Neural and Perceptual Foundations of Motor Learning and Performance (3) I Examines the neural basis of motor behavior and the role and influence of perceptual modalities in motor learning and sports performance; topics include sensory coding, perceptual processing and motor control. Russell

527. Psychology of Sport and Exercise (3) I Examines the effects of motivation, personality, attitudes, competition and group dynamics on sport performance as well as the psychological effects of exercise, exercise adherence and exercise addiction. Williams

528. Stress Management for Performance and Health (3) I Examines within a biopsychosocial framework the concept of stress as it relates to performance and the etiology of stress-related health disorders. Also examines and applies stress management interventions to enhance performance and promote health. Williams.

529. Psychological Interventions and Ergogenic Aids for Peak Performance (3) II The application and effectiveness of ergogenic aid mechanisms, particularly psychological interventions, in enhancing performance. P, 528. Williams

530. Advanced Physiology of Exercise (4) I Metabolic, cardiopulmonary, thermoregulatory, fluid-electrolyte, neuroendocrine, neuromuscular and various environmental factors which influence physiological adjustments to acute exercise and the physiological adaptations to chronic exercise. P, 373. Tipton/Seals/Enoka/Lohman


535. Issues and Trends in Physical Education and Sport (3) II Designed to aid the student in identifying, analyzing, and evaluating recent developments and basic issues in physical education and sport. P, 12 upper-division units of Ex.S.S. Miller

536. Administration of Sports Programs (3) II Designed to provide a theoretical framework for students pursuing sports management careers and others interested in various functions involved in the conduct of sport programs. Miller

545. Evaluation and Regulation of Body Build and Composition (3) I Laboratory and field assessment of body fat, lean body mass and somatotype; anthropometry; body build and composition of the athlete; morphology of fat and lean tissue; exercise and dietary regulation of obesity and chronic underweight. P, 373, 374, Math. 117e. Bunt

548. Nutrition in Sport and Exercise (3) II S A critical analysis of research in the role of nutrition in physical performance. Emphasis on both nutritional deficiencies and supplements and their relation to performance, the assessment of nutritional status, the interaction of exercise and nutrition in fitness and weight control programs. N.F.S. 310 or N.F.S. 410. (Identical with N.F.S. 548) Lohman
550. **Advanced Exercise Physiology Laboratory** (3) II Experiments designed to demonstrate basic concepts of physiological responses to exercise with emphasis on development of skills in laboratory instrumentation and techniques of research. Roby/Seals/Tipton

555. **Cinematographic Techniques for Analyzing Human Movement** (3) II High-speed motion picture photography applied to the study of human motion; techniques of data collection, reduction, analysis and interpretation. P, 520. Atwater

565. **Physical Activity in Aging and Chronic Diseases: Physiological Aspects** (3) II The etiology and pathophysiological processes involved in coronary heart disease, hypertension, diabetes, and aging; role of exercise in prevention as a potential therapeutic intervention. Seals

566. **Physical Activity in Aging and Chronic Diseases: Psychosocial Aspects** (3) I Psychosocial dimensions of exercise programs designed for populations with chronic diseases as well as for older populations. P or CR 565. Fairchild

570. **Research Design in Exercise and Sport Sciences** (2) I II Study of research designs, methodologies and data analysis procedures pertinent to the exercise and sport sciences; emphasis is on the selection of research problems and interpretation of research articles. Lohman

571. **Laboratory in Research Design for Exercise and Sport Sciences** (1) I II Laboratory experiences in literature retrieval systems; data analysis procedures by calculator, microcomputer, and mainframe computer; critical analysis procedures of research articles, and participation in a research project. CR 570. Lohman

575. **Statistical Analysis in Exercise and Sport Sciences** (3) II Analysis of research designs and data analysis procedures in the field of exercise and sport sciences with emphasis on appropriateness of selected designs and interpretation of various data analysis procedures. Statistical power, reliability, covariance and multiple regression techniques and uses of micro-and mainframe data analysis software. P, 570 and 571. Lohman

580. **Evaluation of Athletic Injuries** (3) I Advanced study of the etiology, pathology, and clinical signs of common athletic injuries. Emphasis on clinical evaluation of athletic injuries by the athletic trainer. P, 377; 800 hrs. of clinical experience in athletic training. Delforge

581. **Therapeutic Modalities** (2) II Advanced study of the role of hydrotherapeutic and electrotherapeutic agents in the rehabilitation of athletic injuries. P, 580. Delforge

582. **Anatomical Basis of Sport Injuries** (3) I Comprehensive survey of bones, ligaments, muscles, nerves, and vessels of the trunk and upper and lower extremities, with emphasis on their relationship to sport injuries. 2R, 3L. P, CR 580. Hillman

584. **Rehabilitation of Athletic Injuries** (3) II Principles in the planning and implementation of rehabilitation programs for injured athletes with emphasis on application of contemporary therapeutic exercise techniques. P, 580. Delforge

585. **Issues in Athletic Training and Sports Medicine** (3) I Current issues and trends in athletic training and sports medicine with emphasis on the professional preparation of athletic trainers and the role of the certified athletic trainer in athletic health care delivery systems. P, 580. Delforge

586. **Physical Education and the Law** (3) I Investigation and analysis of legal parameters within which the physical educator and coach operate; negligence theory; common defenses; product liability; insurance; legal implications for program development and methodology. Baker

588. **Legal Aspects of Sports Administration** (3) II Development of administrative and coaching techniques from the legal perspective. Analysis of personnel procedures, purchase of equipment, athletic associations, certification, transportation, medical procedures, officiating, and the handicapped athlete as influenced by litigation. P, 586. Baker

594. **Practicum**
   b. Exercise Technician/Exercise Prescription (2) I II P, 374, 394d. Roby

695. **Colloquium**
   a. Motor Control (2) [Rpt./8 units] II P, Psio. 480 and consult department before enrolling. (Identical with Psio. 695a, Psyc. 695a, Sp.H. 695a, S.I.E. 695a)

791. **Preceptorship**
   a. Laboratory Rotations (2) I II 6L. Open to majors only. P, Ex.S.S. 550.

795. **Colloquium**
   a. Motor Control (1) [Rpt./1] II P, 530.
   b. Environment (1) [Rpt./1] II P, 530.
   c. Aging and Disease (1) [Rpt./1] II P, 530.
   d. Metabolism (1) [Rpt./1] II P, 530.
FAMILY AND CONSUMER RESOURCES

Professors Robert R. Rice, Director, Oscar C. Christensen, Victor A. Christopherson, Roger J. Daldrup, Kathryn L. Hatch, James R. Hine (Adjunct), Theodore Jacob, Jean Ruley Kearns, Amy Jean Knorr (Emerita), Doris E. Manning (Emerita), Shirley O'Brien (Adjunct), Naomi A. Reich, Carl A. Ridley, George B. Sproles, Mary Adele Wood (Emerita)

Associate Professors Richard L. Erickson, Ellen Goldsberry (Adjunct), Donna R. Iams, Roger M. Kramer, Philip J. Lauver, Jessica Lazarus (Adjunct), Mary H. Marion, Betty J. Newlon, Joel Rudd

Assistant Professors Oscar A. Blazquez, Brenda M. Brandt, Maureen E. Kelly, Elizabeth L. Kendall, Molly Longstreth, Chet J. Ross, Mari S. Wilhelm

Extension Specialists Alberta C. Johnson, Norma J. Redeker, Corinne I. Stinson (Emerita), Frank R. Williams

The School of Family and Consumer Resources strives to research, create, and apply knowledge to improve the well-being of families and individuals and increase understanding of the reciprocal relationships among individuals, families, and their several environments. It deals with social, economic, aesthetic, technological, managerial, health, and ethical aspects of family relations, child development, clothing, housing, and interior design.

The school offers the Bachelor of Science in Family and Consumer Resources with majors in child development and family relations (emphasizing family studies, child studies, or a combination of the two); clothing and textiles; consumer studies and family resource management; early childhood education; general home economics; home economics and journalism; home economics education; home economics extension education; interior design (design track or merchandising track); and merchandising and fashion promotion. The School of Family and Consumer Resources offers programs leading to the Master of Science with a major in family and consumer resources or home economics education, the Master of Education with a major in family and consumer resources, and the Master of Home Economics Education with a major in home economics education. For the Master of Science degree with a major in family and consumer resources, concentrations are available in clothing, textiles, and interior design; consumer studies and family resource management; counseling and guidance; home economics education; human development; interpersonal relationships; family economics; consumer economics; and consumer education.

Students enrolled in majors in Family and Consumer Resources may elect to choose a minor subject area with the approval of the student's advisor.

An extension/non-formal education option to supplement the student's major is also available to all students in the School of Family and Consumer Resources. Students taking this option must take A.Ed./H.E.E. 220; H.E.E. 428; H.E.E./A.Ed. 448; F.C.R. 493; and F.C.R. 496; plus two elective courses from the approved list available from the student's advisor.

Family and Consumer Resources

129. Professional Development (3) II Knowledge and attitudes generally needed by professionals in family and consumer resources or related fields; exploration of careers and cross specialization concepts.

297. Workshop
   a. Self and the World of Work (1) II
   b. Student Executive Training in Higher Education (2) II
   c. Student Assistant in College Residence Halls (1) I

465. Women in International Development (3) GC II (Identical with Anth. 465)

696. Seminar
   z. Family and Consumer Resources (1 to 3) [Rpt./1] I II

Child Development and Family Relations

Professor Jacob, Chairperson of the Division
The Division of Child Development and Family Relations focuses on generation and dissemination of basic and applied knowledge concerned with human development and family relations throughout the life span. Students major either in child development and family relations or in early childhood education, and may elect courses in consultation with faculty members to reflect additional emphasis in one of the following areas: child studies, family studies, or a combination of the two. The early childhood education major leads to certification for public school teachers.

**The major in child development and family relations:** I. C.D.F.R. 117; F.C.R. 129; C.D.F.R. 223; 247; 337; 457; 10-12 units chosen from C.D.F.R. 137, 327, 347, 407, C.S. 416, C.D.F.R. 427, 447, 467, 487, H.E.E. 448, N.F.S. 101; f.c.r. upper-division course outside the major; 21 units chosen from anthropology, education, childhood development family relations, clothing and textiles, interior design, home economics education, consumer studies, family and consumer resources, library science, exercise and sport science (non-activity course), psychology, management and policy, sociology; electives 23-28 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). Ill. Hum. 250a, 250b, 250c (to total 8 units) or 9 units chosen from the humanities courses accepted by the College of Arts and Sciences. IV. Engl. 308; 6 additional units chosen from speech, a language, journalism, media arts V. Psyc. 101, Soc. 100, 3 units chosen from economics; anthropology, sociology, psychology, politics, or education. VI. Math. 116; 6-8 units chosen from biological and physical science. VII. 9 additional units from one area III, IV, V, or VI.

**The major in early childhood education:** In addition to the requirements listed under the College of Education section of this catalog, majors must take F.C.R. 129 and an upper-division family and consumer resources course outside the major, plus electives for a total of 130 units.

117. Human Development and Relations (3) I II Behavioral science approach to personal development and interpersonal competence through the life span.

137. Education for Marriage (3) I II Practical study of factors involved in courtship, mate selection, marital adjustment, and parenthood.

223. Child Development (3) I II Growth, development, and socialization of the child within the family setting, from conception to the middle school years; observations of infants and preschoolers. P, Psyc. 101.

243. Sociology of Adult Life (3) I I (Identical with Soc. 243)

247. Adolescence (3) I II Growth, development and socialization of the child from the middle school years through adolescence. P, Psyc. 101.

327. Parent Education and Guidance (3) I II Theoretical perspectives and current literature applying to child guidance and parent education; practical considerations of principles and procedures involved in parent study programs. P, 117 or 223.

337. Family Relations (3) I I The modern family and its relationships. Comparative, functional, and institutional factors are examined.

347. Child Development in Group Settings (3 to 6) [Rpt./1] I Laboratory experience with young children. Supervised experience with 3-5 year-old children in a group setting; interactions, observations, discussions. P, 223.

407. Problems in Child Development (3) GC II 1988-89 Special child-rearing contexts in contemporary society; poverty, minority group membership, social change, and special developmental considerations.

413. Issues in Aging (3) GC II Introductory course in gerontology, with emphasis upon contemporary issues. (Identical with Gero. 413)

417. Advanced Human Development and Relations (3) GC II Behavioral science approaches to interpersonal competence within various societal contexts. P, 117.

427. Problems in Marriage and the Family (3) GC II Identification and analysis of major problem areas in marriage and the family, including economic, sexual, role conflict, emotional disorders, and childrearing.

447. Advanced Child Development (3) GC II In-depth examination of various dimensions of human growth and development. P, 223; 6 units of psyc. Writing-Emphasis Course*

457. Bio-Social Determinants of Socialization (3) GC II Bio-social factors related to socialization and the influence of various subcultures and contexts upon child-rearing practices. P, 223; 6 units of child dev. or soc. or psyc. (Identical with Soc. 457) Writing-Emphasis Course*

DEPARTMENTS AND COURSES OF INSTRUCTION

487. Readings in Family Relations (3) GC II Critical analysis of selected studies and research. P, 137, or 337, or Soc. 321.

500. Life Span Development (3) (Identical with Ed.P. 500).

503. Advanced Adolescent Development (3) II (Identical with Ed.P. 503)

507a-507b. Research Methods in Social Science (3-3) I II 507a: Problem selection, literature review, research design, data analysis, and other related topics, leading to the development of a research prospectus. 507b: Introduction to computer usage in social sci.; critical review of thesis writing by faculty and peers, including literature review, problem formulation, and research design.

517. Program Development and Evaluation in Micro-level Human Services (3) I Comprehensive review of human and family intervention projects and the procedures involved in developing, implementing, and evaluating these projects. All-day field trips. P, 507b.

547. Theories of Human and Family Development (3) I Analysis and integration of the major theories of individual and family development within a social context; evaluation of theoretical formulations in selected content areas of human relations and individual growth. P, 9 units of child dev., family relations, psyc. or soc.

557. Methods in Marital Therapy (3) I Theories and principles of counseling for premarital, marital, and group counseling situations. (Identical with Coun. 557)

573. Family Development (3) I Internal development of families over the life cycle, with emphasis on family goals, structure and functioning in the context of American society. P, 223, Soc. 100, or Psyc. 101.

607. Topics in Child Development and Family Relations. (1 to 3) [Rpt./1] I II Variable content: cognitive development, biological theories of development, role theory, middle childhood, and others.

637. Trends in Human Relations (3) I Philosophy, content, and resources for understanding, teaching and working in the field of human relations.

"Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Clothing, Textiles, and Interior Design

Professor Hatch, Chairperson of the Division

The Division of Clothing, Textiles, and Interior Design provides instructional programs for clothing and textiles, merchandising and fashion promotion, and interior design. Majors in clothing and textiles and in merchandising and fashion promotion acquire expertise in coordinating complex economic, aesthetic, technological, and sociological factors in dress as they prepare for professional careers. Majors in interior design acquire expertise in the various aspects of the design of the interior environment.

Students are advised to take note of the College of Business and Public Administration's Advanced Standing requirement, which includes a cumulative grade-point average of 2.25 or better to establish eligibility for the upper division level business courses. Majors in clothing and textiles, interior design merchandising track, and merchandising and fashion promotion require a number of upper division level business courses as part of the requirements. A student who does not complete the required business courses will not be able to graduate under any of the respective CTID majors.

The major in clothing and textiles: I. F.C.R. 129; I.D. 115; C.T. 145; 234; 284R; 284L; 304; 325; 344; 393b (1 unit); 444; 454; 464; 6 units from C.T. 434, 445, 464, 484, 493b; f.c.r. upper-division course outside the major; Art 101 or 241; Econ. 201b, 9 units from 493b (3 units maximum), m.a.p., mktg., m.i.s.; 9 units from one area: art or rehabilitation or journalism; electives 11-10 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. Ill. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art 117, 118 and additional 3 units or Drama 140a, 140b and additional 3 units. IV. Comm. 102; 112; Eng. 307 or 308. V. Econ. 201a; Soc. 100; Psyc. 101. VI. Chem. 101a; 102a; 101b; 102b or Ecol. 159a; Ecol 159b. VII. 9 units from one area Ill, IV, V, VI.

The major in merchandising and fashion promotion: I. F.C.R. 129; I.D. 115; C.T. 145; 284R; 284L; 304; 325; 344; 393b (1 unit); C.T. 434 or 454; C.T. 444 or 445; C.S. 446; 6 units from C.D.F.R. 117, C.T. 234, 344, 434, 444, 454, 464, 484, 493b, C.S. 416, 466; f.c.r. upper-division course outside the major, electives 10-12 units; Acct. 200; Mktg. 361; 364; 458; 3 units from Mktg. 410, 450, 452, 453; 9 units from acct., m.a.p., C.T. 493b (3 units maximum), mktg., m.i.s.; Art 101 or Art 241. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). Ill. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art 117, 118 and additional 3 units, or
Dram. 140a, 140 b and additional 3 units. IV. Comm. 102, 112; Eng. 307. V. Econ. 201a, 201b; Soc. 100. VI. Chem. 101a, 102a; and 4 units from Math. 117, statistics, biological and physical sciences. VII. Psyc. 101; 6 additional units from behavioral and social sciences.

The major in interior design requires a two-year preprofessional and a two-year professional phase. Prior to entering the professional phase, the student must select one of two tracks of study: design or merchandising. The design track focuses on the relationships between people and their interior environments: residential and contract. It draws from the humanities, behavioral and social sciences, and fine arts for support course work. The merchandising track focuses on the retailing, marketing and business aspects of the interiors profession providing expertise in coordinating complex economic, aesthetic and sociologic factors. An application for admission to the professional phase, design track, must be filed with the program chairman by the last day of classes of the spring semester preceding the intended fall admission. The application shall consist of a portfolio, an examination, a completed application form, and a transcript. Applicants will be evaluated on the basis of the following criteria: grade-point average (especially in design and related courses), course work, statement of intent, portfolio review, successful completion of the qualifying examination, and creative endeavors. (It is highly unlikely that a student with a grade point average lower than 3.00 in design courses and 2.00 overall will be admitted to the design track.) For application the student must have completed 60 units, including I.D. 115, 155, 265a, 265b; Art 101, 102; and 6 units of art history or Hist. 103, 104 (6 units) or Hum. 250a, 250b, 250c (8 units).

The major in interior design (design track): I. F.C.R. 129; I.D. 115; 155; 265a; 265b; 335; 355; 365; 375; 393i (1 unit); I.D. 475; 485; 488; C.T. 284R; C.S. 356; Art 101; Art 102; Art or I.D. 493i (3 units); Arch. 101; L.Ar. 202; family and consumer resources upper-division course outside the major; electives 16-18 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, Hist. 104 and additional 3 units or Art 117, 118 and additional 3 units. IV. Comm. 102; 6 additional units. V. Econ. 201a; Psyc. 101; Soc. 100. VI. Chem. 101a; 102a; 4-5 additional units. VII. 9 units in behavioral and social science.

The major in interior design (merchandising track): I. F.C.R. 129; I.D. 115; 155; 265a; 335; 355; 375; 393i (1 unit); 485; C.T. 284R; 304; C.S. 356; family and consumer resources upper-division course outside the major; Art 101; art elective; Acct. 200; Mktg. 361; 458; 6 units from m.a.p. or mktg. or I.D. 493i; electives 19-21 units. II. Engl. 101 or 103H; Engl. 102 or 104H; ex.s.s. 2 units. III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art 117, 118, and additional 3 units. IV. Comm. 102; 6 additional units. V. Econ. 201a, 201b; Psyc. 101. VI. Chem. 101a; 102a; Math. 117e; 1-2 additional units. VII. Soc. 100; 6 additional units.

**Clothing and Textiles**

114. Apparel Analysis (2) I II Fashion production terms and techniques; comparison and evaluation of apparel, quality, fit and appearance for intended consumer markets.

145. Fashion Concepts and Theory (3) I II Theories of consumer’s choice and use of clothing and fashions.

234. Apparel Design (3) I II Application of intermediate apparel construction and fitting techniques to arrive at aesthetically pleasing and functional garments. 1R, 6L.


284L. Textile Science Laboratory (1) I II Lab. analysis of fibers and fabrics. P, 284R or CR.


325. Historical Analysis of Dress and Fashion (3) I II Western dress and the development of the fashion system from an historical perspective from ancient to modern periods; special emphasis on twentieth century dress. P, Hist. 103, 104; or 8 units of Hum. 250a-250b-250c; or 6 units of Art 117, 118, 119; or Dram. 140a-140b. Writing-Emphasis Course*

344. Advanced Apparel Design (3) I Experimental problems in advanced techniques of apparel construction, with emphasis on pattern alteration, modification, fitting and couture construction. 1R, 6L. P, 115, 234.

393. Internship

b. Merchandising, Textiles, and Clothing (1) I II Open to clothing and textiles and to merchandising and fashion promotion majors only.
DEPARTMENTS AND COURSES OF INSTRUCTION

434. **The Fashion Industry** (3) GC II Operations of the fashion business including producers of fibers, fabrics, apparel and fashion retailers. P, 304 or consult department before enrolling.

444. **Dimensions of Clothing Behavior** (3) GC II Analysis of psychological, social, cultural, historical, economic and aesthetic dimensions of clothing reported in literature. P, 145, Soc. 100, Psyc. 101, Econ. 201a.

445. **Clothing for Special Needs** (3) GC I Clothing and accessories for special needs; based upon research. (Identical with Gero. 445)

454. **New Developments in the Textile Field** (3) GC I Fabric finishes, new fiber development, textured yarns, knits, and fabric use and care problems. P, 284R.

464. **Aspects of Clothing Design** (3) GC II Projects in the analysis and manipulation of design media to produce garments to meet selected needs and populations. 1R, 6L. P, 145, 344.

484. **Textile Analysis** (3) GC II 1987-88 Physical and chemical testing, dyes, microscopic analysis and use of textile testing equipment for fabric analysis. 2R, 3L. P, 454.

493. **Internship** b. Merchandising, Textiles, and Clothing (1 to 12) [Rpt./1] Open to clothing and textiles and to merchandising and fashion promotion majors only.

**Interior Design**

115. **Fundamentals of Design** (3) I II GRD Elements and principles of design; theory and exploration of design interpretation, historical and contemporary. Open to majors only or consult department before enrolling.

155. **Social Awareness of Design** (3) I II Programming and planning of design to focus on the psychological and sociological needs of individual and group units. P, 115

265a-265b. **Presentations** (3-3) 265a: I Drafting mechanics, interrelationships of 2-d to 3-d composition; plans, sections, elevations; introduction to model-building skills. 265b: II 2-d and 3-d rendering techniques and technical illustrations; working drawings; model-building techniques. P, 115, Art 101.

335. **Interior Furnishings Industry** (3) I Patterns of production and distribution in the interior furnishings industry, the market area, and in merchandising techniques. P, 155.

345. **Interior Perspective** (3) S Application of various one-point perspectives in interior design. Use of techniques such as pencil, ink, color pencils and markers applied to interior perspective for presentation as well as use of sketches and furniture perspectives. P, 265a-265b or drafting course.

355. **History of Design** (3) I Period styles in interiors, classical through the 20th century. P, 6 units of art history, Hist. 103, 104 or 8 units of Hum. 250a-250b-250c. Writing-Emphasis Course*

365. **Housing** (3) II Historical aspects of housing, providing housing, housing legislation, current issues and trends. Field trips.


393. **Internship** i. Interior Design (1) I II Open to interior design majors only.

405. **Barrier Free Design** (3) GC II Current research in architecture, interior design, product design, physical therapy, behavioral science and rehabilitation reviewed and applied in design problem-solving.

455. **Visual Merchandising and Display** (3) GC S All aspects of displaying merchandise, including window display, interior display, color and lighting techniques, line and composition, three-dimensional presentation, fixtures and systems, planning and layout, scheduling and promotion. P, 115 or Art 101.

475. **Contract Design** (3) GC I Design problems, presentations and purchasing. P, 265b, 355, L.Ar. 345.

485. **Ethics and Practice for Interior Design** (3) GC II Readings in the interior fields, with emphasis on individual professionalism. P, 375.

488. **Advanced Studio Project: Interior Design** (3) GC II Detailed studio-based design projects applying previously acquired design and graphic skills demonstrating high level of competence in problem solving. 1R, 6L. P, 375, 475.

493. **Internship** i. Interior Design (1 to 12) [Rpt./1] I II Open to interior design majors only.

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
Counseling and Guidance

Associate Professor Erickson, Chairperson of the Division

The Division of Counseling and Guidance offers professional preparation in counseling and guidance, with concentrations in marriage, family, agency, and career counseling. The Master of Science degree with a major in family and consumer resources and a concentration in counseling and guidance is available through the Division. For admission and degree requirements, please see the Graduate Catalog.

401. Basic Skills in Counseling (3) GC I Selected counseling skills and their applications to noncounseling settings. Designed for nonmajors needing basic skills in counseling as an adjunct to other primary occupational functions.

403. Principles of Adlerian Psychology (3) GC I, II Techniques for the study of human behavior; implications for improving adult-child relationships, with emphasis on Adlerian principles.

445. Psychosocial Aspects of the Drug Use Process (3) GC I (Identical with Ph.Pr. 445)

521. Techniques of Interviewing (3) I, II Types and functions, process, and application of the interview in various settings.

549. Counseling and Guidance Laboratory (1 to 3) I, II Supervised observation and participation in selected counseling and guidance activities: campus, public school, and community settings.

557. Methods in Marital Therapy (3) I (Identical with C.D.F.R. 557)

570. Counseling the Adult (3) I Adult crisis, midlife changes and developmental patterns; counseling techniques and intervention strategies.

571. Counseling Women (3) II Examination of the counseling needs of contemporary women and current types of intervention designed to meet these needs. (Identical with W.S. 571)

597. Workshop
   c. Self-Management Techniques (3) S
   j. Anger, Depression and Guilt (3) S
   k. Family Systems and Psychodrama (3) S.

601. Foundations of Counseling (3) I, II Relationship and contributions of various fields to the work of the counselor at all levels, in current and historical perspective; derivation of principles and objectives; integrated lab. experience in selected settings. Open to majors only.

622. Appraisal of the Individual (3) I, II Methods of appraising and reporting individual behavior, with emphasis on nonpsychometric data. Open to majors only.

623. Testing in Counseling (3) I, II Evaluation and selection of psychological tests for guidance; use of psychometric data in counseling. Open to majors only.

631. Career Counseling (3) I, II Theories of vocational development; types, sources, and use of occupational and educational information in career counseling and decision making. P, 601 or CR.

644. The Counseling Process (3) I, II Introduction to theories of counseling; collation and interpretation of counseling data; the counseling process; study of cases. P, 601, 622.

645. Theories of Counseling (3) I, II Rationale, development, and research underlying major counseling theories. P, 631, 644.


648. Procedures in Family Counseling (1 to 3) I, II Theory and process in family counseling; problem solving techniques applied to parent-child conflict; lab. experience. P, 403.


683. Group Counseling (3) I Theory and process in group counseling; applications in school, college, and community settings; lab. experience. P, 644.

693. Internship
   a. Counseling (1 to 9) [Rpt.] I, II
DEPARTMENTS AND COURSES OF INSTRUCTION

694. Practicum P, 24 units of counseling courses. Supervised practice is offered on the basis of need and demand in the following areas:

d. Agency Counseling [1 to 9] [Rpt.] I II

e. Family Counseling [1 to 9] [Rpt.] I II

f. Group Counseling [1 to 9] [Rpt.] I II
g. Marriage Counseling [1 to 9] [Rpt.] I II

795. Colloquium

a. Professional Practice [1 to 3] [Rpt.] I II

b. Counselor Education and Supervision [1 to 3] [Rpt.] III
c. Counseling Theory [Theory varies] [1 to 3] [Rpt.] I II
d. Career Development [1 to 3] I II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Home Economics Education/Consumer Studies

Associate Professor Rudd, Chairperson of the Division

The Division of Home Economics Education/Consumer Studies provides instructional programs for home economics education, home economics extension education, consumer studies and family resource management, home economics and journalism, and general home economics. Opportunities for field experiences are provided in all programs.

The major in home economics education prepares students to develop and implement educational programs in home economics and leads to certification for teaching in public schools. Candidates for admission to undergraduate programs in education and home economics education must present evidence of having completed 56 units of work applicable to the B.S. in F.C.R. degree with a minimum grade-point average of 2.250. Those who register for H.E.E. 489 and T.T.E. 338g must have a cumulative grade-point average of 2.5 in F.C.R. and N.F.S. course work.

The major in home economics education: I. F.C.R. 129; C.D.F.R. 223; 337; 347; C.T. 145; 234; 284R; 284L; C.S. 116; 316; 416 or 446; I.D. 115; C.S. 346; 356; 3 courses from N.F.S. 101, 201, 251, 350; family and consumer resources upper-division course outside the major; H.E.E. 288; 408; 338g; 489; 428; 499 (1 unit); electives recommended H.E.E. 393, 409, T.T.E. 485. II. Engl. 101 or 103; Engl. 102 or Engl. 104; ex.s.s. 2 units. III. Two courses in humanities and arts and one course in U.S. history from those listed in the College of Education section of this catalog. IV. L.R.C. 435; T.T.E. 494b; 5 additional communications units. V. Psyc. 101; Pol. 110, Econ. 210a. VI. Chem. 101a, 102a; 101b, 102b; 3 units of math. VII. Ed.P. 311; Ed.A. 350.

The major in home economics extension education prepares students for educational positions in nonformal settings such as the Cooperative Extension Service, business or government or human services.

The major in home economics extension education: I. F.C.R. 129; C.D.F.R. 223, 337; C.T. 114 or 234; 284R, 284L; I.D. 115; C.S. 356 or I.D. 365; N.F.S. 101; 251; C.S. 116; 416; 436; 446; 3 additional family and consumer units; family and consumer extension education upper-division course outside the major; A.Ed. 301; H.E.E. 288; 428; 448; 493e; 497s; electives 14-16 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. III. Hum. 250a, 250b or 8-9 units from art, classics, history, literature, music, or philosophy. IV. Agri. 422; L.R.C. 435; T.T.E. 417. V. Econ. 201. VI. Chem. 101a, 102a; 4-5 additional units with Chem. 101b, 102b recommended. VII. 3 units from anthropology or sociology; 6 additional units from behavioral and social sciences.

The major in consumer studies and family resource management prepares students for careers as consumer affairs specialists in government or business, as consumer educators in adult or nonformal educational programs, and as personal and family financial advisers.

The major in consumer studies and family resource management: I. F.C.R. 129; C.S. 116; C.D.F.R. 337; C.S. 356; 376; 386; 416; H.E.E. 428; C.S. 436; C.S. 446; H.E.E. 448; C.S. 466; N.F.S. 101; 15 additional family and consumer resources units; family and consumer resource upper-division course outside the major; electives 22-24 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). III. Hum. 250a, 250b or 9 units from art, classics, history, literature, music, philosophy IV. 9 units from journalism, media arts, communication, a language. V. Econ. 201a, 201b; 330. VI. 8-9 units; Math. 119 and 123 recommended. VII. 9 units from anthropology, politics, psychology, sociology.
The minor in consumer studies and family resource management: C.S. 116, 416; 376, 386; 446, 466; Econ. 201a (credit for this course will not count for minor). Students select one course from C.S. 316, 356, 411, 436. Students desiring to minor in consumer studies and resource management should consult that division for a consumer studies minor advisor.

The major in general home economics is for students interested in an emerging and innovative career in the area of family and consumer resources for which there is no formal program. Students should seek aid of an adviser in building an individualized program.

The major in general home economics: I. F.C.R. 129; C.D.F.R. 223; 337; C.T. 114 or 145 or 234; C.T. 284R, 284L; I.D. 115; H.E.E. 428; C.S. 116; 446; 356 or I.D. 365; N.F.S. 101, 251; C.S. 416; 436; H.E.E. 448; C.S. 466; 8-10 additional family and consumer resources units; family and consumer resources upper-division course outside major; C.S. 316 recommended; electives 22-24 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. III. Hum. 250a, 250b or 9 units from art, classics, history, literature, music, philosophy, IV. 9 units from journalism, a language, media arts, communication V. 9 units from agricultural economics, economics, anthropology, economics, politics, psychology. VI. 8-9 units; Chem. 101a-101b; Chem. 102a-102b recommended. VII. 9 additional units from one area III, IV, V or VI.

The major in home economics and journalism prepares students to use home economics and communications background for careers in mass media, including newspapers, trade journals, magazines, television, and radio.

The major in home economics and journalism: I. F.C.R. 129; C.D.F.R. 117; 223; C.T. 114 or 145; C.T. 284R, 284L; I.D. 115; C.S. 356 or I.D. 365; N.F.S. 101; 251; C.S. 116; 446; H.E.E. 428; C.S. 436; 466; 6 additional family and consumer resources units; family and consumer resources upper-division course outside the major; electives 23-25 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. III. Hum. 250a, 250b or 9 units from art, classics, history, literature. IV. Jour. 205, 206, 208, 401. V. 9 units from behavioral and social sciences. VI. 8-9 units from biological and physical sciences; Chem. 101a, 102a, 101b, 102b recommended. VII. Jour. 411 or 413, 412, 420, 422.

Consumer Studies

116. **Personal Resource Management** (3) I II Principles of management as applied to individuals and home situations; time, money, and energy studies.


346. **Household Equipment** (3) II Principles of selection, use, and expected performance of household equipment; home wiring, lighting, interior surface materials; recent research findings related to each. 2R, 3L.

356. **Social and Economic Aspects of Housing** (3) I Neighborhoods and sites, family requirements, characteristics of a good house, physical, psychological, and social environments, buying new and old houses; equipment and maintenance.

376. **Consumer Problems** (3) I The buyer-seller relationship, with emphasis on consumer problems, the consumer movement, and business and consumer rights and responsibilities.

386. **Consumer Protection** (3) II Study and application of principles of consumer protection among consumers, businesses, and government agencies. Writing-Emphasis Course*

411. **Consumer Fraud in Nutrition** (3) GC S (Identical with N.F.S. 411)

416. **Management of Family Finances** (3) GC I II Management of family finances throughout the family life cycle to achieve financial well being. P, Econ. 201a.

436. **Economics of Aging** (3) GC II Economic issues as they affect the aging individual, family and society; economic demographics, consumer problems, and retirement financial planning. (Identical with Gero. 436)

446. **Consumer Economics** (3) GC I II Study and application of consumer economics under existing market conditions. P, Econ. 201a.

466. **Family Economics** (3) GC I Analysis of the family as an economic-decision-making unit within the larger economic system. P, Econ. 201b.

Home Economics Education

220. Non-Formal Education (3) I (Identical with A.Ed. 220)

288. Observation/Participation in Home Economics Education and Extension (2) II Functions of home economics educators in school- and community-based programs; characteristics of home economics programs; structuring learning settings to meet student/client needs. 1R, 3L.

338g. Teaching Home Economics (3) I (Identical with T.T.E. 338g) Writing-Emphasis Course*


409. Occupational Home Economics Programs (3) GC II Purposes and methods of teaching home economics-related occupations, with emphasis on cooperative home economics vocational education. P, T.T.E. 338g; CR H.E.E. 408 and 489 or teaching experience.

411. Consumer Fraud in Nutrition (3) GC S (Identical N.F.S. 411)

428. Professional Presentations and Techniques (3) GC I Theory and practice of educational techniques in non-formal settings in positions in business, government and human services. 2R, 3L.

448. Extension Program Planning and Evaluation (3) GC II Bases and procedures for program planning, implementation and evaluation in non-formal education programs such as the Cooperative Extension Service. Examination of issues and trends, observation and individual projects. P, A.Ed. 338, and H.E.E. 428 or A.Ed. 409. (Identical with A.Ed. 448)

489. Supervised Teaching in Home Economics (1 to 8) II Teaching vocational home economics under supervision in approved programs in secondary schools in Arizona. Preregistration first semester of jr. yr. P, T.T.E. 338g; CR H.E.E. 408.

493. Internship
   e. Supervised Work Experience in Home Economics (1 to 6) [Rpt./2] I II S Open to h.ec.ed. majors only.

497. Workshop
   l.* Extension Communications (1 to 2) [Rpt./2] GC (Identical with A.Ed. 497l, which is home)
   m.* Human Motivation in Extension Programs (1 to 2) [Rpt./2] (Identical with A.Ed. 497m, which is home)
   n.* Youth Development through 4-H Programs (1 to 2) [Rpt./2] (Identical with A.Ed. 497n, which is home)
   r.* Public Relations in Extension (1 to 2) [Rpt./2] GC (Identical with A.Ed. 497r, which is home)

538. Philosophy and Principles of Extension Education (3) I (Identical with A.Ed. 538)

539. Extension Education Methods (3) II (Identical with A.Ed. 539)

597. Workshop
   c.* Extension Credibility and Accountability (1 to 2) [Rpt./2] (Identical with A.Ed. 597c, which is home)
   d.* Extension Supervision and Administration (1 to 3) [Rpt./2] (Identical with A.Ed. 597d, which is home)
   g.* Microcomputers-Extension (1 to 2) [Rpt./2] (Identical with A.Ed. 597g, which is home)
   h.* Family Development through Home Economic Programs (1 to 2)
   t. Principles of Extension Training (1 to 3) I (Identical with A.Ed. 597t, which is home)
   u. Evaluation in Extension Education (1 to 3) I (Identical with A.Ed. 597u, which is home)
   v. Volunteer Staff Development in Extension (3) I 2R, 3L. (Identical with A.Ed. 597v)
   w. Administration of Extension Programs (1 to 3) I (Identical with A.Ed. 597w, which is home)

*Offered only through the Cooperative Extension Service Winter School.

607. Topics in Home Economics Education (1 to 3) [Rpt./12 units] II S Philosophy, content, and resources for understanding, teaching, and working in home economics education.


610. Investigation and Studies in Home Economics (3) I Study and analysis of research literature, methods, techniques, and procedures for conducting investigations, selecting and developing plans for research problems.

618. Evaluation in Home Economics Education (3) II 1988-89 Application of theory to the selection and construction of evaluation instruments, their use and interpretation in home economics programs.

628. Curriculum Theory In Home Economics (3) I 1988-89 Theoretical bases and processes of curriculum building in home economics; current issues in home economics education.

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

For information concerning nutrition and food science, see the Department of Nutrition and Food Science elsewhere in this catalog.
FAMILY ECONOMICS AND HOME MANAGEMENT
(See Family and Consumer Resources)

FAMILY RELATIONS
(See Family and Consumer Resources)

FILM STUDIES
(See College of Arts and Sciences, Faculty of Fine Arts, Department of Media Arts)

FINANCE AND REAL ESTATE
Professors Gerald O. Bierwag, Co-Acting Head, Willard T. Carleton, Co-Acting Head, Nestor R. Roos (Emeritus)
Associate Professors Erich K. Bleck, Joseph S. Gerber (Emeritus)
Assistant Professors Prabir Datta, William V. Harlow, Ill, John D. Schatzberg, Howard S. Stern, Gerry Suchanek
Lecturers Thomas C. Moses, Sanders K Solot

Majors in finance are prepared for corporate financial management, investment portfolio management, brokerage, and investment and commercial banking. Those who concentrate in real estate are exposed to the practical aspects of appraising, financing and managing real property in addition to the economics of land uses.

Undergraduate majors in finance and real estate are offered through the Bachelor of Science in Business Administration (see the College of Business and Public Administration section of the catalog). Nonbusiness students interested in a minor in one of these areas should contact the department head for information. A Master of Science with a major in finance is available, and the department participates in the Master of Business Administration and the Doctor of Philosophy degrees with a major in business administration.

201. Personal Finance (3) I II Principles of personal money management and financial planning for the individual and family, including analysis of home buying, credit purchases, insurance, savings, and investments. Not open to B.P.A. students.

221. The Stock Market (3) I II Analysis of the markets for securities of both public and private issuers: brokers, dealers, investment bankers, organized and over-the-counter markets; the mechanics of trading, and the investment risks and merits of all classes of securities. Open only to nonmajors.

251. Risk and Insurance (3) I II Theory of risk; essentials of risk management, with emphasis on insurance, including analyses of coverages purchased by business firms and families. Designed for those seeking a general knowledge of insurance.

261. Real Estate Principles (3) I II Survey of the business aspects of real estate.


313.* Economics of Futures Markets (3) I I (Identical with A.Ec. 313)

361.* Real Estate Finance (3) I II Real estate risks and financing; kinds, sources, costs, and uses of funds; the secondary market and related governmental activities. P, Fin. 261.

362.* Real Estate Appraisals (3) I II Factors influencing real property values; application of three approaches in determining the value of residential, commercial, and industrial properties. P, Fin. 261.
412.* Corporate Financial Problems (3) GC I II Advanced financial problems of the firm: capital structure, valuation, reorganization, recapitalization, growth, and failure. P. Fin. 311.

421.* Investments (3) GC I II Operation and analysis of the stock, bond, and commodity markets; theory and practice in construction and management of investment alternatives. P. Fin. 311.

422.* Securities Analysis (3) GC I II Current practices and techniques of evaluating common stocks, bonds, stock options and warrants. P. Fin. 421.

431.* Financial Intermediaries (3) GC I II Financial markets and institutions; effects of economic conditions and government policy on financial institutions, the flow of funds, and interest rates; term structure of interest rates; financial institution management. P. Fin. 311, Econ. 330.

461.* Real Estate Law (3) GC I II Principal areas of the law of real estate. P. Fin. 261.

463.* Real Estate Investment and Taxation (3) GC II Professional management and use of real estate for income production; tax influences. P. Fin. 361, 362, Acct. 320.

465.* Advanced Real Estate Appraisal (3) GC II Valuation of income-producing property; the capitalization process, discounted cash flow, concepts of investment analysis. P. Fin. 361, 362.

471.* Policy Formulation and the Finance Function (3) GC I II Integrative course utilizing the case study approach and focusing on the financial impact of marketing and production strategies. P. Fin. 412, M.A.P. 305, 373, Mktg. 361. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

486.* Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487.* Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

"Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

511. Business Finance (3) I II Integration of the basic principles and theory of business finance, with emphasis on analytical financial management of the firm. Students with credit in Fin. 412 should take Fin. 512. Open only to students admitted to a BPA graduate program. P. Acct. 550.

512. Advanced Corporation Finance (3) I II Financial theory applied to capital structure; investment decisions; corporate valuation; and corporate financial policies. P. Fin. 412 or 511.

513. Theory of Finance (3) I Theoretical models pertaining to financial decisions. P. Fin. 412 or 511.

521. Portfolio Management (3) I Portfolio theory and applications; equity markets, fixed income, and option markets; risk analysis and investment strategies. P. Fin. 421.

522. Advanced Securities Analysis (3) II Examination of securities risk, return, and price behavior in competitive markets. P. Fin. 421 or 521.

531. Money and Capital Markets (3) I Analysis of the theoretical and practical problems facing individuals and financial institutions managing money and fixed-income portfolios. P. Fin. 421 or 431.

532. Financial Futures and Options (3) II Design and trading of interest rate futures and options. Examination of their use in hedging, speculating, arbitraging, and their regulation. P. Fin. 421 or 521.

537. Finance for New Ventures (3) III Value maximization; simulation of value distribution; sources of venture capital; timing of initial public offering; new venture ownership structuring. Open only to students in the entrepreneurship program. P. Fin. 511, Econ. 500a-500b, Mktg. 500. (Identical with M.A.P. 537)

539. Planning of New Ventures (3) II (Identical with M.A.P. 539)


696. Seminar
a. Investment Analysis (1 to 3) [Rpt./1] I II
b. Financial Markets (1 to 3) [Rpt./1] I II
c. Corporation Finance (1 to 3) [Rpt./1] I II
d. Capital Budgeting (1 to 3) I II
e. Research Methods (1 to 3) [Rpt./1] I II
The following courses in the Faculty of Fine Arts, College of Arts and Sciences, are interdepartmental in subject matter and in instruction. Therefore, they are offered by the Faculty of Fine Arts rather than by a specific department. They are crosslisted in Fine Arts departments, when appropriate. These courses are taught by faculty in the Faculty of Fine Arts.

207. Western Civilization and the Arts: The Twentieth Century (3) I II The arts as an interdisciplinary framework of human heritage from which connections are made to contemporary issues in ethics, philosophy, science, law, and politics. (Identical with Mus. 207, Dnc. 207, Dram. 207, Art 207, M.Ar. 207)

307. Western Civilization and the Arts: Paleolithic Through Renaissance (3) I II The arts as an interdisciplinary framework of human heritage from which connections are made to historical issues in ethics, philosophy, science, law, and politics. (Identical with Mus. 307, Dnc. 307, Dram. 307, Art 307, M.Ar. 307)

317. Western Civilization and the Arts: Baroque Through Nineteenth Century (3) I II The arts as an interdisciplinary framework of human heritage from which connections are made to historical issues in ethics, philosophy, science, law, and politics. (Identical with Mus. 317, Dnc. 317, Dram. 317, Art 317, M.Ar. 317)

FOOD SCIENCE
(See Nutrition and Food Science)

FOOD SERVICE MANAGEMENT
(See Nutrition and Food Science)

FOUNDATIONS OF EDUCATION
(See Educational Foundations and Administration)

FRENCH AND ITALIAN

Professors Guido Capponi (Emeritus), Frank M. Chambers (Emeritus), Jean-Jacques Demorest, Charles I. Rosenberg
Associate Professors Jonathan Beck, Head, Edward G. Brown, Ingeborg M. Kohn, Henri Servin, Gianni Spera, Ronnie H. Terpening
Assistant Professor Lise Leibacher
Lecturers Gerard Agniéray, John L. Gesell, Jean Goetinck, Annamaria Kelly

The Department of French and Italian offers instruction in both languages at the elementary, intermediate, and advanced levels. It also offers courses in the literature and civilization of France, in technical and commercial French, and in the literature and civilization of Italy. Study-abroad programs are conducted by the Italian section in Florence, and by the French section in Paris. Undergraduate majors in French or Italian can expect to attain a command of the language and a knowledge of the culture that will prepare them to teach at the secondary level, to undertake professional graduate studies in French or Italian, or to pursue careers in international business or in the foreign service.
The department offers the following degrees: Bachelor of Arts with majors in French and Italian; Bachelor of Arts in Education with a teaching major in French; Master of Arts with major in French (with a concentration available in Francophone literature); Master of Education with a teaching major in French; and Doctor of Philosophy with a major in French. The department also participates in offering the Master of Arts with a major in Romance languages through the Committee on Romance Languages.

Writing-Emphasis Courses: Because writing in all upper-division courses is in either French or Italian, the requirement will be satisfied through completion of at least one 3-unit course designated as a Writing-Emphasis Course within the minor department (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Honors: The department participates in the Honors Program and offers honors sections of selected courses. Inquire with the departmental honors advisor.

French

Unless otherwise indicated, all courses are taught in French. For purposes of appropriate placement, enrollment in all language courses is subject to the consent of the instructor.

Literature major: 30 units (in addition to 101a-101b), including 300a-300b-300c, 375a-375b, and 6 additional units of literature in the 400 series. No fewer than 22 units must be upper-division course work. The minor subject will be chosen in consultation with the major advisor.

Teaching major: 30 units (in addition to 101a-101b), including 300a-300b-300c, 375a-375b, 414, and 6 additional units in the 400 series.

Teaching minor: 20 units (in addition to 101a-101b), including 305a-305b. Students offering 2 years of French as entrance credit must include 6 units from 300a-300b-300c.

Non-teaching minor: For various options, consult the undergraduate advisor in French.

101a-101b. Elementary French (4-4) CDT Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Also see 302a-302b.

101y. Intensive Review and Elementary French (4) I Review at the 101b level for students handicapped by time-lapse between high school French and enrollment in college French; prepares for 201a in the following semester. Admission is by assignment based upon placement test results. P, no more than two years of high school French.

201a-201b. Intermediate French (4-4) CDT P, 101b or two years of high school French. Both 201a and 201b are offered each semester.

201y. Intensive Review and Intermediate French (4) I Review at the 201a level for students handicapped by time-lapse between second-year high school French and the first year of college; prepares for 201b in the following semester. Admission is by assignment based upon placement test results.

202a-202b. Accelerated French (6-6) S 202a is the equivalent of 101a-101b; 202b is the equivalent of 201a-201b. Credit is allowed for this course or 101a-101b; 201a-201b, but not for both.

282a-282b. French Literature in Translation (3-3) Representative masterpieces of French literature. Will not count toward fulfillment of the language requirement or the major or minor in French 282a is not prerequisite to 282b.

300a-300b-300c. Types of French Literature (3-3-3) A detailed study of literary texts. 300a: The Middle Ages and the 16th century. 300b: The 17th and 18th centuries. 300c: The 19th and 20th centuries. P, 201b. 300a, 300b, and 300c are offered each semester.

302a-302b. Intensive French (4-4) P, knowledge of another language at the 305b level, or permission of instructor. 302a is the equivalent of 101a-101b; 302b is the equivalent of 201a-201b.

305a-305b. Composition and Conversation (3-3) Designed for students who wish to write and speak fluently in everyday idiom; material based upon practical current topics. P, 201b. Both 305a and 305b are offered each semester.

370a-370b. Commercial and Technical French (3-3) The basic workings of the French economy and the essential vocabulary and style specific to French business. P, 201b or consult department before enrolling.


375a-375b. Advanced Composition and Conversation (3-3) Practice in formal writing and formal oral communication. P, 305b. Both 375a and 375b are offered each semester.

403a-403b. Literature of the 16th Century (3-3) GC 1987-88 403a: Early Renaissance, Reformation, Rabelais, the Pleiade. 403b: The Humanists, Montaigne, D'Aubigne, the drama. P, 201b. 403a is not prerequisite to 403b.

404a-404b. Literature of the 17th Century (3-3) GC 1988-89 404a: Human condition, as seen by the epoch of Louis XIII and the Fronde. 404b: Classical ideal. P, 201b. 404a is not prerequisite to 404b.

405a-405b. Literature of the 18th Century (3-3) GC 1987-88 Study of ideas in the French Enlightenment. 405a: Rationalist currents. 405b: Sensibility. P, 201b. 405a is not prerequisite to 405b.


414. Teaching of Modern Languages (3) GC II (Identical with T.T.E. 414)

415. Stylistics (3) GC I Principles of stylistics, with exercises in literary translation and original writing. P, 375b.

416. Translation (3) GC II Theory and practice of translation (French/English; English/French). Literary and technical. P, 375b or 370b.

422. Introduction to Romance Philology (3) GC I 1988-89 (Identical with Span. 422)

430a-430b. French Civilization (3-3) GC Historical, social, economic, literary, and artistic elements in the development of the French nation. P, 201b. 430a is not prerequisite to 430b.

431. Contemporary French Philosophy (3) GC II 1987-88 Discussion course, conducted in English with readings in French; Bergson, Camus, Simone Weil, Teilhard de Chardin, Sartre, Levi-Strauss.

450a-450b. French Literature of Black Africa and the West Indies (3-3) GC 1987-88 Up to 1960. 450b: 1960 to present. P, 201b. 450a is not prerequisite to 450b. (Identical with BLS. 450a-450b)

452. French Literature of Quebec (3) GC II 1988-89 Comprehensive study of the most significant literary expression in Quebec. P, 201b.


470. Advanced Grammar and Usage (3) GC II Structural analysis of spoken and written French, with emphasis on structural patterns and attention to contrasts with English. Graduate students will do additional work in composition and stylistics. P, 201b.

497. Workshop

b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

500. Intensive Reading Course for Graduate Nonmajors (3 hrs/wk., no credit) I IL Rapid acquisition of reading proficiency in French. No prior knowledge of the language necessary. Proficiency certification obtained from this course fulfills graduate foreign language requirement in some departments (consult department for information).

510. Materials and Methods of Research (2) I 1987-88 Problems and methods of advanced research in French language and literature. Use of specialized library resources and computerized data bases. Style and presentation conventions for preparation of scholarly research.

511. Contemporary French Literary Theory (3) II 1987-88 Methods of criticism and techniques of literary analysis.


557. Rousseau (3) II 1988-89 Rousseau's political thought; his ideas concerning education; The Confessions; the beginning of Romanticism.

558. Realism and Naturalism in the Novel (3) I 1987-88 Flaubert, Zola, Maupassant, etc.

559. Contemporary Theatre (3) II 1988-89 Theatre from 1950 to the present time; Ionesco, Beckett, Genet, Arrabal, Obaldia, Tardieu, Dubillard, etc.


579. Problems in Teaching College French (1 to 3) II Methodology course in lower-division college pedagogy. Discussion of broader issues of language, pedagogy, academe, the history of foreign language education, college teaching as a career.
DEPARTMENTS AND COURSES OF INSTRUCTION

696. Seminar
   a. Romance Philology (3) I II
   b. Topics in French Literature (3) [Rpt./2] I II
   c. Old French Literature (3) I II
   d. 16th Century (3) I II
   e. 17th Century (3) I II
   f. 18th Century (3) I II
   g. 19th Century (3) I II
   h. 20th Century (3) I II

Italian

The major: 30 units (in addition to 101a-101b), including 305a-305b, and/or 405a-405b, 400a-400b, and 6 additional units of literature courses in the 400 series. No fewer than 22 units must be upper-division course work.

The minor: 20 units (in addition to 101a-101b), including 305a-305b or 405a-405b (for students who require additional fluency), and 400a-400b.

Students with teaching minors will be required to complete a course in methodology dealing with teaching foreign languages in high school and/or junior college.

101a-101b. Elementary Italian (4-4) CDT Both 101a and 101b are offered each semester. (The first year of work in a foreign language shall not be counted toward a minor.) Also see 101z.

101z. Intensive Elementary Italian (4) I P, language major or proven language proficiency. Corresponds to 101a-101b.

201a-201b. Intermediate Italian (4-4) CDT Both 201a and 201b are offered each semester. P, 101b or two years of high school Ital. Also see 201z.

201z. Intensive Intermediate Italian (4) II P, language major or proven language proficiency. Corresponds to 201a-201b.

282a-282b-282c-282d. Italian Literature in Translation (3-3-3-3) Detailed study of representative masterpieces of Italian literature. 282a: The Middle Ages. 282b: The Renaissance. 282c: The Theater. 282d: The Novel. Will not count toward fulfillment of the language requirement or the major or the minor in Italian.

305a-305b. Composition and Conversation (3-3) GRD Designed to develop linguistic skills in listening, comprehension, speaking and writing. P 201b or consult department before enrolling.

400a-400b. Main Currents of Italian Literature (3-3) 400a: The Middle Ages and Renaissance. 400b: The 17th through 20th centuries. P, 201b or consult department before enrolling.


404a-404b. Literature of the Renaissance (3-3) GC 404a: Humanism and Early Renaissance. 404b: High and Late Renaissance. P, 201b.

405a-405b. Lingua e Stile (3-3) GC Practice in formal writing and formal oral communication. Principles of stylistics. P, 305b or consult department before enrolling.


420a-420b. Italian Civilization. (3-3) GC S Historical, geographical, social, and artistic aspects of the development of the culture of Italy. Offered only in Florence, Italy. P, 201b. 420a is not prerequisite to 420b.

422. Introduction to Romance Philology (3) GC I 1988-89 (Identical with Span. 422)

450. Renaissance Studies (4) S Taught in English. On-site study of the birth and development of the Italian Renaissance with emphasis on Florence. Offered only in Florence, Italy.

497. Workshop
   b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

696. Seminar
   a. Italian Literature (3) [Rpt.] I II
GENERAL BIOLOGY
(See Ecology and Evolutionary Biology)

GENETICS

Committee on Genetics (Graduate)

Professors William P. Bemis (Emeritus, Plant Sciences), Harris Bernstein (Microbiology and Immunology), John R. Davis (Pathology), John E. Endrizzi (Plant Sciences), Robert M. Harris (Emeritus, Ecology and Evolutionary Biology), William B. Heed (Ecology and Evolutionary Biology), Frank R.H. Katterman (Plant Sciences), Robert G. McDaniel (Plant Sciences), Neil H. Mendelson (Molecular and Cellular Biology), David W. Mount (Molecular and Cellular Biology) Robert T. Ramage (Plant Sciences), Donald Ray (Animal Sciences), Nobuyoshi Shimizu (Molecular and Cellular Biology)

Associate Professors Oscar G. Ward (Ecology and Evolutionary Biology), Chairperson, Richard E. Michod (Ecology and Evolutionary Biology), Jeffrey Trent (Radiation Oncology), Stephen Zegura (Anthropology)

Assistant Professor Sue DeNise (Animal Sciences)

The genetics program is administered by an intercollege committee comprising geneticists from various departments. It offers areas of study in animal and plant genetics, cytogenetics, ecological, human, microbial, molecular, population and statistical genetics. Graduate study leading to the Master of Science and Doctor of Philosophy degrees with a major in genetics is provided. For admission and degree requirements, please see the Graduate Catalog.

413. Principles of Animal Breeding (3) GC II (Identical with An.S. 413)
414. Animal Breeding Systems (2) GC I (Identical with An.S. 414)
415. Somatic Cell Genetics (2) GC I (Identical with M.C.B. 415)
428R. Advanced Microbial Genetics (3) GC II (Identical with M.C.B. 428R)
435. Evolution (3) GC I (Identical with Ecol. 435)
473. Recombinant DNA Techniques (3) GC II (Identical with M.C.B. 473)
513. Quantitative Genetics (3) I 1988-89 (Identical with An.S. 513)
520. History of Genetics (1) I 1988-89 Experiments and discoveries which have led to the present state of knowledge in the various areas of genetics. P, Ecol. 320 or 321.
523. Cytogenetics (3) II (Identical with Ecol. 523)
524. Theoretical Population Genetics (3) I (Identical with Ecol. 524)
525. Speciation (2) II (Identical with Ecol. 525)
526. Genetics in Populations (2) II (Identical with Ecol. 526)
539. Statistical Methods (2) I II (Identical with A.Ec. 539)
   a. Analysis of Variance (1) I II (Identical with A.Ec. 539a)
   n. Nonparametric Methods (1) I (Identical with A.Ec. 539n)
   r. Regression Analysis (1) I II (Identical with A.Ec. 539r)
   s. Sample Surveys (1) II (Identical with A.Ec. 539s)
555. Molecular Mechanisms of Development (3) II 1988-89 (Identical with M.C.B. 555)
568. Nucleic Acids (3) II 1987-88 (Identical with Bioc. 568)
570. Molecular Genetics (3) I 1987-88 (Identical with Micr. 570)
571. Molecular Gene Cloning (3) II 1988-89 (Identical with Micr. 571)
595. Colloquium
   a. Genetics (1) [Rpt.] I II
DEPARTMENTS AND COURSES OF INSTRUCTION

620. Applications and Techniques of Human Genetics (3) I Genetic theory and technique, as applied to man; methods of analysis of genetically determined cytological and biochemical differences in individuals and populations. 2R, 3L, P, Ecol. 320 or 321. (Identical with Ecol. 620) Ward

627. Advanced Genetics (3) I 1988-89 (Identical with Pl.S. 627)

635. Advanced Cytogenetics (4) II 1987-88 (Identical with Pl.S. 635)

665. Survey of Physical Anthropology (3) II (Identical with Anth. 665)

666. Human Microevolution (3) II 1988-89 (Identical with Anth. 666)

670. Recent Advances in Genetics (2) I Recent advances in the field of genetics. (Identical with Ecol. 670)

GEOGRAPHY AND REGIONAL DEVELOPMENT

Professors Charles S. Alexander (Adjunct), Terence Burke, Robert D. Carpenter (Emeritus), Walter N. Duffett (Adjunct), Lay J. Gibson, Lawrence D. Mann, Leland R. Pederson, Richard W. Reeves, Thomas F. Saarinen, Dan Stanislawski (Emeritus), Andrew Wilson (Emeritus), Ervin H. Zube (Renewable Natural Resources)

Associate Professors Gordon F. Mulligan, Head, D. Robert Altschul, Michael E. Bonine (Oriental Studies), Charles F. Hutchinson (Adjunct), Janice J. Monk (Adjunct), David A. Plane, Marvin Waterstone (Adjunct)

Assistant Professor Sallie A. Marston

Lecturer Michael C. Parton

Curricula in geography and regional development are designed to contribute to general education, to provide a solid, substantive and methodological grounding in geography for those who plan to teach or pursue graduate work in the field, and to provide preparation for those persons desiring professional training and/or careers in such fields as urban and regional planning, land development, resource management, environmental policy-making, foreign service, and cartography and remote sensing.

The degrees of Bachelor of Arts with a major in geography and Bachelor of Science with a major in regional development are available through the College of Arts and Sciences and the Bachelor of Arts in Education, with a teaching major in geography, is available through the College of Education. In addition, the Master of Arts, Master of Education, and Doctor of Philosophy degrees are offered with a major in geography. The Master of Science with a major in planning (regional planning concentration) is offered through the Graduate College for students wishing professional preparation for careers in planning for urban and rural regions.

The major in geography: 35 units, including 257 in the methods and techniques subfield and at least 3 units in each of the other 3 subfields of physical geography, human geography, and regional geography. At least 21 units must be at the upper-division level. Students may select from five different options:

The general geography option: 3 additional units in each of the four subfields.

The applied geography option: 12 units selected from 330, 381, 417, 457, 481, 483, 485 and 6 units of either human or physical geography.

The environmental analysis option: 12 units from 305, 330, 360, 362, 417, 461, 463, 464, 483, or 485.

The planning and urban geography option: 18 units from 110, 275, 301, 359, 360, 371, 379, 393, 407, 453, 456 or 457.

The regional development and planning option: 305, 371, and 471; and 6 units from 360, 379, 393, 414, 453, 456, 461 and 3 units of regional geography.

The supporting minor may be in biological sciences, earth sciences, languages, social sciences, or other fields approved by the departmental advisor.

The major in regional development: 35 units, including at least 20 units from 102b, 110, 257, 301, 305, 371, 379, 393, 457, 471 and at least 6 units from 275, 330, 381, 414, 417, 444, 453, 456, 461, 464, 481, 483, 485. At least 21 units must be at the upper-division level and at least 6 units must be from the geographical methods and techniques subfield. A supporting minor in economics, finance, real estate, marketing, or general business is recommended.

General studies majors may elect a geography concentration; students may also minor in geography. Concentrations and minors parallel each of the options available to majors.
The teaching major in geography: 30 units, including 6 units from each of the four subfields of physical geography, human geography, regional geography, and geographical methods and techniques.

The teaching minor in geography: 18 to 24 units, depending upon major and electives, to include at least 3 units from each of the four subfields.

For classification of courses by subfields, consult the departmental advisor.

Honors: The department participates in the Honors Program.

Internships: The department offers internship opportunities to qualified students.

Note: 103a-103b and 104a-104b are the only geography courses which may be applied to the Biological and Physical Sciences Study Area of the Arts and Sciences General Education Program.

102a-102b. Human Geography (3-3) Introduction to the main fields of human geography, with emphasis on world patterns of distribution and regional examples. 102a is not prerequisite to 102b. Both 102a and 102b are offered each semester. Pederson/Gibson

103a-103b. Physical Geography (3-3) Treats the atmosphere, biosphere, hydrosphere, and lithosphere as interrelated and geographically variable components of the earth's physical landscapes and the natural environment of man. Both 103a and 103b are offered each semester. 103a is not prerequisite to 103b. Reeves/Altschul

104a-104b. Physical Geography Laboratory (1-1) Field observation and lab. analysis of data and map interpretation. 104a: P, CR 103a. 104b: P, CR 103b. Both 104a and 104b are offered each semester.

110. Regional Land Use (3) I II Problems of regional environments in relation to the use and development of activities on the land. Emphasis on field study of actual land uses and introduction to the analysis and mapping of these using microcomputers. The relation of land use to taxation, zoning, and real estate transfer and development. (Identical with Ping. 110) Mann

151. World Regional Geography (3) I II Geographic concepts and information organized by conventional region and nation. Appropriate for elementary and secondary teaching. Not open to students with 6 or more units of credit in 102a-102b, 103a-103b.

171. Introduction to Meteorology and Climatology (3) I II (Identical with Atmo. 171)

171L. Introduction to Meteorology and Climatology (1) I II (Identical with Atmo. 171L)

257. Geographical Techniques (3) I II Formulation and solution of geographic problems; models, research design, and methods of gathering, analyzing, and portraying geographic data. 2R, 3L. P, 3 units of geog. Plane

275. Metropolitan Tucson (3) I Physical and cultural bases of Tucson's geographic patterns, with emphasis on the city's site, situation, settlement patterns and problems of growth and change. Field trips. Saarinen

301. Introduction to Regional Planning (3) I II Introduction to the principles and techniques used for planning in metropolitan and rural regions. Field trips. (Identical with Ping. 301) Mann

305. Economic Geography (3) I II Analysis and modeling of the spatial structure of primary, secondary, and tertiary economic activities; location theory and regionalization in economic systems. Mulligan Writing-Emphasis Course*

330. Introduction to Remote Sensing (3) I Introduction to remote sensing principles, techniques, and applications, designed principally for those with no background in the field. (Identical with G.En. 330, Geos. 330, S.W. 330, and Ws.M. 330) Parton

359. Land Use and Growth Regulation (3) I II Land use analysis and fundamentals of zoning. Current planning, legal, and financial methods to regulate the rate of development, sequence of growth, and eventual size of cities, regions, and states. Practical application of methods. Field trips. (Identical with Ping. 359)

360. Environmental Perception (3) I II Consideration of patterns in human perception in relation to modification of environment and environmental planning. Saarinen Writing-Emphasis Course*

371. Principles and Practices of Regional Development (3) I Introduction to basic concepts, objectives, practices and techniques of regional and industrial development as a professional activity, with emphasis on development problems and solutions. Field trips. Gibson Writing-Emphasis Course*

379. Urban Growth and Development (3) I II Location patterns in urban areas and processes of growth; historical development of U.S. cities, rent theory, housing markets, commercial and industrial location, the role of transportation and planning. Student development teams create a model city using the ACRES real estate simulation game. Plane

381. Cartography (3) I Tools and techniques, properties and construction of projections, design and preparation of maps for publication. 2R, 3L.
DEPARTMENTS AND COURSES OF INSTRUCTION

401. Introduction to Water Resources Policy (3) GC II (Identical with W.R.A. 401)

407. The American Landscape (3) GC II Origin and character of the visual aspects of places viewed individually and regionally; changes in habitat, vernacular structures, landscaping, townscapes, countrysides and special features. Field trips. (Identical with L.Ar. 407) Zube Writing-Emphasis Course*

408. Arizona and the Southwest (3) GC II The changing character of the land and man’s occupation of it, with emphasis on Arizona; historically and problem oriented. Field trip. Duffett Writing-Emphasis Course*

411. Middle America (3) GC II Land, man, and culture in the major natural and cultural regions of Mexico, Central America, and West Indies. Pederson Writing-Emphasis Course*

412. South America (3) GC I Physical and cultural bases of South America’s geographic patterns, with emphasis on human settlement and problems of resource development. Pederson Writing-Emphasis Course*

413. Africa (3) GC II Physical and human bases of regional contrasts, with emphasis on tropic environmental systems and changing patterns of resource utilization and development. Altschul/Writing-Emphasis Course*

414. Rural Area Development (3) GC I (Identical with A.Ec. 414)

417. Introduction to Geographic Information Systems (3) GC II (Identical with R.N.R. 417)

444. Site Planning (2) GC II (Identical with Arch. 444)

453. Locational Analysis (3) GC II Industrial location theory, location factors, and case studies; consumer behavior and shopping models; geography of economic impacts; geographic inequalities and spatial welfare; location of public facilities. (Identical with Ping. 453) Mulligan Writing-Emphasis Course*

456. Urban Geography (3) GC I An integrated approach to the built environment with special emphasis on the historical, social and political aspects of American urban development. (Identical with Ping. 456) Mulligan Writing-Emphasis Course*

457. Statistical Techniques in Geography and Planning (3) GC I Methods of gathering and analyzing data for the solution of geographical, urban, and regional planning problems, with emphasis on quantitative and statistical techniques used in spatial analysis and cartography, on the one hand, and program planning, on the other. (Identical with Ping. 457) Silvers/Plane

459. Topics in Economic Geography of the Middle East (3) GC II (Identical with Or.S. 459)

461. Population and Resources (3) GC I Estimates of present and potential world population; distribution and methods of conserving important resources. Field trips. (Identical with Ping. 461 and W.R.A. 461) Marston Writing-Emphasis Course*

463. Physical Aspects of Arid Lands (3) GC II Landforms, climate, hydrology, soils, vegetation, and animal life of deserts, with particular emphasis on the interaction of these phenomena in southern Arizona. Altschul/Writing-Emphasis Course*

464. The Arid and Semiarid Lands (3) GC I Past, present and future of settlement and resource utilization in the world’s arid lands; spatial interrelationships of environmental, demographic, socioeconomic and political systems. Altschul/Writing-Emphasis Course*

469. Geography of the Middle East (3) GC I (Identical with Or.S. 469) Writing-Emphasis Course*

471. Problems in Regional Development (3) GC I II Regional inventories and methods of analysis; development problems, policies and strategies, generation, implementation, and evaluation of development of programs; case studies. (Identical with A.Ec. 471 and Ping. 471) Gibson Writing-Emphasis Course*

476. Metropolitan Land Development (3) [Rpt.1/1] GC I II A Case-oriented approach to site selection, rezoning, financing, architectural design, economic feasibility, and other facets of the land development process. Field trip. Consult with department before repeating course. (Identical with Ping. 476)

481. Computer Cartography (3) GC II Introduction to the use of computers for map production, with emphasis on cartographic principles and practical experience with several user-oriented mapping programs. (Identical with Ping. 481) Parton

483. Geographic Applications of Remote Sensing (3) GC II Use of aircraft and satellite imagery for monitoring and analyzing landforms, soils, vegetation and land use, with the focus on problems of land-use planning, resource management and related topics. 2R, 3L. Field trip. P, two units of remote sensing or equivalent experience. (Identical with Ping. 483) Parton

485. Geography Summer Field Camp (3) [Rpt./2] GC S Physical and cultural problems in geography studied at first hand. Fee $250. P, 3 units of geography. Reeves/Gibson Writing-Emphasis Course*

510. Development of Regional Planning (3) I Survey of the historical development of the planning profession; the evolution of American planning as a response to urbanization. Open to majors only. Credit allowed for this course or 300, but not for both. (Identical with Ping. 510)

511. Metropolitan and Regional Planning (3) I Survey and evaluation of concepts and examples, including metropolitan, economic development, state and national, and environmental plans in the U.S. and abroad. (Identical with Ping. 511) Mann

556. Urban Systems Analysis (3) II Theoretical and applied analysis of urban growth models, gradients of urban influence, residential and facility decisions, and urban transportation. (Identical with Ping. 556) Mulligan

557. Spatial Analysis (3) II Formal analysis and modeling of spatial structures and processes; conceptual evaluation of point patterns, networks, surfaces and interaction. P, 457. (Identical with Ping. 557) Reeves

561. Resource Management (3) I Examination and critical appraisal of social and behavioral science aspects of resource management, with special emphasis on decision making. (Identical with Ping. 561) Saarinen

562. Paleoecology and Man (3) I (Identical with Geos. 562)

563. Perception of Environment (3) I II Examination of interdisciplinary research on environmental perception; consideration of social and behavioral variables at all scales of environmental perception and planning. (Identical with Ping. 563) Saarinen


596. Seminar
   a. Economic Geography (3) I II
   b. Cultural Geography (3) I II
   c. Physical Geography (3) I II
   d. Historical Geography (3) I II
   e. Area Study (3) I II
   f. Doctoral Research Seminar (3) [Rpt./3] I II
   u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Ids. 596u, which is home)

605. Planning Theories and Perspectives (3) I A critical examination of normative and methodological assumptions of alternative planning models, with emphasis on developing a perspective on contemporary planning issues. (Identical with Ping. 605) Mann

608. Planning Law (3) II Land-use controls, the law of zoning, exclusionary zoning, restrictive covenants, comprehensive plan, environmental protection, eminent domain, nuisance. (Identical with Ping. 608) Williams

609. Policy Problems in Structure and Change (3) II (Identical with M.A.P. 609)

611. Projects in Regional Planning (1 to 5) [Rpt./5 units] II Lectures, laboratory, and field projects covering various aspects of professional practice. P, 605, 24 units toward a graduate degree in planning. Field trips. (Identical with Ping. 611)

659. Growth Controls (3) II Current legal and planning techniques to regulate the rate of growth, the sequence of growth, and the eventual total size of towns, regions, and states; concentration on case studies. (Identical with Law 659 and Ping. 659)

696. Seminar
   f. Master's Research Seminar (3) [Rpt./9 units] I II
   o. The General Plan (3) [Rpt./6 units] I II (Identical with Ping. 696o)
   p. The Land Development Process (3) [Rpt./6 units] I II (Identical with Ping. 696p)

796. Seminar
   a. Doctoral Research Seminar (3) [Rpt./3] I II

"Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

GEOLOGICAL ENGINEERING
(See Mining and Geological Engineering)
GEOLGY
(See Geosciences)

GEOSCIENCES

Professors William R. Dickinson, Head, John W. Anthony (Emeritus), Victor R. Baker, Bryant Bannister (Laboratory of Tree-Ring Research), William B. Bull, Robert F. Butler, Clement G. Chase, Peter J. Coney, Paul E. Damon, George H. Davis, Jeffrey S. Dean (Laboratory of Tree-Ring Research), Harold C. Fritts (Laboratory of Tree-Ring Research) (Emeritus), Jibamitra Ganguly, Laurence M. Gould (Emeritus), John M. Guilbert, C. Vance Haynes (Anthropology), Malcolm K. Hughes (Director, Laboratory of Tree-Ring Research), Gerhard O. W. Kremp (Emeritus), Valmore C. LaMarche (Laboratory of Tree-Ring Research), Everett H. Lindsay, Paul S. Martin, Edgar J. McCullough, Jr., H. J. Melosh (Planetary Sciences), Bartholomew S. Nagy, Denis L. Norton, William J. Robinson (Laboratory of Tree-Ring Research), Joseph F. Schreiber, Jr., Terah L. Smiley (Emeritus), Charles W. Stockton (Laboratory of Tree-Ring Research), Marvin A. Stokes (Laboratory of Tree-Ring Research), John S. Sumner (Emeritus), Spencer R. Titley, James R. Wait (Electrical and Computer Engineering)

Associate Professors Karl W. Flessa, Austin Long, P. Jonathan Patchett, Randall M. Richardson

Assistant Professors Andrew S. Cohen, Owen K. Davis, Christopher J. Eastoe, George E. Gehrels, Joaquin Ruiz, Frank W. Telewski (Laboratory of Tree-Ring Research), Terry C. Wallace

Geosciences, or those sciences dealing with the study of the Earth, incorporate singularly or collectively the various fields of study that are applicable to an understanding of the formation and development of the chemical, physical, and biological aspects of the Earth. Academic and research pursuits in the geosciences lead toward a professional career in solving or helping to solve the current and projected issues dealing with land use, urban development, the search for energy sources, water, industrial and commercial minerals, and questions concerning earth processes involved in modern geologic studies.

The department offers the following degree programs: Bachelor of Science in Geosciences with concentrations in geology and geophysics, Bachelor of Arts with a major in geosciences, and a Master of Science and Doctor of Philosophy with a major in geosciences. The degree of Bachelor of Science in Education with a teaching major in earth sciences is available through the College of Education; students in this program are advised during their first two years in the Department of Geosciences.

The B.S. in Geosciences: In addition to the requirements of the College of Arts and Sciences, the following courses are required for the B.S. in Geosciences (geology concentration): Geos. 101a-101b, 102a-102b, 109, 221, 225, 302, 315a-315b, 322, and a field program (Geos. 412, 413), plus 3 units of 400-level “applied” geosciences; Math. 124 or 125a, 125b, and one additional course from Math. 215, 223, 263, or 461; Chem. 103a-103b, 104a-104b; Phys. 103a-103b, 180a-180b, or Phys. 100, 116, 121; a computer science course approved by the advisor; plus approved electives from geosciences and supporting fields to total 131 units.

The B.A. in Geosciences subject area is currently under review and students are advised to confer with the departmental undergraduate policy committee for particulars.

The B.S. in Geosciences (geophysics concentration) degree program, in addition to the requirements of the College of Arts and Sciences, requires the following courses: Geos. 101a-101b, 102a-102b, 109, 221, 302, 322, 412, 416, and 419 or 424 or 432 or 434; Math. 124 or 125a, 125b, and one additional course from Math. 215, 223, 263, or 461; Chem. 103a-103b, 104a-104b; Phys. 103a-103b, 180a-180b, or Phys. 100, 116, 121; a computer science course approved by the advisor; plus approved electives from geosciences and supporting fields to total 131 units.

Students in the B.S. in Education (earth science teaching major) enroll in the College of Arts and Sciences for their first two years and transfer to the College of Education at the beginning of their junior year to complete degree requirements. The necessary general education electives to complete this program must have the approval of the Department of Geosciences. Courses
required include: Astr. 110a-110b; Atmo. 171; Geos. 101a-101b, 102a-102b; 12 units of approved earth sciences courses; Math. 117f; a minor selected from chemistry, physics, or mathematics; an approved biology course of 3-4 units; Freshman Composition; Pol. 110; 15-17 additional units in arts and sciences to include one course each in U.S. history, general psychology, social and behavioral sciences, and two courses in the humanities and the arts; College of Education requirements; and elective credit hours in science, preferably outside the designated minor field, to total 125 units. At least 40 units of upper-division work must be included in the total number of units offered in satisfaction of the requirements for a degree.

A minor in geosciences requires a minimum of 20 units in geosciences. An advisor in the student’s field of interest will assist in selecting courses. A split minor is also an option.

The teaching minor: 20 units of approved earth science courses, including Geos. 101a-101b, 102a-102b, Astr. 110a-110b, and Atmo. 171.

Honors: The department participates in the Honors Program.

101a-101b. Introduction to Geology (3-3) 101a: Earth’s materials; surface and internal geologic processes; development of plate tectonics model. 101b: Geologic history of the earth with emphasis on North America; modern concepts on the origin of life and evolution.

102a-102b. Introduction to Geology Laboratory (1-1) 102a: Practical experience in rock and mineral identification, topographic and geologic maps, and applied problems in geosciences. Field trips. 102b: An introduction to fossil identification, principles of paleoecology, stratigraphy, and applied problems in geosciences. Field trips. Labs must be taken concurrently with 101a-101b.

106. Survey of the Solar System (4) I II (Identical with Pty.S. 106)

108. Dynamic Earth and Human Affairs [1 to 3] [Rpt./6 units] I II Explores the interrelationships between Earth’s processes, natural resources, and man. New, current subjects each semester. See schedule of classes or call Geosciences office. Primarily for nonmajors.

109. Introduction to Crystallography and Mineralogy (4) I GRD Morphological crystallography; recognition of selected minerals in hand specimen; relation of properties of minerals to their internal structure; mineral genesis. 3R, 6L. P, 101a, 102a; Chem. 103a-103b, 104a-104b.

221. Structural Geology (4) II GRD Description and analysis of geologic structures of deformational origin; stereographic and experimental work in lab.; structure mapping in the field. 3R, 4L. P, 101a, 102a. G. Davis/G. Gehrels

225. Introduction to Paleontology (4) I GRD Basic principles and concepts; morphology and classification of fossils; their occurrence, distribution, geologic and evolutionary significance. 3R, 2L. Field trips. P, 101b, 102b or Ecol. 101a or 104. Flessa


315a-315b. Introduction to Petrology (3-3) GRD Classification, distribution, and theory of genesis of rocks; hand specimen description. 2R, 3L. P, 109. Ganguly/Schreiber

322. Introduction to Geophysics (3) I GRD Physical principles applied to problems in earth science including seismology, gravity, magnetics, heat flow, plate tectonics. P, Phys. 116 or 103b and 180b. Butler

330. Introduction to Remote Sensing (3) I (Identical with Geog. 330)

396H. Honors Proseminar (3)

401. Environmental Education (3) GC I II Nature of ecosystems; relationships of people and their environment; major conservation problems; discussion of proposed solutions; the experiential approach. Field trips, including three days in Sonoran wilderness.

403. Introduction to the Solar System (3) GC I (Identical with Pty.S. 403)

405. Optical Mineralogy and Petrography (3) I Introduction to optical properties of minerals, and the use of the petrographic microscope. 1R, 6L. P, 109; Phys. 121 or 103b and 180b.

407. Photogeology (3) GC II (Identical with G.En. 407)

409. Introductory Vertebrate Paleontology (3) GC I Survey of the vertebrate fossil record, with emphasis on morphological characters relating the major groups of vertebrates. P, 101b, 102b or Ecol. 102. Lindsay
Mammalian Phylogeny and Evolution (3) GC II 1988-89 A study of the mammalian fossil record, with emphasis on taxonomy and morphological evolution of selected mammal orders. 2R, 3L. Field trips. P, 409. Lindsay

Introduction to Planetary Geology (4) I 1988-89 (Identical with Pty.S. 411)

Geology Field Camp I (3) S Field methods in geology; preparation of geologic reports. P, 221, 302, 315b. Fee.

Geology Field Camp II (3) S Field studies in geology, with emphasis on geologic mapping. P, 412. Fee.

Sedimentary Geology (3) GC I Sedimentary processes and depositional systems; sedimentary textures and structures; nonmarine, transitional, and marine deposition. 2R, 3L. Field trips. P, 109.


Field Studies in Geophysics (3) GC S (Identical with G.En. 416)

Global Tectonic Processes (3) GC II Plate tectonics; thermal properties and processes in the Earth; mechanical behavior of lithosphere and mantle; global gravity and geoid. P, Math. 254; Phys. 121. (Identical with Pty.S. 419) Richardson/Chase

Geophysical Exploration: Potential Field Methods (4) GC I Principles of gravity, magnetic, and electrical exploration; acquisition and interpretation of data to define geologic structure and evaluate resources. 3R, 2L. P, Phys. 110, 116, Math. 223 (Identical with G.En. 420) Chase/Sternberg

Petroleum Geology (3) GC I Origin, migration, chemistry, and accumulation of petroleum; reservoir mechanics, types of traps; recovery of petroleum; oil shales and tar sands. 2R, 3L. Nagy

Paleomagnetism: Principles and Applications (3) GC II Physical basis for remanent magnetism in rocks, techniques of sample collection, measurements, and statistical treatment; review of polarity time scale, apparent polar wander, plate tectonics. P, Phys. 103b or 116. Butler


Hydrogeology (3) GC I (Identical with Hydr. 435)

Biogeography (3) GC II (Identical with Ecol. 438)

Introduction to Geodynamics (3) [Rpt./1] GC II 1987-88 Large scale tectonic problems approached through geophysical combined with geological analysis, both in regional tectonic context. P, 20 units of geology, incl. 221, Math. 254, and 3 units geophysics.


Geomorphology (4) GC I Concepts of landform development, with emphasis on fluvial processes and environmental applications. 3R, 3L. Field trips. P, 101a, 102a. Bull

Glacial and Quaternary Geology (3) GC II Glacial processes, landforms, and deposits. Physical aspects of Quaternary paleoenvironmental change and effects on fluvial, eolian, lacustrine, weathering, and mass movement processes. P, 101b, 102b. Baker

Introduction to Geochemistry (3) GC I Nuclear systematics and thermodynamics with applications to geologic processes. P, 101a, 102a; Chem. 103b, 104b.

Low Temperature Geochemistry (3) GC II Equilibrium and kinetic chemical processes producing soils, natural waters, and chemical sediments. P, 101a, 102a, 455 or Chem. 480a; Chem. 103b, 104b. (Identical with Hydr. 457) Long

Introduction to Quaternary Ecology (3) GC I Survey of methods and theories used in reconstructing vegetation and climate. Ocean cores, palynology, dendroclimatolgy. Field trip. (Identical with Anth. 462)

Introduction to Dendrochronology (3-3) GC Survey of dendrochronological theory and methods. Applications to archaeological, geological, and biological dating problems and paleoenvironmental reconstruction. Emphasis on dating methods, developing tree-ring chronologies, and evaluating tree-ring dates from various contexts. 2R, 3L. Field trips. (Identical with Anth. 464a-464b and Ws.M. 464a-464b) La Marche
470. **Introduction to Paleoecology** (3) GC II Paleontologic approaches to the reconstruction of ancient environments, populations and communities. Evolution of communities through geologic time. 2R, 3L. Field trips. P, 225, 302. *Flessa*

473. **Geology and the Urban Environment** (3) GC II Geologic processes that result in loss of life and/or property damage; emphasis on case studies of urban areas in the Southwest. Implications for public policy. 2R, 3L. All-day field trips. (Identical with Ping. 473)

475. **Cenozoic Mammalian Faunas** (3) GC II 1987-88 Continental Cenozoic stratigraphy and mammalian biochronology of North America and other continents. 2R, 3L. Field trips. P, 409. *Lindsay*

504. **Geology of Arizona** (3 to 4) I Systematic coverage of Basin and Range province and Colorado Plateau geology as part of the Southern Cordillera, with emphasis on significant problems. Field trips. Consult dept. before enrolling for three unit option. *Damon*

506. **Analytical Techniques in Geology** (4) II Strengths and limitations of methods and analysis of geologic material including XRF, XRD, microprobe, AA theory/experience, INAA, and mass spectrometry theory. 3R, 3L. Open to majors only. P, Chem. 103a-103b, Phys. 110, 116, 121 or 103a-103b and 180a-180b.

507. **Applied Multispectral Imagery** (3) II (Identical with G.En. 507)

509a-509b. **Petroleum** (3-3) Earth composition; spatial and temporal distribution of rock types; application of physicochemical principles to magmatic and metamorphic processes. P, 405, Chem. 480a or CR. *Ganguly*


512. **Petrology of Sandstones** (3) I Origin, deposition, and diagenesis of sandstones and other terrigenous sedimentary rocks; classification in hand specimens, detrital grains, and thin sections. 2R, 3L. Field trips. P, 405. *Schreiber*

514. **Late Quaternary Geology** (3) I Paleoenvironment and geochronology of Late Quaternary alluvium as read from the stratigraphic records and geomorphology at key localities in North America. The interaction of fluvial and aeolian processes in the eastern Sahara will be evaluated using enhanced LANDSAT and Shuttle Imaging Radar. Domestic field trips. Enrollment limited to 10 students. P, 101b, 102b. (Identical with Anth. 514) *Haynes*

520. **Meteorites** (3) II 1988-89 (Identical with Pty.S. 520)

521. **Analysis of Regional Geologic Structure** (3) II Geometric, kinematic, and dynamic analyses of deformational structures; stereographic and computer treatment of fabric data; experimental deformation; structural analysis in field; report writing. All day field trips every Friday. P, 412.

522. **Well Logging Interpretation** (3) II (Identical with G.En. 522)

523. **Advanced Geologic Mapping** (3) [Rpt./3] I Geologic mapping in a variety of rock types and structural regimes, with emphasis on the recognition and solution of regionally significant structural problems. Field trips. P, 413. G. *Gehrels*

525. **Regional Tectonics** (3) I Methods of tectonic regionalization and integration based on litho-tectonic assemblages, tectono-stratigraphic terranes, and regional structural analysis. Discussion of types of orogenic systems, plate regimes and their kinematics, economic aspects regional tectonics. *Coney*

526. **Cordilleran Tectonics** (3) II Geologic and tectonic evolution of the North American Cordillera based on analysis of geologic, paleomagnetic, and paleobiogeographic constraints and tectonic models. *Gehrels*

528. **Nuclear Geology** (3) II 1988-89 Nuclear phenomena applied to the solution of geologic problems, with emphasis on radio isotope dating and isotope petrology. (Identical with Pty.S. 528) *Damon*

535. **Aquifer Mechanics** (3) I (Identical with Hydr. 535)

536. **Development of Groundwater Resources** (3) II (Identical with Hydr. 536)

537. **Advanced Ecology** (2) II (Identical with Ecol. 537)

540. **Topics in Geodynamics** (3) [Rpt./1] II 1988-89 Large-scale tectonic problems approached through combined geophysical and geological analysis, both in regional tectonic context. P, 20 units of geology, including 221; 3 units of geophysics; Math. 254.

541. **Soil Genesis** (3) II (Identical with S.W. 541)

542. **Ore Deposit Petrology** (3) II 1988-89 Orthomagmatic, porphyry base metal, skarn, and leached capping lithologic-mineralogic deposits by petrographic microscope, electron probe, and advanced techniques. 1R, 6L. P, 425 or CR, 546a. *Guilbert*

543. **Mathematical Theory of Magma-Hydrothermal Systems** (3) I Dynamics and chronology of natural systems are reconstructed using mathematical systems and computer models to represent the redistribution of thermal and mechanical energy around magma chambers. *Norton*
DEPARTMENTS AND COURSES OF INSTRUCTION


545. Geochemical Processes in Magma-Hydrothermal Systems (3) II Migration of chemical components in natural fluid-rock systems are analyzed using the geochemical theory that represents irreversible, equilibrium and advection mass transfer. Norton

546a-546b. Advanced Ore Deposit Geology (4-4) Geology, characteristics and origins of ore deposits in igneous, sedimentary, and metamorphic rocks. Labs. include field trips, analytical techniques, problem solving. 2R, 6L. P, 303, 405, Chem. 480a or CR. Titley/Guilbert

554. Evolution of Planetary Surfaces (3) II 1988-89 (Identical with Pty.S. 554)


560. Electrical Exploration Methods (3) I (Identical with G.En. 560)

561. Paleodinian Origins (3) I (Identical with Anth. 561)

564. Isotope Hydrology (3) I Theory and application of light stable and cosmogenic isotopes to hydrological and paleoenvironmental problems. Radiometric dating of ground water. (Identical with Hydr. 564) Long

565. Isotope Geology (3) II Theory and application of light stable isotopes to petrological, ore deposition, and geothermal problems. Long/Eastoe

566. Botanical Basis of Dendrochronology (3) II 1987-88 Examination of the environmentally modified processes of developmental tree physiology and wood anatomy and their application to tree-ring analysis. Field trip. (Identical with Ws.M. 566) Telewski


568. Advanced Seismology (3) II 1987-88 Computational techniques in seismology. The application of synthetic seismograms to model source processes and complex structure. P, 432; Math. 422b. Wallace


579. Introduction to Quaternary Macrofossil Analysis (4) [Rpt./I] II 1988-89 Literature and techniques of identification of plant remains including leaves, seeds, and wood of gymnosperms and angiosperms. 2R, 6L. Field Trips. P, Ecol. 472 O. Davis


581. Quaternary Palynology (4) II 1987-88 Theory and application of pollen to geology, biology, archaeology, and paleoecology; definition of information pollen sample record; experience in pollen extraction and identification. 3R, 4L. O. Davis (Identical with Anth. 581)

584. Sedimentary Basins (3) II Sedimentologic, stratigraphic, structural, subsidence, thermal, and diageneric evolution of sedimentary basins in relation to plate tectonic settings. 2R, 3L.

585. Petrology of Carbonate Rocks (3) II Origin, depositional environments, and diagenesis of carbonate and associated chemical and biochemical sedimentary rocks. 2R, 3L. Field trips. P, 405. Schreiber


596. Seminar

a. Petrography-Petroleum (1 to 4) I II
b. Structural Geology (1 to 4) I II
c. Mineral Deposits (1 to 4) I II
d. Petroleum Geology (1 to 4) I II
e. Tectonics (1 to 4) I II
f. Mineralogy-Crystallography (1 to 4) I II
g. Vertebrate Paleontology (1 to 4) I II
h. Paleontology (1 to 4) I II
i. Paleocology-Paleoenvironments (1 to 4) I II
j. Geomorphology (1 to 4) I II
k. Geophysics (1 to 4) I II
l. Geomathematics (1 to 4) I II
m. Sedimentology (1 to 4) I II
n. Stratigraphy (1 to 4) I II
o. Regional Tectonics (1 to 4) I II
p. Hydrogeology (1 to 3) [Rpt./II] II (Identical with Hydr. 596p, which is home)
q. General Geochronology (1 to 4) I II
r. Quaternary Geochronology (1 to 4) I II (Identical with Anth. 596r)
s. Sedimentary Petrography (1 to 4) I II
t. Organic Geochemistry (1 to 4) I II
u. Inorganic Geochemistry (1 to 4) I II
v. Dendrochronology (1 to 4) I II
w. Palynology (1 to 4) I II
x. Organic Geochemistry (1 to 4) I II
y. Role of Water in Geologic Processes (1 to 4) I II
z. Topics in Geophysics (1 to 4) I II


**651. Tectonic and Climatic Geomorphology** (3) II 1988-89 Effects of tectonic movements and climatic changes on geomorphic processes, landforms, and soils; paleoclimatic and earthquake-hazards interpretations. 2R, 3L. Field trips (includes spring break field trip). Bull


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**GERMAN**

Professors Renate A. Schulz, *Head*, Jean R. Beck (*Emeritus*), David H. Chisholm, Max Dufner, David J. Woloshin (*Emeritus*)

Associate Professors Dennis I. Greene, Richard C. Helt, Babette Luz (*Emerita*), Roland Richter

Assistant Professor Mary Wildner-Bassett

Lecturer John R. Wendel

The Department of German provides instruction designed to develop fluency in oral and written communication, knowledge of German literature, and insights into German cultural tradition. A major in German, by itself or in combination with another field, can open the door to careers in education, international business, the foreign service and many other professions.

The degrees available are Bachelor of Arts and Master of Arts with a major in German, and Bachelor of Arts in Education and Master of Education with a teaching major in German.

*The major:* 24 units beyond 200-level courses, including 302a-302b, 315a-315b, 400a-400b, and 410a-410b. Ger. 307a-307b is highly recommended.

*The supporting minor* must be selected with the assistance and approval of the major advisor.

*The teaching major:* includes 302a or 302b, 315a-315b, 400b, 410a-410b, 475a, and 480. Candidates must demonstrate oral proficiency in German at the level of ACTFL/ETS Oral Proficiency Advanced or the equivalent. The work done in the College of Education will include T.T.E. 493b, which carries up to 10 units of credit. The student may proceed to student teaching after demonstrating the required level of oral proficiency.

*The department offers no teaching minor.*

For graduate admission and degree requirements, consult the *Graduate Catalog*.

*Honors:* The department participates in the Honors Program.

*Additional subject areas available:* In addition to the courses listed below, the Department of German faculty is prepared to offer courses in the following areas, subject to faculty availability and student interest: Special Topics in German Literature; Linguistic and Computer-Assisted Approaches to Literature; Scandinavian Literature in English Translation; German Cinema; German Reading for Graduate Students; and Second Language Acquisition, Teaching and Testing.

**101a-101b-101i. Elementary German** (4-4-6) GRD 101i: I Intensive. Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Wildner-Bassett

**201a-201b-201i. Intermediate German** (4-4-6) GRD Speaking, understanding, writing, and reading Ger. 201i: II Intensive. P, 101b or 101i. Both 201a and 201b are offered each semester. Helt
DEPARTMENTS AND COURSES OF INSTRUCTION

207a-207b. Conversation (2-2) GRD Intermediate course for students who wish to concentrate on spoken Ger. P, 101b. 207a is not prerequisite to 207b.

208. Intensive Conversation (4) S Intensive training toward fluency in spoken German; emphasis on frequent idioms and conversational patterns dealing with contemporary life in Germany. Successful completion fulfills foreign language proficiency at 16-unit level. P, three semesters of college level German.

270a-270b. German Literature in Translation (3-3) Reading and discussion of representative works from the 13th century to the present. 270b: Emphasis on modern works after Romanticism. Will not count toward fulfillment of language requirement or a major or minor in Ger. 270a is not prerequisite to 270b.

302a-302b. Masterpieces in German Poetry and Prose (3-3) GRD Careful study of significant expressions in literature of German thought and life, with attention to periodic and individual differences in style. P, 201b. 302a is not prerequisite to 302b.

307a-307b. Advanced Conversation (2-2) GRD Intensive practice leading toward fluency in spoken Ger., using material based upon topics of current interest. P, 201b or 207b. 307a is not prerequisite to 307b.

315a-315b. Oral Expression and Written Composition (3-3) GRD Review and practical application of important grammatical principles; vocabulary building. P, 201b or 207b. 315a is not prerequisite to 315b.

345. Yiddish Literature in Translation (3) I GRD Reading and discussion of representative works of Yiddish literature in English translation.

371. Scandinavian Literature in Translation (3) II GRD Outstanding works of Scandinavian poetry, drama and narrative prose read in English translation to trace their development in relation to intellectual and social evolution of Denmark, Norway, and Sweden.

400a-400b. History of German Literature (3-3) GC GRD Historical survey of German literary development from the beginning to the modern period; lectures in German, alternating with conferences in Engl. P, 6 units of upper-division German. 400a is not prerequisite to 400b.

405. History of the English Language (3) GC I (Identical with Engl. 405)

410a-410b. Cultural Development of Germany (3-3) GC GRD Social, political, religious, and artistic elements entering into the growth and development of Germany; lectures in English. 410a is not prerequisite to 410b. Dufner/Richter Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

469a-469b. Germanic Folklore: An Introduction to Nonliterary Forms (3-3) GC Tales, balladry, folk speech, customs and lore of the Germanic people. Readings and lectures in Engl. Readings in German for German majors. 469a is not prerequisite to 469b. (Identical with Engl. 469a-469b)

475a-475b. Advanced Grammar and Stylistics (3-3) GC GRD Practical training in written German through the study of the more complex refinements of German grammar and style, as found in representative documents. P, 315b. 475a is not prerequisite to 475b. Richter

479. Issues in Foreign Language Teaching (3) GC I Modern methods of language teaching with emphasis on German as a foreign language. Schulz/Wildner-Bassett


496. Proseminar
   a. Translation (3) [Rpt./2] GC I II P, 315b.
   b. Workshop

501. German Lyric Verse from the Reformation through Classicism (3) II 1988-89 Introduction to the principles and forms of poetry; analysis and interpretation of outstanding examples of German lyric verse from the 16th through the 18th centuries. P, 6 units of upper-division German.

502. German Lyric Verse from Romanticism to the Present (3) I 1989-90 Introduction to the principles and forms of poetry; analysis and interpretation of outstanding examples of German lyric verse of the 19th and 20th centuries. P, 6 units of upper-division German.

503. Eighteenth-Century German Literature (3) II 1987-88 Klopfstock, Lessing, Wieland, Goethe, Schiller, Hoelderlin and other authors. P, 6 units of upper-division German.

505. German Romanticism and Realism (3) I 1988-89 Readings and discussions of representative works from 1797 to 1848. P, 6 units of upper-division German.
506. German Literature from 1848 through Naturalism (3) I 1987-88 Readings of major prose and dramatic works of the second half of the 19th century, in German. P, 6 units of upper-division German. Helt

507. Goethe's Faust (3) II 1988-89 A close reading of the poem and an introduction to some of the critical secondary literature. P, 6 units of upper-division Ger. Dufler

509. German Literature from 1900 through the Weimar Republic (3) II 1987-88 Readings of major prose and dramatic works between 1900 and 1933, in German. P, 6 units of upper-division German. Helt

510. German Literature from 1933 to the Present (3) I 1988-89 Readings of major prose and dramatic works after 1933, in German. P, 6 units of upper-division German. Helt

511. Middle High German (3) GRD II 1988-89 Introduction to Middle High German language and literature; selective readings from representative literary works of the period. P, 302b, 315b.

520. History of the German Language (3) GRD II 1987-88 Introduction to Germanic philology; an overview of the development of the German language from its roots in the Indo-European language family to New High German. P, 8 units of upper-division German. (Identical with Engl. 520)

525. Beowulf (3) II (Identical with Engl. 525, which is home)

527a. Studies in Medieval Language and Literature (3) (Identical with Engl. 527a)

594. Practicum
   a. Translation (2 to 5) [Rpt./3] P, 496a or departmental proficiency exam.

596. Seminar
   i. Germanic Linguistics (3) [Rpt.] I II (Identical with Engl. 596i, which is home)

597. Workshop
   a. Translation (3) [Rpt./3] I II P, competency at third-year undergraduate level or pass departmental placement test.

601. Materials and Methods of Research (3) I 1987-88 Survey of the tools and methods of literary and linguistic research and introduction to principles of literary analysis. Chisholm

696. Seminar
   a. Literature (2 to 4) [Rpt.] I II
   b. Linguistics (2 to 4) I II (Identical with Engl. 696b)
   c. Folklore (2 to 4) I II (Identical with Engl. 696c)
   d. Pedagogy (2 to 4) [Rpt.] I II
   e. Translation (2 to 4) [Rpt.] I II

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**GERONTOLOGY**

**Committee on Gerontology**

Professors William A. Stini (Anthropology), Chairperson, Daniel R. Boone (Speech and Hearing Sciences), John T. Boyer (Internal Medicine), Herbert E. Carter (Biochemistry), Theodore H. Koff (Management and Policy), Fred B. Roby, Jr. (Exercise and Sport Science), Roy G. Spece, Jr. (Law), Charles W. Weber (Nutrition and Food Science)

Associate Professors J. Lyle Bootman (Pharmacy Practice), Alfred W. Kaszniaik (Psychology), Jessie V. Pergrin (Nursing)

Assistant Professor Evan W. Kligman (Family and Community Medicine)

Because of its multidisciplinary nature, courses in gerontology are located in a number of departments. The Committee on Gerontology plays a facilitating role in the coordination and development of aging studies and will guide students who wish to include an emphasis in gerontology in their course of study. Although the Committee offers neither an undergraduate nor graduate major it is possible for students to include an emphasis in gerontology in several ways. Students may choose to incorporate courses into their regular degree program to supplement work in their major field. In addition they can pursue a gerontological focus through work in a practicum, internship, independent study or thesis. While no formal recognition is offered it is possible to obtain a rich background in gerontology this way.

Formal recognition for gerontological study is available at both undergraduate and graduate levels. In the College of Arts and Sciences an undergraduate may satisfy requirements for a minor or for Subject Area III in General Studies by following an approved curriculum. The Committee
Coordinator serves as minor advisor for these students. At the graduate level the Committee offers a doctoral minor which is most appropriate for students in areas such as education, administration, health, nutrition, and the social and behavioral sciences. A minimum of 15 units is required. In addition it is possible for graduate students to obtain formal recognition through the Committee’s Gerontology Certificate Program, an 18-unit course of study similar to that offered in many other colleges and universities in this country. The program is designed primarily for individuals planning to enter or to continue in a profession which involves provision of services and/or administration of programs for the aging.

Students should consult with the major department about developing a gerontological emphasis within the major field through course work, research, thesis and dissertation. This most commonly occurs in the departments and divisions of Counseling and Guidance, Management and Policy, Psychology, Special Education, Speech and Hearing Sciences, the School of Family and Consumer Resources, and the Colleges of Nursing and Pharmacy. In addition, graduate work with a strong gerontological focus is available in long term care administration (M.P.A.) and gerontological nursing (M.S.).

Courses in other departments identified as having content which deals specifically with elderly and with aging processes include: Coun. 570, I.D. 405, Psyc. 421, 428, M.A.P. 365, 454, 466, 595d, 662, S.E.R. 455.

Students wishing further information on study in gerontology should contact the Coordinator, Committee on Gerontology, Anthropology 214.

238. Theories of Biological Aging (2) II (Identical with N.F.S. 238)
243. Sociology of Adult Life (3) II (Identical with Soc. 243)
406. Social Gerontology (3) GC II (Identical with Soc. 406)
413. Issues in Aging (3) GC II (Identical with C.D.F.R. 413)
435. Psychological Problems of the Aged (3) GC I (Identical with Psyc. 435)
436. Economics of Aging (3) GC II (Identical with C.S. 436)
445. Clothing for Special Needs (3) GC I (Identical with H.E.E. 445)
447. Perspectives in Geriatrics Laboratory (1) GC II (Identical with Ph.Pr. 447)
448. Perspectives in Geriatrics (2) GC II (Identical with Ph.Pr. 448)
457. Law of the Elderly (2) GC II (Identical with M.A.P. 457)
470a. Human Adaptability (3) GC I (Identical with Anth. 470a)
576. Communicative Aspects of Aging (2) I (Identical with Sp.H. 576)
589. Health of the Older Adult (3) I (Identical with Nurs. 589)
695. Colloquium
   a. Research in Gerontology (1) I II (Identical with Ph.Pr. 695a)

**GOVERNMENT**
*(See Political Science)*

**GREEK**
*(See Classics)*

**HEALTH EDUCATION**
*(See Health-Related Professions)*
HEALTH-RELATED PROFESSIONS

Professor William H. King
Associate Professors Sue Criswell, Kam Nasser
Assistant Professor Harold Potter, Jr.

The School of Health-Related Professions, an integral part of the Arizona Health Sciences Center, offers the Bachelor of Science in Health Sciences degree with majors in health education, medical technology, and occupational safety and health; and the Master of Education degree with a major in health education.

Health-Related Professions

210. Introduction to the Health Field (3) I II Interdisciplinary course for the orientation of students to the various health sciences and current health-care concepts.

301. Social Perspectives of Health Sciences (3) I II S Examination of the health sciences and their relationships with economic, political and cultural systems.

302. Introduction to Health Statistics (3) I II Introduction and application of statistics to the health sciences, including basic statistical methods, survey research, indices for health status, sources of health data, and research design.

460. Introduction to Epidemiology (3) GC I II Introduction to the purposes, principles, and methods of epidemiology.

483. Perspectives of Cancer Care for Health Professionals (3) S (Identical with Nurs. 483)

564. Principles and Methods of Epidemiology (3) I II Study of chronic diseases and mortality; indices of health, factor-disease associations; measures of disease frequency, study design, data analysis, and interpretation of results; discussion of basic biostatistical procedures.

Health Education

Health education offers preparation for careers focusing on critical societal health problems. Requirements for admission to the nonteaching option: Engl. 102, or 103H and 104H, Chem. 103a-103b, 104a-104b, Psyc. 101, M.C.B. 103, Ecol. 204, 159a-159b, N.F.S. 101, Pol. 103, Soc. 202, Hlth. 178, Ex.S.S. 261, Math. 117e, 6 units from humanities/arts.

Requirements for admission to the teaching option: Engl. 102 or 103H, 104H, humanities option (6 to 8 units), Math. 116, Ecol. 159a-159b, Psyc. 101, Chem. 101a, 102a, Hist. 106 or 107, Hlth. 178, 180, or 181, Pol. 110, N.F.S. 101, Ex.S.S. 261.

The teaching option: 33 units, including Hlth. 330, 430, 431, 432, 433, 434, 437, 440, and Micr. 357. The candidate for the degree with this major must also complete the following education courses: Ed.P. 311, L.R.C. 435, T.T.E. 225, 329, 330, 417, 493b, and 494b.

Supporting courses required for students planning careers in the non-teaching option: community health education. Thirty-three units selected from Micr. 357, 100, Soc. 100, Ecol. 321, O.S.H. 486, 487, Hlth. 330, 433, 435, 496a, Econ. 487, Math. 263, Nurs. 484, 487, Soc. 189 and 321. Additional courses can be selected from an approved list, in consultation with advisors, according to students' individual needs and career objectives.

The teaching minor in health education: 20 units, including 178, 180, or 181, 330, 433, 434, 437, and Ex.S.S. 261.


Students in the health education teaching option may select any of the approved College of Education teaching minors.

178. Introduction to Health Science Education (3) I II Introduces and analyzes basic personal and community health problems, with emphasis on current scientific information essential to health promotion and maintenance of individual health.
DEPARTMENTS AND COURSES OF INSTRUCTION

180. **Secondary School Health Education** (3) I Emphasis on health science information pertaining to secondary school health instruction programs, community and individual health problems. Credit allowed for this course or 181, but not for both.

181. **Elementary School Health Education** (2) I Emphasis on health science information applicable to elementary health education classes; for students preparing to teach in elementary schools. Credit allowed for this course or 180, but not for both.

330. **Human Sexuality** (3) I II Discussion of the basic aspects of human sexuality, including male and female reproductive physiology, congenital defects, venereal disease, myths and fallacies, variations of sexual response.

430. **Critical Analysis of Health Education** (3) GC I Analysis and evaluation of curriculum, new teaching techniques and administrative trends in health science education; critical discussion of issues, research publications, and current periodicals in the area of health education. P, 180 or 181.

431. **Field Work in Health Education** (3) GC II On the job participation and observation in health programs of public and voluntary health organizations. Open to health education majors only.

432. **Organization and Administration of School Health Education** (3) GC I Principles and techniques for organizing and administering school health programs; discussion of curriculum, facilities, personnel, school health legislation, administrative problems.

433. **International Health Problems** (3) GC I Interprets the major health problems not only of the developed and emerging nations, but also the situations in underdeveloped countries; includes assistance programs by international health groups.

434. **Sex Education** (3) GC II Critical analysis of the current philosophy, principles, programs, problems, trends and basic issues in sex education on the elementary, junior high and high school levels.

435. **Safety Education and Accident Prevention** (3) GC II Analysis of accident prevention programs in schools, colleges, communities, and industry, with emphasis on specific protective measures pertaining to athletics, physical education, recreation, highway safety, and vocational training.

436. **Traffic Safety Education** (3) GC II Principles of accident prevention and traffic survival education, with emphasis on the certification of secondary school teachers preparing to teach driver education and training.

437. **Contemporary Community Health Problems** (3) GC II Analysis of the concept of community health services, human ecology, and conservation of human resources, with emphasis on modern miasmas such as air, water, and noise pollution; sociological problems of alcohol, alcoholism, and drug abuse. P, 178.

440. **Survey of Health Education Literature** (3) GC II Examination of health education literature from ancient societies to present, including an analysis of current health literature from various professional, community, voluntary, public and international health organizations.

475. **Alcohol Abuse and Alcoholism** (1) GC S Review of the nature and ramifications of alcohol problems, as well as analysis of physical, psychological and social implications.

496. **Proseminar**
   a. **Tobacco, Alcohol, and Narcotics** (3) GC I II

*Medical Technology*

Director Dr. Sue Criswell

Medical technology is the health profession responsible for clinical laboratory analysis, including quantitative, qualitative, and morphological measurements which assist the physician in clinical diagnosis and treatment.

Completion of the medical technology program, accredited by the American Medical Association and the National Accrediting Agency for Clinical Laboratory Sciences, qualifies the individual for various National Registry examinations.

*Requirements for admission to the program:* Engl. 101 or 103H, and Engl. 102 or 104H, Hum. 250 (or two humanities option courses)*, social science (12 units)*, Math. 117e and 118 or 117f, 125a or 263, C.Sc. 111 or 115 or S.I.E. 272, Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b, Ecol. 159a-159b, Phys. 102a-102b, 180a-180b, Micr. 110. In addition, the following courses are required: Chem. 322, 323, N.F.S. 406a-406b or Chem. 460 and Micr. 450, V.Sc. 423, Micr. 419, 420R and 420L.

*The major:* 49 units as follows: 387, 481a-481b, 482a-482b, 483a-483b, 484a-484b, 485, 496a.

*See College of Arts and Sciences section of this catalog.*
387. Problems in Medical Technology (3) II Medical lab. procedures and theory. 2R, 3L.

481a-481b. Clinical Laboratory: Hematology (6-4) GC [Rpt./1] S Basic hematology and hematological procedures including cell structure and function, inherited and acquired anomalies, hemostasis, cell enumeration and differentiation, cytogenetics. P, committee permission.

482a-482b. Clinical Laboratory: Immunology and Immunohematology (4-4) GC [Rpt./1] Serological methods used in the clinical laboratory and interpretation of results; blood banking procedures. P, committee permission.

483a-483b. Clinical Laboratory: Chemistry (6-6) GC [Rpt./1] Fundamental concepts of clinical laboratory chemistry including pathophysiology and clinical correlations. P, committee permission.

484a-484b. Clinical Laboratory: Microbiology and Parasitology (6-6) GC [Rpt./1] Clinical laboratory techniques to safely and accurately culture or isolate and identify pathogenic organisms; physiological consequences of parasitism and the role of the laboratory in treatment. P, committee permission.

485. Clinical Laboratory: Sciences (2) GC [Rpt./1] II Basic principles of instrumentation, laboratory mathematics, biostatistics, quality control, toxicology, nuclear medicine, laboratory management and laboratory safety. P, committee permission.

496. Proseminar
   a. Senior Proseminar (2) II P, 387.

Occupational Safety and Health

Director: Dr. M. Van Ert

The occupational safety and health program is concerned with training students in the recognition, evaluation and control of environmental factors and stresses arising from the work place and causing sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or citizens of the community.

Students may elect a concentration in industrial hygiene or industrial safety.

Requirements for admission to the program: Engl. 102 or 103H, 104H, 308, H.R.P. 210, hum. option (four units)*, Comm. 112, Psyc. 101, Econ. 210, soc. sci. (three units)*, S.I.E. 170R, 170L, Math. 117e, 125a-125b, Chem. 103a-103b, 104a-104b, 241a, 243a, Ecol. 159a, Phys. 102a-102b or 103a-103b, 180a-180b, ex.s.s. (two units).


*See College of Arts and Sciences section of this catalog.

402. Industrial Hygiene Instrumentation and Analysis (3) GC II Introduction to field sampling instruments, concepts, quality control, and statistical analysis, with emphasis on instrument selection and calibration. 2R, 3L. P, O.S.H. 486, Chem. 322, 323, and CR Chem. 324.

410. Physical Exposures (3) GC II Recognition, evaluation, and control of physical exposures, including radiation, noise, vibration, and heat stress. Student is required to recognize potential exposures, use correct instrumentation to collect and evaluate data, and develop controls. 2R, 3L. P, O.S.H. 486.


486. Fundamentals of Industrial Hygiene (3) GC I Introduction to the principles of occupational safety and health, with emphasis on industrial hygiene aspects including recognition, evaluation, and control of environmental and industrial health hazards. (Identical with C.E. 486 and Tox. 486)

487. Advanced Industrial Hygiene and Safety (3) GC II An in-depth coverage of the industrial hygiene and safety professions emphasizing the principles of contaminant generation and behavior, the design of industrial hygiene/safety programs, and survey of industrial plants. P, O.S.H. 486. (Identical with C.E. 487 and Tox. 487)

488. Applied Industrial Safety (3) GC II Thorough study of technical safety topics such as fire technology, systems safety, manual materials handling; selected topics in construction and manufacturing safety. P, O.S.H. 486b.

495. Colloquium
HEALTH SERVICES ADMINISTRATION
(See Management and Policy)

HEBREW
(See Oriental Studies)

HIGHER EDUCATION
(See Educational Foundations and Administration)

HISTORY


Assistant Professors Kevin Gosner, Tessie Liu

Lecturer William R. Noyes

The Department of History offers courses designed to provide broad perspectives on the human past, with more specialized instruction in particular areas and periods, and with theoretical and practical training in historical research.

The department offers the degrees of Bachelor of Arts, Master of Arts and Doctor of Philosophy with a major in history. A Bachelor of Arts in Education and a Master of Education with a teaching major in history are also available. For information on graduate degrees, please see the Graduate Catalog.

The major: 33 units, including 396a, 3 units in a course dealing with the period before 1500, and 6 units in three of the following areas: United States, Latin America, Europe, Oriental Studies and Comparative History. (Hist. 247, 430, 458, and other courses the department may approve, including many special topics courses, may be counted toward the comparative area.) No fewer than 18 units must be upper-division. No more than 3 units of independent study or 6 units of internship may be applied toward the major. Hist. 101-102 or 103-104, but not both, may be applied toward the major.

The supporting minor should be selected from foreign languages, the humanities, the social sciences, and other subjects as may be individually justified.

The teaching minor: 21 units, including 101-102 or 103-104, 106-107 one upper-division Unites States history course, and two other history courses.

Honors: The department participates in the Honors Program.

101. History of Western Civilization: Backgrounds and Formation to 1400 (3) GRD I S The western heritage of ideas, values, and artistic expression in interaction with economic, social, and political processes and experiences.

102. History of Western Civilization: Emergence of the Modern World-1400 to 1800 (3) GRD II S The western heritage of ideas, values, and artistic expression in interaction with economic, social, and political processes and experiences.
103. History of Western Civilization: Contemporary World-1800 to the Present (3) GRD I S The western heritage of ideas, values, and artistic expression in interaction with economic, social, and political processes and experiences.

106. History of the United States from 1607 to 1877 (3) I II CDT Political, economic, and social history of the American people from the founding of colonial Jamestown to 1877.

107. History of the United States from 1877 to the Present (3) I II CDT Political, economic, and social history of the American people from the end of Reconstruction to the present.

117. History of England to 1603 (3) I Survey of English history from pre-history to 1603, with emphasis on legal and constitutional history. Cosgrove

118. History of England from 1603 to the Present (3) II Survey of English history from 1603 to present, with emphasis on political and social history. Cosgrove

159. Colonial Latin America to 1700 (3) II 1988-89 A survey of the African, Amerindian, and European backgrounds to Latin America. MacLeod

160. The Latin American Nations, 1700-1880 (3) I Latin America from colonial status to the modern era. Brubaker

161. Modern Latin America (3) II Latin America from 1880 to the present. Latin America's entry into the twentieth century. Brubaker

170a-170b. Introduction to Asian Civilizations (3-3) (Identical with Or.S. 170a-170b)

171. Ancient Civilizations of the Near East (3) I (Identical with Or.S. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II (Identical with Or.S. 172)

204. Ancient History: Greek History (3) I A political, social and cultural history of Greek civilization from the Bronze Age to the death of Alexander the Great. (Identical with Clas. 204) de Laix

205. Ancient History: Roman History (3) II A survey of Roman civilization from the founding of the monarchy to the emperorship of Constantine the Great. (Identical with Clas. 205) de Laix

214a-214b. History of Modern Europe (3-3) Emphasis on political, social and economic developments: 214a: From the Renaissance to Waterloo. 214b: From the Congress of Vienna to the present. 214a is not prerequisite to 214b. Sewell

215. The Two World Wars (3) I The origins and consequences of World War I and World War II. Oswald

227. Nuclear Age (3) II 1987-88 The impact of nuclear science and technology on 20th century society. An examination of the nuclear arms race and the Cold War. The exploration of outer space. (Identical with Pol. 227) Lenoir

230. The History of Black America (3) I History of the Blacks in the United States from their African origins until the present. (Identical with B.L. 230)

233. History of the Mexican American (3) I Survey from the 16th century to the present, with emphasis on social, political and economic trends in their historical context. (Identical with M.A.S. 233) Garcia

236. Indians in U.S. History (3) History of Indians in U.S. development from 1500 to the present with emphasis on relations between competing Indian groups and between Indians and whites. Nichols

244. Western America (3) Survey of the patterns of American expansion and settlement in the western United States. Nichols

245. Frontier America (3) Survey of the patterns of frontier expansion and settlement in the eastern and mid-western United States. Nichols

247. Science and Society (3) I The historical impact of science on society; selected examples of the interaction of science with religion, politics, art, literature, and social thought from the 16th-century to the present. Lenoir

253a-253b. History of Women in the United States (3) Changing role of women in American society from colonial times to the present. (Identical with W.S. 253a-253b) Anderson

315. United States Military History (3) I Survey of American wars from colonial times to the present; military institutions, doctrine, application of the principles of war, campaign strategies and tactics, technology, and leadership. Oswald


339. Tradition, Technology and Business (3) Traces the technological aspects of North Atlantic civilization and culture with emphasis on the role of technology in nineteenth and twentieth century capitalist development. Rebel
DEPARTMENTS AND COURSES OF INSTRUCTION

347. The Old South (3) Social and political history from Jamestown to secession. (Identical with BI.S. 347) Gaines

348. The South Since the Civil War (3) From the Civil War to the present. (Identical with BI.S. 348) Mering

368. Colonial Mexico (3) I From discovery through the War for Independence. (Identical with M.A.S. 368) MacLeod/Meyer

369. Mexico since Independence (3) II Struggle for political, economic and social stability; international relations, cultural patterns. (Identical with M.A.S. 369) Meyer

370a-370b. History of the Jews (3-3) (Identical with Or.S. 370a-370b)

372a-372b. History and Religion of Israel in Ancient Times (3-3) (Identical with Or.S. 372a-372b)

374. The Holocaust (3) II 1988-89 (Identical with Or.S. 374)

375a-375b. History of China (3-3) (Identical with Or.S. 375a-375b)

396. Proseminar

396H. Honors Proseminar (3)

401. Ancient Mesopotamia (3) GC I 1988-89 (Identical with Anth. 401)

402. History of Biology (3) GC II Great writings in biology and medicine. (Identical with Ecol. 402) Lenior

403a-403b. History of Greece (3-3) GC 403a: From prehistoric times to the outbreak of the Peloponnesian War. 403b: From the outbreak of the Peloponnesian War to the end of the Hellenistic Age. 403a is not prerequisite to 403b. (Identical with Clas. 403a-403b) de Laix

404a-404b. History of Rome (3-3) GC 404a: The Republic to the death of Caesar. 404b: The Empire through the reign of Constantine the Great. 404a is not prerequisite to 404b. (Identical with Clas. 404a-404b) de Laix

405a-405b. Medieval Europe (3-3) GC Major institutions and trends in Europe from the breakup of the Roman World to the 15th century. 405a is not prerequisite to 405b. (Identical with Reli. 405a-405b) Bernstein

406. Medieval England (3) GC I From the Roman conquest to the War of the Roses, with emphasis on political, economic, and cultural developments. Bernstein

407. Intellectual History of Medieval Europe (3) GC II Fusion of the Greco-Roman, Christian, and German traditions and analysis of major medieval cultural and intellectual achievements. (Identical with Reli. 407) Bernstein

408. The Renaissance (3) GC I Social, economic, cultural, and religious history of the 14th and 15th centuries; humanism, artistic revolution, and new world discoveries. (Identical with Reli. 408) Weinstein

409. The Reformation (3) GC II The Reformation in thought and action both from the perspective of its religious origins and of the political and social conditions. Analysis of its impact on Sixteenth century Europe including the spread of Protestant reformation and its companion movement, counter-reformation. (Identical with Reli. 409) Oberman

410. History of Hell in Early Europe (3) GC II The concept of punishment after death in Western Europe from the Bible to Dante. Includes the Hebrew, Greco-Roman, Germanic, and Christian traditions. (Identical with Reli. 410) Bernstein

411. European Intellectual History to 1750 (3) GC I Dominant themes in European intellectual history from the end of the Middle Ages to the period of the Enlightenment. Reading and discussions of texts from Petrarch to Locke. Donohoe

412. European Intellectual History: 1750 to 20th Century (3) GC II Dominant themes in European intellectual history from about 1750 to the 20th century. Reading and discussions of texts from David Hume to Friedrich Nietzsche. Donohoe

413. War and Peace in Europe (3) GC II European background to contemporary international relations from the Congress of Vienna through the outbreak of World War II. Browder

414. Medieval and Early Modern Germany (3) GC I The political, social, economic and cultural history of Germany from the late Middle Ages to about 1800. Donohoe/Rebel

415. Modern Germany (3) GC II The political, social, economic and cultural history of Germany from the period of the French Revolution to the present. Donohoe/Rebel

416. Tudor-Stuart England (3) GC I An intensive study of English history from the accession of Edward IV to the Hanoverian dynasty. (Identical with Reli. 416) Cosgrove
17. History of Modern Britain (3) GC II An intensive study of English history from the accession of George III to the present. Cosgrove

18. France under the Old Regime, 1589-1789 (3) GC I French political development, institutions, and culture from Henry IV to the eve of the French Revolution. Vignery

19. The French Enlightenment (3) GC I Cultural history of France in the 18th century, with emphasis on the works of the philosophes. Vignery

20. The French Revolution and Napoleon (3) GC II The origins and progress of the Revolution in France. Vignery

21. History of Russia: Early Period (3) GC I Political, socio-economic, and cultural history of Russia in medieval and early modern times. Kellogg

22. History of Russia: Modern Period (3) GC II Political, socio-economic, and cultural history of Russia in the modern era until the Bolshevik Revolution. Kellogg

23. Intellectual History of Russia (3) GC II The historical significance of social, political, and revolutionary thought in 19th- and 20th-century Russia. Oswald

24. The Russian Revolutions (3) GC I The era of reform and revolutions in Russia from 1890 to 1921, culminating in the formation of the Soviet regime. Browder

25. History of the Soviet Union (3) GC I The Bolshevik Revolution and problems of Soviet Russian history from 1917 to the present. Oswald


27. Russian-American Relations: 1781 to the Present (3) GC II Diplomatic, social, economic and cultural relations between Russia and the United States. Browder

28. Colonial America (3) GC I The experience and evolving institutions of the North Atlantic colonists from the first landings to the end of the French and Indian War. Marietta

29. The Era of the American Revolution (3) GC II Origins, progress, and character of the struggle against Great Britain; internal political, constitutional, social, and economic developments; the problems of the “Critical Period” and the making of the Constitution. Marietta

30. Jefferson and the New Nation, 1790-1825 (3) GC I The Federalists and the rise of the Republican party; a biographical, economic, political and social history of the early North, South and expanding West. Gaines

31. The Jacksonian Era, 1825-1850 (3) GC I II Political, social and economic developments in the United States from the adoption of the Monroe Doctrine through the Mexican War. Gaines/Mering

32. The Coming of the Civil War, U.S. 1845-1861 (3) GC I Political, constitutional, social and economic developments in the U.S. from the Mexican War through the Civil War. (Identical with B.S. 435) Mering

33. Civil War and Reconstruction, U.S. 1861-1878 (3) GC II Political, constitutional, economic, and military developments in the U.S. and the Confederacy during and after the Civil War. (Identical with B.S. 436) Mering

34. U.S. 1876-1919 The Gilded Age and Progressive Era (3) GC Examination of economic, social and political developments in years of rapid industrialization from the end of Reconstruction through World War I. Carter

35. U.S. 1918-1945 From World War I through World War II (3) GC Prosperity, Depression and the New Deal in peace and war. Carter/Garcia

36. United States: 1945 to Present (3) GC I II American society and the role of the United States in world affairs from the Yalta Conference to the present. Dinnerstein/Schaller

37. History of American Society and Thought: Pre-Civil War (3) GC I American political, religious, cultural and philosophical ideas as expressed in colonial, revolutionary, and pre-Civil War society. Carter

38. History of American Society and Thought Since the Civil War (3) GC II The transformation of American minds since the Civil War as expressed in literary, philosophic, religious, and other cultural forms. Carter

39. History of American Foreign Relations to 1914 (3) GC I Examines the rise of America from a struggling colony to a world class power, including its relations with Europe, Latin America and Asia. Schaller
DEPARTMENTS AND COURSES OF INSTRUCTION

450. History of American Foreign Relations since 1914 (3) GC II Examines the pivotal role played by the United States in world affairs since WWI, focusing on America's struggle with revolutionary movements in Europe, Asia and Latin America. Schaller

451. The United States and East Asia: 1840 to the Present (3) GC II 1988-89 An examination of American interaction with Japan and China since the Opium Wars, with special attention given to economic, cultural, and military relations and conflicts. Identical with Or.S. 451) Schaller

452. American Ethnic History (3) GC II A history of the various ethnic minorities in America from Colonial times to the present, with emphasis on adjustment, acculturation and degrees of assimilation. (Identical with Bi.S. 452) Dinnerstein/Garcia

453. History of Women and Work (3) GC I History of women and work in western and non-western nations from prehistoric times to the present. (Identical with W.S. 453) Anderson

454. Spanish Inquisition (3) GC I 1988-89 The Inquisition in Spanish, European, and ethnic history; its bureaucracy and procedures; its festivities, its victims; New and Old Christians, and witches. (Identical with Or.S. 454 and Reli. 454)

455. Feminism: A Comparative History (3) GC II International history of feminism as an ideology and a political movement from the 17th century to the present. (Identical with W.S. 458) Anderson

460. History of the Hispanic Borderlands (3) GC II The Spanish and Mexican experience in the Southwest from the 16th century to 1848. (Identical with M.A.S. 460)

461. The Iberian Empires (3) GC II European background to, and results of, Iberian expansion from the 15th through 17th centuries. Spanish colonialism in the New World is contrasted with Portuguese systems in the East. MacLeod

462. Intellectual History of Latin America since 1810 (3) GC II 1988-89 Latin American thought from Independence to the 20th century; major Latin American thinkers and writers, and influences from Europe and the United States. Brubaker

463. Marxism in East Asia (3) GC I (Identical with Or.S. 463)

464. History of Argentina (3) GC I Survey of Argentine history and culture from the colonial era to the present. Guy

465. History of Spain (3) GC I S History of Spain from remote times to the present; emphasis on the period from 1492, Spain's role in the world and the Spanish Civil War; Spain's cultural contributions. Brubaker

466. History of Brazil (3) GC II Brazil's political, economic, social and intellectual development. Guy

467. Contemporary Latin America (3) GC II Revolution, social change and reaction in Latin America from 1930 to the present. Guy

468a-468b. Asia and the West (3-3) GC 1987-88 (Identical with Or.S. 468a-468b)

469. History of Women in Latin America (3) GC II Women's history in Latin America from the Conquest to the present. (Identical with W.S. 469) Guy

470. Introduction to Indic Civilization (3) GC I (Identical with Or.S. 471)

471. History of Medieval India (3) GC I 1987-88 (Identical with Or.S. 472)

472. History of Modern India and Pakistan: 1750-Present (3) GC II 1987-88 (Identical with Or.S. 473)

474a-474b-474c. History of Japan (3-3-3) GC (Identical with Or.S. 474a-474b-474c)

475a-475b-475c-475d-475e. Periods in Chinese History (3-3-3-3-3) GC (Identical with Or.S. 475a-475b-475c-475d-475e)

476. Modern Chinese History (3) GC (Identical with Or.S. 476)

477a-477b. History of the Middle East (3-3) GC (Identical with Or.S. 477a-477b)

478. Modern History of the Middle East (3) GC I (Identical with Or.S. 478)

479. The Ottoman Empire to 1800(3) GC II 1988-89 (Identical with Or.S. 479)

480a-480b. History of Iran and Central Asia (3-3) GC (Identical with Or.S. 480a-480b)

482. Social History of China (3) GC (Identical with Or.S. 482)

488. History of Byzantium (3) GC II Political, social, and cultural history of Byzantium from A.D. 325 to 1453, including the Byzantine legacy in Europe and the Middle East. (Identical with Clas. 488 and Reli. 488) Kellogg

489. Women in East Asia (3) GC I (Identical with Or.S. 489)
490. Philosophy of History (3) GC I Introduction to historical thinking from antiquity to the present, with emphasis on ideas in European and North American historical writings during the modern and contemporary eras.

495. Colloquium
   a. Revolution in Chinese History (3) GC II (Identical with Or.S. 495a, which is home)
   b. Studies in Black America (3) GC I II (Identical with Bl.S. 495b)
   c. The Mexican American (3) GC I II (Identical with M.A.S. 495c)
   d. Modern Chinese Frontier Areas (3) GC I 1987-88 (Identical with Or.S. 495d) Hedtke

496. Proseminar
   a. Historical Research and Writing (3) GC I II

595. Colloquium
   Certain colloquia in Oriental studies may be used for history graduate credit.
   a. Advanced Studies in United States History (3) I II
   b. Advanced Studies in Latin American History (3) I II
   c. Advanced Studies in European History (3) I II
   d. Applied History (3) I Field trips. (Identical with La.S. 595d)
   e. Advanced Studies in the History of Women (3) I II GRD (Identical with W.S. 595e)
   f. Advanced Studies in Ancient History (3) I II Consult department before enrolling. (Identical with Clas. 595f)

596. Seminar
   Certain seminars in Oriental studies may be used for history graduate credit.
   a. Colonial U. S. History (3) I II
   b. Nineteenth-Century U. S. History (3) I II
   c. Twentieth-Century U. S. History (3) I II
   d. Ancient History (3) I II
   e. Medieval Europe (3) I II
   f. Early Modern Europe (3) I II
   g. Nineteenth-Century Europe (3) I II
   h. Twentieth-Century Europe (3) I II
   i. Colonial Latin America (3) I II
   j. Latin America: Modern Period (3) I II
   k. Historical Writing and Editing (3) I II
   l. History of Science (3) I II

597. Workshop
   a. College Teaching (1) I

HISTORY AND PHILOSOPHY OF SCIENCE

Committee on History and Philosophy of Science (Graduate)

Professors Henry C. Byerly (Philosophy), Chairperson, Leon Blitzer (Physics), Robert M. Harnish (Philosophy), William A. Longacre (Anthropology)
Associate Professor Richard E. Michod (Ecology and Evolutionary Biology)

History of science deals with the origins and development of the human quest for understanding of the world in which we live. Philosophy of science treats the logical analysis of scientific reasoning, the clarification of fundamental scientific concepts, and methodological problems common to many fields of inquiry.

The committee offers a Doctor of Philosophy minor in the history and philosophy of science. For admission and degree requirements, please see the Graduate Catalog.

HOME ECONOMICS
(See Family and Consumer Resources)
HOME MANAGEMENT
(See Family and Consumer Resources)

HONORS PROGRAM

The Honors Program provides special opportunities to those students who demonstrate the highest levels of creativity, curiosity, maturity, and academic achievement. Responsibility for the program is shared between academic departments and the Honors Center. Departments generally assume responsibility for those courses which are endemic to their respective disciplines while the Honors Center participates in this joint venture by offering seminars and colloquia that are broader, often interdisciplinary in focus, and by exposing students to a variety of noncredit, cultural opportunities designed to enrich campus life.

In the Schedule of Classes students receive prior to registration, all honors courses are identified by the suffix "H" attached to the course number (History 106H) or to a section designation positioned under the course number (History 106, section 5H). While honors courses are primarily reserved for honors students, select students not enrolled in the Honors Program may be admitted to a course with the instructor's permission. Course offerings sponsored by the Honors Center and the participating academic departments include, but are not limited to, those listed below. It is important to note that, in order to develop an appropriate blend of honors offerings, these courses may not be offered every semester or year. Students should check the Schedule of Classes each semester to determine if a specific course is available.

Honors Center Courses

280H.* Student Planning Board (2) I II Open to select students interested in working in the Honors Program organization. Prior permission required.

295H.* Honors Colloquium [1-3] I II Small group discussions exploring special topics. Open to all Honors students.

391H.* Honors Preceptorship [1-3] I II Open to select upper-division students interested in gaining teaching or practical experience in a department. (Not available for preregistration.)

396H.* Honors Proseminar (3) I II A small, interdisciplinary class focusing on specialized topics.

399H.* Honors Independent Study (1-3) I II Open to select students who wish to work independently under the supervision of a faculty member.

*The above courses are available only to members of the Honors Program.

Department Course Offerings

American Indian Studies

396H. Honors Proseminar (3) (offered alternatively with Black Studies and Mexican-American Studies)

Anatomy

Independent laboratory opportunities available.

Anthropology

102.* Introduction to Cultural Anthropology (3) I
111.* Biological Anthropology (3) II
396H. Honors Proseminar (3) II

Art

118.* Survey of World Art (3) I
396H. Honors Proseminar (3) (offered alternatively with Music and Drama).
Biochemistry

182.* Life: The Science of Biology (4) II
Additional independent laboratory opportunities are available.

Black Studies

396H. Honors Proseminar (3) (offered alternatively with American Indian Studies and Mexican-American Studies).

Chemistry

105a-105b. Honors Fundamentals of Chemistry (4-5) I II
242a-242b. Honors Lectures in Organic Chemistry (3-3) I II
396H. Honors Proseminar (3) II

Civil Engineering

196H. Honors Proseminar (1) I II
214.* Statics (3) I II
217.* Mechanics of Materials (3) I II
Additional independent research opportunities available.

Classics

396H. Honors Proseminar (3) I

Communication

396H. Honors Proseminar (3) I

Drama

140a-140b.* History of Theater and Drama in Western Civilization (3-3)
396H. Honors Proseminar (3) II

Ecology and Evolutionary Biology

182.* Life: The Science of Biology (4) II
Additional independent laboratory opportunities available.

Economics

201a-201b.* Principles of Economics (3-3)
332.* Aggregate Economic Analysis (3) I II
361.* Intermediate Price Theory (3) I II
396H. Honors Proseminar (3) II
441.* International Trade Theory (3) II
442.* International Economics (3) I
460.* Economic Organization and Government Policy (3) I
461.* Regulated Industry (3) II
481.* Economics of Wage Determination (3) I
DEPARTMENTS AND COURSES OF INSTRUCTION

English

103H. Freshman Composition (3) I II
104H. Freshman Composition (3) I II
495. Colloquium
   a. Honors for Juniors (3) II
   b. Honors for Seniors (3) I II

Fine Arts

207.* Western Civilization-The Arts: The 20th Century (3) I II
307.* Western Civilization-The Arts: Paleolithic Through Renaissance (3) I
317.* Western Civilization-The Arts: Baroque Through 19th Century (3) II

French

201a-201b.* Intermediate French (4-4)
396H. Honors Proseminar (3) I II

Geosciences

101a-101b. Introduction to Geology (3-3)
102a-102b.* Introduction to Geology Laboratory (1-1)
391H. Honors Preceptorship (1-3) I II
396H. Honors Proseminar (3) I

History

101.* Introduction to the History of the Western World to the 17th Century (3) I II
106.* History of the United States from 1607-1877 (3) II
396H. Honors Proseminar (3) I

Humanities

250a-250b-250c.* Introduction to Humanities (4-4-4)
396H. Honors Proseminar (3) II

Journalism

396H. Honors Proseminar (3) II

Management and Policy

396H. Honors Proseminar (3) I

Management Information Systems

396H. Honors Proseminar (3) II

Mathematics

125b.* Calculus (3) II
Mexican-American Studies

396H. Honors Proseminar (3) (offered alternatively with Black Studies and American Indian Studies)

Microbiology and Immunology

182.* Life: The Science of Biology (4) II
396H. Honors Proseminar (1-3) II

Additional independent laboratory opportunities available.

Molecular and Cellular Biology

182.* Life: The Science of Biology (4) II

Additional independent laboratory opportunities available.

Music

107.* Survey of Music (3) I
108.* Survey of Music (3) II
396H. Honors Proseminar (3) I

Nursing

379.* Analysis of Nursing Problems (2) I II
388.* Issues in Nursing and Health Care Delivery (2) I II
389.* Research Methods in Nursing (2) I II
393H. Honors Internship (3-6) S for 10-12 weeks
396H. Honors Proseminar (1-3) I II

Nutrition and Food Science

396H. Honors Proseminar (3) I

Philosophy

111.* Introduction to Philosophy (3) I
113.* Introduction to Moral and Social Philosophy (3) II
396H. Honors Proseminar (3) I

Physics

396H. Honors Proseminar (3) II

Political Science

102.* American National Government (3) I
250.* Contemporary National Politics (3) II
396H. Honors Proseminar (3) I II

Psychology

101.* Introduction to Psychology (3) I II
396H. Honors Proseminar (3) I
Russian

101a-101b.* Elementary Russian (4-4)
201a-201b.* Intermediate Russian (4-4)
396H. Honors Proseminar (3) I

Systems and Industrial Engineering

170R.* Problem Solving Using Computers (2) I II
170L.* Problem Solving Using Computers Laboratory (1) I II

Sociology

100.* Introduction to Sociology (3) II
396H. Honors Proseminar (3) I

Spanish

101a-101b.* First Year Spanish (4-4)
201a-201b.* Third and Fourth Semester Spanish (4-4)
320.* Readings in Literary Genres (3) I
396H. Honors Proseminar (3) II

Women's Studies

396H. Honors Proseminar (3) I

*Honors section available. Consult Schedule of Classes for information.

In addition to the courses listed above, all departments and colleges participating in the Honors Program offer the following standardized courses (available only to students who are members of the Honors Program):

199H. Honors Independent Study Grades available A-B-C-D-E-I-W.
299H. Honors Independent Study Grades available A-B-C-D-E-I-W.
399H. Honors Independent Study Grades available A-B-C-D-E-I-W.
499H. Honors Independent Study Grades available A-B-C-D-E-I-W.
498H. Honors Thesis (3) [Rpt./6 units] An honors thesis is required of all students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis. Grades available A-B-C-D-E-I-W.

Individual departments frequently offer honors courses in addition to those listed above. Information on these specific programs may be obtained from the Honors Center or from the respective college honors advisors.

In order to graduate with honors, a student must: (1) maintain and graduate with a 3.5 grade-point average, (2) complete 30 units in university-wide, college, or departmental honors courses, (3) take at least 3 of these 30 units in the 396H Proseminar series of courses, (4) complete both semesters of 498H as part of the 30-unit honors requirement, and (5) submit a completed honors thesis to the Honors Center prior to graduation. The format of the program is structured such that a student can fulfill the academic honors requirements by enrolling in at least one honors course each semester, plus completing the required 498H sequence (6 units).
HUMANITIES

Professor Billie Jo Inman, Director
Assistant Professors Ann Kerwin (Adjunct), Meredith E. Little (Adjunct)
Senior Lecturer Donna E. Swaim

The Humanities Program offers three linked interdisciplinary courses treating the development of western civilization as shown in outstanding works in literature, philosophy, science, religion, and the arts, and a related course in travel abroad. It offers an interdisciplinary course in the Contemporary Period, and is planning to introduce similar courses at the 400 level in other periods during 1987-89. In becoming knowledgeable about outstanding writings and works of art in a range of fields, humanities students attain a rich general education that not only is personally satisfying, but also is increasingly appreciated by employers in industry and business. Courses listed plus independent studies can constitute a subject area within the general studies major. The three-sequence course, Introduction to Humanities, satisfies the western civilization requirement.

250a-250b-250c. Introduction to Humanities (3-3-3) 250a: Major Ancient Cultures, from the Sumerian through the Roman, with emphasis on the Greek I II P, 6 units in freshman composition or CR Engl. 103H or 104H. 250b: European Culture, from the Early Christian Period through the Seventeenth Century I II P, 6 units in freshman composition or CR Engl. 103H or 104H. (250a is not a prerequisite to 250b.) 250c: The Modern World: Eighteenth, Nineteenth and Twentieth Centuries I II P, 250a or 250b.

310. Voyage of Discovery (3) S Small group (8-14) travel to cultural centers of Europe to experience major works of art and architecture studied in 250a-250b-250c and 355. P, 6 units in interdisciplinary humanities.

355. Contemporary Complexities (4) I II (Rpt./1) An interdisciplinary survey of contemporary culture and its roots as expressed in literature, art, and philosophy. Field trips. P, 250a or 250b or 250c. May be repeated with departmental approval.

HYDROLOGY AND WATER RESOURCES

Professors Nathan Buras, Head, Robert A. Clark (Adjunct), Donald R. Davis, Stanley N. Davis, Lucien Duckstein, Daniel D. Evans, Martin M. Fogel (Watershed Management), John W. Harshbarger (Emeritus), Simon Ince, William B. Lord (Water Resources Research Center), Thomas Maddock, III, Shlomo P. Neuman, Eugene S. Simpson (Emeritus), David A. Woolhiser (Adjunct)
Associate Professors Harold W. Bentley (adjunct), Michael D. Bradley, Soroosh Sorooshian
Assistant Professors Roger C. Bales, Susan C. Nunn, T.-C. Jim Yeh

Hydrology and water resources include the origin, distribution, and properties of the waters of the Earth, as well as the development and management of water resource systems for multiple purposes. The faculty offers competence in hydrogeology, hydrogeochemistry, ground-water and surface-water hydrology, water quality, mathematical and statistical methods in hydrology (including numerical modeling), and water resource planning, management and administration. The department offers the Bachelor of Science in Hydrology and the Master of Science and Doctor of Philosophy degrees with majors in both hydrology and water resources administration. See College of Engineering and Mines section of this catalog for the undergraduate requirements. For information regarding graduate degrees, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.
Hydrology

101a-101b. Water and the Environment (4-4) Relation of physical and biological sciences to the understanding of the water cycle; man's impact on water resources, with emphasis on factors affecting the availability and quality of water in arid and humid regions. 3R, 3L. Field trips. 101a is not prerequisite to 101b. Open to nonmajors only.

150. Principles of Hydrology (3) II Basic principles of hydrology dealing with the chemical, physical, and biological aspects of water movement and mass transfer; techniques of measurement of hydrologic variables; relations used by man to develop water supplies. 2R, 3L.

296. Proseminar
   a. Hydrology (1) [Rpt./1] II

402. Fundamentals of Water Quality (3) GC I Introduction to chemical processes affecting the behavior of major and minor chemical species in the aquatic environment. Physical, equilibrium, organic, and analytical principles as applied to natural waters. Open to majors only. P, Chem. 103b, Phys. 103b, and Math. 125b.

403. Subsurface Hydrology (3) GC I Physical, mathematical, geologic, and engineering fundamentals to subsurface hydrologic processes. Open to majors only. P, A.M.E. 331a or C.E. 321; Math. 125b; Geos. 101a.


405. Hydrology of Unsaturated Media (3) GC I Physical properties and processes of unsaturated media related to storage and movement of water and transport of contaminants. P, Phys. 103b, Math. 125b. (Identical with S.W. 405)

414a-414b. Field Hydrology (Summer Camp) (3-3) GC S Field methods of collection, compilation, and interpretation of data in surface and ground-water hydrology; investigation of a small water resources project; preparation of hydrologic reports. Daily field work. Fee. P, 405, 423, 435.

423. Hydrology (3) GC I (Identical with C.E. 423)


450. Environmental Hydrology (3) GC II Chemical and physical properties of water in relation to man's use; transport and dispersion of pollutants in surface and subsurface water; chemical and transport models. 2R, 3L. Field trips. P, 150, Chem. 103a-103b, Math. 125b, S.I.E. 170.

457. Low Temperature Geochemistry (3) GC II (Identical with Geos. 457)

460. Watershed Hydrology (3) GC I (Identical with Ws.M. 460)

471. Water Quality Control (3) GC II (Identical with C.E. 471)

480. Hydrologic Systems (3) GC I Major aspects of the hydrologic cycle are studied quantitatively, with emphasis on model construction and simulation. 2R, 3L. Field trips. P, 423 or 460.

481. Physical Oceanology and Limnology for Hydrologists (2) GC II 1987-88 Origin, distribution, and characteristics of oceanic water; advective and convective processes; estuarine and shoreline processes; effect on coastal aquifers; classification and hydrologic regimen of lakes. P, Math. 125b.

502. Snow Hydrology (2) I 1988-89 (Identical with Ws.M. 502)

503. Subsurface Fluid Dynamics (3) I Kinematics and dynamics of fluids in saturated porous and fractured media; introduction to free surface, unsaturated, and multiphase flows. P, A.M.E. 331a or C.E. 321, Math. 422a. (Identical with C.E. 503)

504. Numerical Methods in Subsurface Hydrology (4) II Finite difference and finite element methods for subsurface fluid flow and mass or energy transport; applications to aquifers, unsaturated soils, seepage through earth dams, geothermal systems. 3R, 3L. P, Math. 422a. (Identical with C.E. 504)

506. Water Quality Dynamics (3) I Chemical and physical methods are used to study the quality of ground and surface waters with emphasis on electrolyte chemistry, heterogeneous processes, colloids, and surface processes including sorption phenomena. Equilibrium and dynamic models of water chemistry. P, Chem. 480a or 450.

536. Development of Ground-Water Resources (3) Analytic techniques to evaluate geohydrologic systems; case histories used to study management of ground-and surface-water resources; planning and design of regional water resource investigations. Field trips. P, 535. (Identical with Geos. 536)


545. Advanced Statistical Hydrology (3) 1987-88 Advanced application of statistics and probability to hydrology and water resources; multivariate modeling, choice of models and parameters, simulation, Bayesian decision theory. P, 445.

564. Isotope Hydrology (3) (Identical with Geos. 564)

565. Hydrochemistry (3) 1987-88 (Identical with S.W. 565)

596. Seminar

a. Hydrogeology (1 to 3) [Rpt./2] III (Identical with Geos. 596p)

603. Well Hydraulics and Pumping Test Analysis (2) 1988-89 Flow to wells in aquifers, with emphasis on design and interpretation of pumping tests; confined, unconfined, and leaky aquifer systems; fractured rocks; automatic curve matching. P, 503 or 535, Math. 422a.

605. Soil Water Dynamics (3) 1988-89 (Identical with S.W. 605)


695. Colloquium

a. Hydrology (1-to 3) [Rpt./1] II

696. Seminar

b. Unsaturated Flow (2 to 3) II

c. Regional Hydrologic Analysis (1 to 3) II P, 423, 435.

d. Desert Hydrology (1 to 3) [Rpt./2] I II 1988-89

e. Pollutants in the Hydrologic Environment (1 to 3) II

h. Aquatic Chemistry of Surfaces (1 to 3) 1987-88 P, 506.

Water Resources Administration


408. Water Resources Management, Planning, and Rights: A Policy Approach (3) GC II An introduction to basic concepts and issues of water resources management and administration, emphasizing water law and rights, water resources planning, institutional and organizational arrangements, and policy processes such as adjudication and rule-making. Open to majors only.

443. Quantitative Planning Methods in Water Resources Administration (3) GC I Applications of quantitative methods to water resource management; benefit-cost analysis; optimization; structure and basis of planning process; principles and guidelines. P, microeconomics, Math. 125a.

444. Quantitative Design Methods in Water Resources Administration (3) GC II Applications of quantitative methods to water resource management; benefit-cost analysis; optimization; operations research methods (linear, quadratic, and dynamic programming). P, FORTRAN, microeconomics, Math. 125a.

451. Population and Resources (3) GC I (Identical with Geog. 461)

476. Natural Resource Economics (3) GC II (Identical with A.Ec. 476)

480. Forest Policy and Administration (3) GC II (Identical with Ws.M. 480)

481. Environmental Policy (3) GC II (Identical with Pol. 481)

501a-501b. Water Resources Policy and Administration (3-3) Institutional and policy aspects of water resources administration; management, organizational theory, and international problems of water use and development; ground-water management and policy. 501a is not prerequisite to 501b.
DEPARTMENTS AND COURSES OF INSTRUCTION


525. Water Quality Modeling (3) I (Identical with C.E. 525)

526. Water Quality Management (3) II Optimization and systems analysis techniques used in modeling; current models used in formulation and implementation of water quality policy. P, 525. (Identical with C.E. 526)

556. Finite State Methods in Water Resources Management (3) II 1988-89 Finite state methods; applications to natural resource systems as arise in hydrology, ecology, and earth sciences, including the modeling of interfaces such as socioeconomic processes. P, Math. 254, S.I.E. 170. (Identical with S.I.E. 556)


576. Advanced Natural Resource Economics (3) I (Identical with A.Ec. 576)

577. Natural Resource Economics and Public Policy (3) II (Identical with A.Ec. 577)

643. Water Resources Systems Analysis (3) I 1988-89 Applications of mathematical programming to the analysis of interactions of hydrology, engineering, economics, and socio-institutional environment in regional water resources systems. P, 544b or consult department before enrolling.

695. Colloquium
   a. Water Resources Administration [1 to 3] [Rpt./1] I II

696. Seminar
   h. Long-Range Resource Planning [1 to 3] [Rpt./2] I
   i. International Water Resource Management [1 to 3] [Rpt./2] I
   m. Water Storage Systems [1 to 3] [Rpt/1] II P, consult department before enrolling.

INDUSTRIAL ENGINEERING
(See Systems and Industrial Engineering)

INTERDISCIPLINARY PROGRAMS

The Office of Interdisciplinary Programs coordinates both interdisciplinary programs and courses. Such programs are described under "Office of Interdisciplinary Programs" in the General Divisions of the University section of this catalog.

In most cases, interdisciplinary courses are listed under a "home" department and crosslisted in a variety of other departments. Such courses would not appear in this section. Those interdisciplinary courses for which no department acts as "home" are listed below.

596. Seminar
   u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Arch. 596u, Geog. 596u, L.Ar. 596u, Psyc. 596u, and Ping. 596u).

INTERIOR DESIGN
(See Family and Consumer Resources)

IRRIGATION
(See Agricultural Engineering)
ITALIAN
(See French and Italian)

JAPANESE
(See Oriental Studies)

JOURNALISM
Professors George W. Ridge, Jr., Head, Donald W. Carson, Abraham S. Chanin, Philip Mangelsdorf
Associate Professors Ford N. Burkhart, William F. Greer, James W. Johnson, Jimmy D. Patten, Jacqueline E. Sharkey
Assistant Professors C. Bickford Lucas, Carole Rich
Lecturers Wallace Beene, Anne-Marie Brady, S. Jeffrey Minker, Carol Weinstock

The department's program is designed to balance a student's development in the theory and practice of journalism with an even stronger emphasis on the humanities, arts and sciences. The department offers instruction in the reporting, writing and editing skills necessary for a journalism career along with in-house internships for professional development. Courses are also required to provide students with an understanding of journalism's role in U.S. society. The department offers programs combining the major in journalism with that in Oriental studies or Latin American studies.

The department offers a major in journalism for the degrees of Bachelor of Arts and Master of Arts. For graduate admission and degree requirements, consult the Graduate Catalog. A Bachelor of Arts in Education with a teaching major in journalism also is available.

The major in journalism: 26 units in addition to the general education requirements for the Bachelor of Arts degree described in the College of Arts and Sciences section of this catalog. All majors must take 205, 206, 208, 301, 302, 320, 413, 450 and 470. Students then can select courses in one of the following areas of emphasis: newspapers, magazines, community journalism, public information, photojournalism. Students must complete one advanced course from among Jour. 405, 411, 412, 415, 417, 419, 425, 451 and 452. No more than 35 units of journalism will count toward the 125 units needed for the degree.

Journalism majors must complete at least 6 units in the Arts and Sciences Study Areas in addition to those required by the College of Arts and Sciences. All majors must take at least 9 units in English writing or literature in addition to freshman English.

The supporting minor: Students are strongly advised to minor or obtain a second major in economics, English writing or literature, history, political science, a modern language, anthropology, psychology, sociology or natural sciences.

The teaching major: 30 units, including 205, 206, 208, 301, 302, 320, 411 or 413; 450, 470.

The teaching minor: 20 units, including 205, 206, 301, 302, 422, 470.

Honors: The department participates in the Honors Program.

The Arizona Journalism Institute: The department sponsors the Arizona Journalism Institute, a permanent center for study and conference among professional journalists in the state.

Freedom of the Press Award: Each year the department gives the John Peter Zenger Award to a journalist whose professional work has made an outstanding contribution to the preservation of freedom of the press and the people's right to know.

Publications: The department publishes the local edition of The Tombstone Epitaph; the bilingual South Tucson Independiente; and The Pretentious Idea, a media review. In addition, students report on state government and the legislature for community newspapers. During the spring semester, the department awards the Don Bolles Fellowship to permit one student to work full time in Phoenix covering the legislature.
DEPARTMENTS AND COURSES OF INSTRUCTION

Cable Television: The department produces Tucson News and Sports, a cabletext news service for a public-access channel.

Guadalajara Exchange: Students interested in Latin American reporting are offered a one-year exchange program with the School of Journalism at the Autonomous University of Guadalajara in Mexico.

The Department of Journalism is accredited by the Accrediting Council on Education for Journalism and Mass Communications.

151. News in Mass Communications (3) I II Designed to acquaint the nonjournalist with communications techniques used by newspapers, wire services, information agencies, news magazines and broadcast news; analysis of social and historical influence on the news media.

205. Reporting the News (3) I II Gathering, evaluating, and writing news. P, CR 208, Freshman Composition, knowledge of typing. Consult department before enrolling. (Identical with M.Ar. 205)

206. Advanced Reporting (3) I II Comprehensive and accurate news presentation, with emphasis on interview techniques and coverage of major news stories. P, 205.

208. Law and Ethics of the Media (3) I Introduction to Freedom of Expression. Responsibility of the media; libel; and laws pertaining to broadcast and print journalism. (Identical with M.Ar. 208)

301. Photojournalism (2) I II Reporting and interpreting the news through pictures.

302. Photojournalism Laboratory (1) I II Open to majors only. P, CR 301.

305. Broadcast Writing (3) I II (Identical with M.Ar. 305)

320. Editing (2) I II Theory and techniques of copy editing and headline writing; training on video display terminals. 1R, 3L. P, 208, 206 or CR. Department permission required.

364. Creative Advertising (3) I II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Mktg. 364)

366. Public Relations (3) I II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Mktg. 366)

396H. Honors Proseminar (3) I II

403. Advanced Photojournalism (3) GC I II Open to majors only. P, 301, 302.

405. The Study of News (3) GC I II Critical study and problem analysis of the media. Field work may include publication of conclusions.

411. News Features (3) GC I II Writing the basic news feature article; specialized reporting and rewriting techniques. P, 206. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


413. Reporting Public Affairs (3) GC I II Study and practice of newsgathering on executive, legislative, and judicial levels in city, county, state and federal governments, with emphasis on news sources and interpretive writing. P, 206, 208. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

415. The News Agency: Arizona News Service (1) GC [Rpt.] I II Role and operations of the news agency, wire service or syndicate. Class members will form staff of Arizona News Service to supply client newspapers from bureaus in Tucson and Phoenix. Field trips. P or CR, 411 or 413.

416. The Editorial Page (3) GC I II Critical study of opinion-makers, with emphasis on editors and public-affairs columnists; analysis of editorial pages in a changing society; writing of editorials. P, 206.

417. The Weekly Newspaper (3) GC I II Community and suburban weeklies, including problems of news coverage, production, advertising and circulation. Integration of electronic text systems. Field trips.

419. Public Information Writing (3) GC I II S The history, principles and techniques of public information, the relation between news media and government, and the responsibilities of government and other public information specialists.

422. **Publications Layout and Design** (3) GC I Theory and practice of layout, typography, and design for magazines. P, permission of department.

425. **The Electronic Newspaper: Tucson News and Sports** (3) GC I II Reporting and writing Tucson news stories suitable for use on local cable television station. Students produce copy on a character generator and send it by modem to a public access channel. P, 205, 206 or CR.

450. **Community Journalism: The Tombstone Epitaph** (3) GC [Rpt.] I II Class members work as editorial staff to produce the local newspaper for Tombstone, Arizona. Intensive study of problems and responsibilities of community newspapers. P, 206, 208, 301, 320, discussion of preparation with instructor.

451. **Community Journalism: El Independiente** (3) GC [Rpt.] I II Class members work as editorial staff to produce a publication for the city of South Tucson. Intensive study of problems and responsibilities of journalism. P, 206, 208, 301, 320, discussion of preparation with instructor.

452. **Press Criticism: The Pretentious Idea** (3) GC I II Study of press criticism, including the publication of a press review. Open to majors only. P, 206, 208, 320, discussion of preparation with instructor.

450. **The Press and Society** (3) GC I II Critical study of press performance in current affairs; changing requirements for socially responsible and professional journalism in a democracy. (Identical with M.Ar. 470)

471. **International Communications** (3) GC I II Study of world news systems, including newsgathering agencies, role of the foreign correspondent, the foreign press, and factors influencing international news flow.

497. **Workshop**
   a. **Color Photography** (2) [Rpt./1] GC S Two-week field trip with fee.

502. **Freedom of Expression** (3) II Analysis of access and barriers to information and communication at local, state, national and international levels; intensive study of the legal relationship between mass media and society. Open to majors only.

509. **Media in the Twentieth Century** (3) I The social, cultural, and economic role of a free press in American society. Interaction of press and government at judicial, executive, and legislative levels.

596. **Seminar**
   a. **History of Mass Media** (3) I II
   b. **International Communications** (3) I II
   c. **Reporting Governmental Affairs** (3) I II
   d. **Magazines** (3) I II
   e. **Electronic Media** (3) I II
   f. **Community Journalism** (3) I II
   g. **Journalism Education** (3) I II
   h. **Latin-American Press** (3) I II
   i. **News Analysis** (3) I II
   j. **Media Organization** (3) I II

**LANDSCAPE ARCHITECTURE**
*(See Renewable Natural Resources)*

**LANGUAGE, READING AND CULTURE**

Professors Kenneth S. Goodman, Yetta M. Goodman, Amelia Melnik, Kenneth J. Smith, William J. Valmont


Assistant Professor Arminda Fuentevilla
The division offers programs leading to the Master of Arts and Master of Education degrees with majors in bilingual/bicultural education and reading. The division offers programs leading to the Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees with a major in reading. For information on graduate admission and graduate degree programs, please consult the Graduate Catalog.

At the time the catalog was being edited, many programs in the College of Education were being redesigned. All current and prospective students should check with the Office of Student Services in the College of Education or the Division of Language, Reading and Culture for current admission and degree requirements in each major.

304. Decoding Skills in the Elementary School (2) I II Basic decoding skills needed in reading; methods and materials used in teaching reading.

325. Foundations of Bilingual Education (3) I II Introduction to the theory and practice of bilingual education. (Identical with M.A.S. 325)

406. Foundations of Reading Instruction in Spanish (2) GC II Introduction to the theoretical and practical aspects of the reading process, with attention to essential decoding and comprehension skills; special application for teaching Spanish-speaking children to read. Taught in Span. P, Span. fluency. (Identical with M.A.S. 406)

420. Education and the Culturally Diverse (3) GC I II Analysis of the interaction of school, community, and family factors in the education of diverse populations.

427. Bilingual Curriculum Development (3) GC I II Theory and application of curriculum development to bilingual instructional program: designs, organizational patterns, materials and media, change strategies, and evaluation.

430. Computer Literacy for Teachers GC (3) I II Microcomputer operation; software evaluation; use of author systems and word processors in the classroom; computer managed instruction; organization for computer use.

435. Secondary School Reading in the Classroom (3) GC I II Provisions and procedures for evaluating and developing reading skills needed in content areas.

481. Children’s Literature in the Classroom (3) GC I II Strategies for teachers to promote literary appreciation and analysis of classic and contemporary children’s literature of all genres.

494. Practicum
   a. Elementary School Reading (1) I II P, 304.
   b. Reading in School Settings (3) I II Credit allowed for one of the following: 494a, 494c, or 494d.
   c. Reading Certification (1) I II S P or CR, 304, 435, or 607.

504. Language and Culture in Education (3) I II Theory and research concerning language acquisition in first and second languages and relationships to reading and writing; impact of linguistic and cultural background on education; pedagogical implications.

505. Essentials of Reading and Writing Instruction (3) I II Theories and principles underlying reading instruction, approaches to teaching, basic analysis of research.

507. Analysis of Decoding (3) I II Phoneme theory; prerequisites for learning phoneme-grapheme associations; teaching word identification skills; examination and analysis of instructional materials and related research. P, 505 or CR.

508. Bilingual Reading and Writing (3) I II Analysis of reading situations encountered by bilingual students; phonological, semantic and syntactic aspects of instruction; methods and materials. P, 505 or CR.


525. Educating the Bilingual Learner (3) I I Analysis of theories and practices affecting bilingual learners; historical, social, and cultural influences; relationship of theory to the characteristics and needs of the bilingual learner.

532. Pre-Reading and Beginning Reading Development (3) I II An examination of various aspects involved in pre-reading and beginning reading development, including psychological, sociological, physiological, linguistic and educational considerations.

534. Reading Comprehension: Theories, Research, and Methods (3) I II Factors affecting cognitive development; methods of influencing growth in reading comprehension; examination and analysis of instructional materials; research related to comprehension and cognitive development. P, 505 or CR.

535. Reading in the Secondary School Curriculum (3) I II Organization of reading programs: skills and methodologies; evaluation of published materials; development of teacher-made materials. P, 505, 507 or CR.
537. **Classroom Diagnosis and Instruction (3)** I II Procedures for diagnosing and developing reading and writing skills for pupils of below-average achievement level. P, 505, 507, 534 or CR.

540. **Curriculum Development and Supervision in Reading (3)** I II Organizational patterns of reading curricula; approaches to the improvement of reading instruction; personnel relations. Designed for the reading supervisor and the school administrator. P, 505 and 507 or CR.

551. **Psycholinguistics and Reading (3)** I II Basics in psycholinguistics of reading and reading instruction, with emphasis on the comprehension of written language.

553. **Language Acquisition and Development (3)** I Study of the development of language in young children, and exploration of instructional techniques to maximize that development. P, 551 or CR.

554. **Applied Linguistics in Education (3)** I The application to curriculum, teaching and learning of concepts from linguistics, psycholinguistics and sociolinguistics. P, 551 or CR.

557. **Application of Miscue Analysis (3)** I II Study of miscue analysis to explore the reading process, reading research, and readability, as well as to evaluate readers; applications to reading strategies and curriculum; focus on comprehension. P, 551 or CR.

578. **Field Experience (3)** I II Supervised experience in assessment and instruction of literacy-related practices. P, 504, 505, 507, 534 or CR.

595. **Colloquium**
   a. Issues in Reading (3) I II P, 504, 505 or CR.
   b. Language, Learning and Reading Disabilities (3) II (Identical with S.E.R. 595b, which is home.)
   c. Issues in Educating Mexican American Children (3) I S
   d. Applications of Language and Literacy (3) [Rpt./9 units]

596. **Seminar**
   a. Research in Reading (1 to 6) P, 504, 505, 507, 534 or CR.
   b. Language Research Methodology in Education (3) II P, 553 or 554.
   c. Research in Language and Literacy (1 to 6) [Rpt./9 units]

597. **Workshop**
   a. Southern Arizona Writing Project (3 to 9) [Rpt./12 units] I II S (Identical with Engl. 597a)
   b. Miscue Analysis in Teacher Education (2 to 3) II 1988-89
   c. Teaching of English (3) I II S (Identical with Engl. 597c, which is home)

612. **English Grammar for ESL (3)** I (Identical with Engl. 612)

613. **Teaching of ESL (3)** I (Identical with Engl. 613)

638. **Reading Diagnostic Laboratory (3 to 6) [Rpt./6 units] I II Supervised practice in reading assessment; identification of factors influencing reading achievement, evaluation, construction, and administration of assessment procedures; development of interview techniques. P, 507, 534, 535 or CR.

639. **Reading Instructional Laboratory (3 to 6) [Rpt./6 units] I II Supervised practice in teaching reading and writing; preparing, analyzing and critiquing special instructional programs for students. Open to majors only. P, 507, 534, 535 or CR.

653. **Written Language Development (3)** I II S Exploration of the emerging writing and reading behavior of children ages 2-10 and the relationship between oral and written language development through current and original student research. P, 553, 554 or CR.

694. **Practicum**
   a. Bilingual Education (3) [Rpt./2] P, 15 graduate units incl. 506 and 525.

795. **Colloquium**
   a. Language and Culture (1 to 3) II [Rpt./15 units]

796. **Seminar**
   a. Research and Evaluation (1 to 3) I II [Rpt./15 units]
   b. Bilingual Education (3) I

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**LATIN (See Classics)**

**LATIN AMERICAN STUDIES**

*Latin American Area Center*

Director Michael C. Meyer
Assistant Director Raúl P. Saba
The Latin American Area Center offers an interdisciplinary program designed primarily for students planning government, business, teaching, or other careers. The Center offers a Bachelor of Arts degree, a Master of Arts degree, and a doctoral minor in Latin American studies. A student with an interest in the Latin American area selects a concentration in one department and enriches that concentration with related studies, cultural or professional, in other departments.

Students admitted to the B.A. program must complete a minimum of 30 upper-division units (courses numbered 300 and above) and choose a concentration from one of the following: anthropology; economics; geography and regional development; history; political science; Portuguese; and Spanish.

A minimum of 12 upper-division units must be chosen from the concentration. A minimum of 18 upper-division units, with no fewer than 6 in any one department, must be selected from two or three departments offering related studies: agricultural economics; anthropology; art history; business and public administration; economics; English as a second language; educational foundations and administration; family and consumer resources; geography and regional development; history; journalism; music; political science; Portuguese; sociology; and Spanish. A student may not duplicate in related studies the department chosen for the concentration. La.S. 495a must be taken once; upon consultation with an advisor, credit for this course may be applied toward the concentration or the related studies.

The student must demonstrate proficiency in either Portuguese or Spanish, depending upon the student’s career goals, by completion of Port. 202b or Span. 301a with a grade of "B," or by an equivalency exam.

Honors: The department participates in the Honors Program.

495. Colloquium

595. Colloquium
d. Applied History (3) [Rpt./5] I (Identical with Hist. 595d, which is home)

596. Seminar
   a. Latin American Studies (3) I P, Span. or Port. proficiency.

LAW


Associate Professors Gary B. Born, Theresa A. Gabaldon, James R. Ratner, Jane B. Silverman

The College of Law offers course work leading to the Juris Doctor degree. The course program has been thoroughly revised and expanded to include a modernized set of required courses and a wide variety of problem-method courses, seminars and clinical programs. For course descriptions and degree requirements, please see the College of Law Catalog.

600. Contracts (5)

601a-601b. Introduction to Legal Process and Civil Procedure (3-2)
602. Criminal Procedure (4)
603. Research and Writing (2)
604a-604b. Torts (2-3)
605. Property (5)
606. Constitutional Law I (3)
607. Appellate Practice and Moot Court (1)
608. Evidence (4)
609. The Legal Profession (2)
610. Family Law (3) II
611. Law and Medicine (3) II
612. Workers' Compensation (2) II
613. Constitutional Law II (4) II
614. Corporations (3) II
615. Appellate Practice and Moot Court (1)
616. Evidence (4)
617. Corporate Finance (2) II P, 616.
618. Antitrust Law (3) II
619. Estates and Trusts (4) I
620. Immigration Law (3) I
621. Administrative Law (3) II
622. Law Review (1 to 3) II
623. Conflict of Laws (3) II
624. Labor Law (3) I
625. Jurisprudence (3) I
626. Comparative Law (3) I
627. Law and Humanities (3) II
628. Indian Law (2) I
630a-633b. Commercial Transactions (3-3) 633a is not prerequisite to 633b.
634. Products Liability (2) II
635a-635b. Insurance (2-3) 635a is not prerequisite to 635b.
636. Federal Tax Procedure (2) II P, 646.
637. Real Estate Transactions (3) II
638. Community Property (2) I
639. Mining and Public Land Law (3) I
640. Water Law (3) I
641. Federal Jurisdiction (3) II
642. Arizona Civil Procedure (3) II
643a-644b. Remedies (1-3)
645a-645b. Trial Practice (2-3) P, 608, 609.
646. Federal Income Taxation (5) I
647. Corporate Taxation (3) II P, 646.
648. Estate and Gift Taxation and Basic Estate Planning (3) I
649. Torts II (3) II
DEPARTMENTS AND COURSES OF INSTRUCTION

650. Criminal Law(3) II
651. Accounting and the Law(2) II
652. Income Taxation of Estates and Trusts(2) II P, 646.
653. Advanced Appellate Practice and Moot Court (2) II
654. The First Amendment (3) II
658. Securities Regulation(3) II
659. Growth Controls(3) II (Identical with Geog. 659, which is home)
661. Moot Court Board(2) I II
662. Debtor-Creditor Law (3) II
665a-665b. Interviewing, Counseling and Negotiating (1-1) 665a is not prerequisite to 665b.
666. Lawyering Skills Outside the Courtroom (2) I II P or CR 696c or substantial clerking experience.
667. Law and Economics(3) II
669. Preservation of Historic Environments(3) II 1987-88 (Identical with Ping. 669, which is home)
671. Business, Government and Society (3) I II (Identical with M.A.P. 671)
696. Seminar
   e. Business Planning (3) II P, 616, 647.
   f. Advanced Civil Procedure (3) I
   g. Current Business Regulation (3) II P, 616.
   i. Labor and Employment Problems (3) II P, 624.
   o. Mental Health Law (2) II 1987-88
   t. Law and Technology (3) I II

LIBRARY SCIENCE
(Graduate Library School)

Professors Ellen Altman, Donald C. Dickinson, Robert K. Johnson (Emeritus), Margaret F. Maxwell,
Lawrence Clark Powell (Emeritus), Elinor C. Saltus (Emerita), Arnulfo D. Trejo,
(Emeritus)
Associate Professors Charlie D. Hurt III, Director, Helen M. Gothberg, Helen Renthal (Emerita),
Ronald A. Van De Voorde
Assistant Professors John M. Budd, Charles A. Seavey

The Graduate Library School offers programs for students who wish to follow a career in libraries and information centers. Courses emphasize planning and evaluation related to acquiring, organizing, and accessing information.

The advanced degree is the Master of Library Science. For admission and degree requirements, please see the Graduate Catalog.

417. Media in Instruction (3) GC I II S (Identical with T.T.E. 417)
441. Children's Literature in Spanish (3) GC I (Identical with Span. 441)
443. Mexican-American Literature (3) GC II (Identical with Span. 443)
480. Literature for Children in Libraries (3) GC I II Literature to promote literary appreciation and to meet the interests and needs of elementary school children.
503. Library Collection Development (2) I II Principles of collection development; evaluation and review of materials; selection tools; acquisition of materials; problems in selection, including censorship.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>504</td>
<td>Foundations of Library and Information Services (2)</td>
<td>I Elements of librarianship, historical backgrounds, types of libraries, the role of the library in American life, current issues.</td>
</tr>
<tr>
<td>505</td>
<td>Basic Reference (3)</td>
<td>I Survey of general reference sources; discussion of reference technique.</td>
</tr>
<tr>
<td>506</td>
<td>Research Methods (2)</td>
<td>I Need and opportunities for research in librarianship; types of research; research methodology; study of research design; elementary statistics.</td>
</tr>
<tr>
<td>507</td>
<td>Library Management (3)</td>
<td>I Introduction to management concepts, the organizational structure of libraries, systems analysis, financial administration and the utilization of library personnel.</td>
</tr>
<tr>
<td>509</td>
<td>Information Sources for Agricultural Scientists (1)</td>
<td>I (Identical with Pl.S. 509)</td>
</tr>
<tr>
<td>510</td>
<td>Introduction to Information Science (3)</td>
<td>Methods, theories, and technology of information science; elements of computer programming and systems design; implementation and management of computer systems in libraries and information centers.</td>
</tr>
<tr>
<td>511</td>
<td>Information Storage and Retrieval (3)</td>
<td>II Student involvement in on-line, interactive systems. P, 510.</td>
</tr>
<tr>
<td>512</td>
<td>Automation in Libraries (3)</td>
<td>II Introduction to automated procedures currently in use in libraries, including systems analysis of actual technical services and planning for their automation. P, 510.</td>
</tr>
<tr>
<td>513</td>
<td>Library Systems Analysis (3)</td>
<td>I Introduction to quantitative methods for the design, analysis and control of library systems. P, 510.</td>
</tr>
<tr>
<td>515</td>
<td>Library Cooperation and Networks (3)</td>
<td>II Study of the background and state of the art of library cooperative systems, networks, and bibliographic utilities.</td>
</tr>
<tr>
<td>516</td>
<td>Coordination of Instructional Media Programs (3)</td>
<td>II (Identical with T.T.E. 516)</td>
</tr>
<tr>
<td>517</td>
<td>Preparation of Instructional Materials (3)</td>
<td>II (Identical with T.T.E. 517)</td>
</tr>
<tr>
<td>520</td>
<td>Technical Service Problems (3)</td>
<td>I Examination of problems in acquisitions, cataloging, serials, and other areas related to activities in academic, public, school, and special libraries; consideration of developing technology. P, 502.</td>
</tr>
<tr>
<td>522</td>
<td>Automated Alternatives to the Library Catalog (1)</td>
<td>II Alternatives to the card catalog with consideration given to type of library function, size, and budget; comparisons of card, printed book, on-line, and micro-image catalogs. Field trips. P, 502, 505.</td>
</tr>
<tr>
<td>523</td>
<td>Indexing and Abstracting (3)</td>
<td>II Theory and current practices for compiling manual and computer-produced indexes; vocabulary control and thesaurus construction; production and evaluation of indexes and abstracts.</td>
</tr>
<tr>
<td>526</td>
<td>Introduction to Bibliography (3)</td>
<td>Introduction and critical examination of various styles of bibliographic description; practical application in construction of a systematic bibliography. P, 505.</td>
</tr>
<tr>
<td>530</td>
<td>Public Librarianship (3)</td>
<td>I Administration of tax-supported libraries serving the general public, including problems of governmental relationships, community responsibilities, financial support, buildings, personnel, collections. P, 507.</td>
</tr>
<tr>
<td>540</td>
<td>Academic Librarianship (3)</td>
<td>I Present trends in academic libraries, including financial administration, collection evaluation, personnel requirements and building needs. P, 507 or equivalent experience.</td>
</tr>
<tr>
<td>550</td>
<td>Special Librarianship (3)</td>
<td>I Mission, organization and administration of the special library. P, 507 or equivalent experience.</td>
</tr>
<tr>
<td>560</td>
<td>History of Books and Printing (3)</td>
<td>I Survey of the history of books and printing from early times to the present, including development of the alphabet, manuscript books, the invention and dissemination of printing and modern printing techniques.</td>
</tr>
<tr>
<td>561</td>
<td>History of Children's Literature (3)</td>
<td>I Survey of literature for children in England and America from earliest times to the close of the 19th century, together with study of cultural and social values reflected in the literature. (Identical with Engl. 561)</td>
</tr>
<tr>
<td>562</td>
<td>Library Public Relations and Communication (3)</td>
<td>I Essentials for library public information activities, brochures, news releases and public service announcements for radio and television, communication problems at public service desks.</td>
</tr>
<tr>
<td>570</td>
<td>Literature of Science and Technology (3)</td>
<td>I Creation, organization, and dissemination of scientific and technical literature; reference function and problems of bibliographic control. A science background is not required. P, 505.</td>
</tr>
<tr>
<td>571</td>
<td>Information Sources in the Social Sciences and Humanities (3)</td>
<td>I II Advanced bibliographic and reference sources in the humanities and social sciences, with emphasis on the structure of knowledge in the various disciplines and evaluation of user services. P, 505.</td>
</tr>
</tbody>
</table>
573. **Government Publications** (3) II Examination of the varieties of government publications available from municipal, county, state, national and international agencies, with emphasis on selection and use of publications of the U.S. government.

576. **Administration of Reference** (2) I Theory of information service, policy development, special services, and administration of reference services. Open to majors only. P, 505.

581. **School Library Administration and Organization** (3) II Services, finances, personnel, evaluation, quarters, organization and technical services in the school library. P, 502.

582. **Audiovisual Materials in Libraries** (2) I Introduction to AV information resources for the library.

585. **Literature for Adolescents** (3) I II Literature to meet recreational and developmental needs of the junior and senior high school age, including some books for adults. Reviewing and book talks.

586. **Oral Presentation of Children’s Literature** (2) II Principles and techniques of storytelling and of reading aloud to children; stories for different age groups, presentation of picture stories; practice in reading and telling stories and in planning the story hour. P, 480.

600. **Introduction to Graduate Study in Music** (3) II (Identical with Mus. 600)

607. **Planning Library Services** (3) I The total planning cycle as a management approach to various library/information center services. Open to majors only. P, 506.

693. **Internship**
   a. Academic Library (2 to 4) [Rpt./1] I II S. P, 502, 503, 505, CR 507 or CR 540.
   b. Special Library (2 to 4) [Rpt./1] I II S. P, 502, 503, 505, CR 507 or CR 540.
   c. Public Library (2 to 4) I II S. P, 502, 503, 505, CR 507 or CR 540.
   d. School Library (2 to 4) [Rpt./1] I II P, 480 (elementary only) or 585 (secondary only), 502, 503, 505, CR 581.
   e. Community College Library (2 to 4) [Rpt./1] I II S. P, 502, 503, CR 507.

695. **Colloquium**
   e. Theory of Classification (1 to 3) I II
   g. Laboratory in Library Communications (1 to 3) I II
   f. Issues in Library and Information Science (1 to 3) [Rpt./4 units].

**LINGUISTICS**

Professors Jane Hill (Anthropology), Acting Head, Richard Demers, Robert Michael Harnish (Philosophy), Nils Hasselmo, Adrienne Lehrer, Susan Steele

Associate Professors Chisato Kitagawa (Oriental Studies), Richard T. Oehrle

Assistant Professors Diana Archangeli, Ann Farmer, Ofelia Zepeda (American Indian Studies)

The Department of Linguistics offers instruction in introductory, intermediate, and advanced courses in phonology, syntax, and semantics. It also offers course work in Native American languages of the Southwest (e.g., Navajo and O’odham) and courses on the native languages of North America. Undergraduate majors in linguistics can expect to be prepared to undertake professional graduate studies in linguistics and related areas or to pursue careers in such language related fields as education, publishing, and certain sectors of business.

The Department of Linguistics offers programs leading to a Bachelor of Arts, a Master of Arts, and a Doctor of Philosophy with a major in linguistics. For graduate admission and degree requirements, please see the Graduate Catalog.

*The major for the Bachelor of Arts*: 30 units, including 101, 200, 300 and one year of work in a non-Indo-European language. Remainder taken in one of the following three tracks: (1) general linguistics, (2) theoretical linguistics, (3) sociolinguistics and applied linguistics.

**General linguistics**: Required: (a) Semantics /Pragmatics: (422 or 465). (b) Historical: (480, 420, or history of a language). (c) Phonetics: (Sp.H. 260 or 367, or phonetics of a language). (d) Structure: (210 or structure of a language).


Majors are urged to continue their foreign language study beyond minimum 16 units required by the college.
Course work for the **supporting minor** is selected in consultation with the undergraduate advisor. A **minor in linguistics** requires a minimum of 20 units including 101, 200, and 300.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Introduction to Linguistics</td>
<td>3</td>
<td>Survey of linguistic concepts and methods: communication among animals; physiology of human speech; elementary phonetics, syntax, and language change; language and the brain; language and thought.</td>
</tr>
<tr>
<td>102</td>
<td>Linguistics for Native American Communities</td>
<td>3</td>
<td>Introduction to descriptive linguistics for Native Americans; practical linguistic and social issues in Native American languages; phonetics and phonology; orthography; dialects and language change; classroom applications. (Identical with A.In.S. 102)</td>
</tr>
<tr>
<td>200</td>
<td>Fundamentals of Linguistic Analysis</td>
<td>3</td>
<td>The basic nature of linguistic investigation with the aim of discovering some of the regularities of language structure. P, 101.</td>
</tr>
<tr>
<td>203a-203b</td>
<td>Elementary Navajo Language</td>
<td>3-3</td>
<td>(Identical with A.In.S. 203a-203b)</td>
</tr>
<tr>
<td>210</td>
<td>Native Languages of North America</td>
<td>3</td>
<td>Genetic and typological diversity of North American native languages; areal features, i.e., characteristics spread over a geographical region; and the history of the study of these languages, concentrating on individuals and the problems of classification. (Identical with A.In.S. 210)</td>
</tr>
<tr>
<td>222</td>
<td>The Structures and Sources of American English Words</td>
<td>3</td>
<td>Linguistic principles governing the internal structure of English words and the ways in which new words are created, with a focus on spelling, sounds and morphemes.</td>
</tr>
<tr>
<td>260</td>
<td>Speech Science</td>
<td>4</td>
<td>(Identical with Sp.H. 260)</td>
</tr>
<tr>
<td>276</td>
<td>The Nature of Language</td>
<td>3</td>
<td>(Identical with Anth. 276)</td>
</tr>
<tr>
<td>307a-307b</td>
<td>Elementary O'odham (Papago) Language</td>
<td>3-3</td>
<td>GRD Speaking, reading, writing, and oral comprehension in the O'odham (Papago) language. 3R, 1L. (Identical with A.In.S. 307a-307b)</td>
</tr>
<tr>
<td>320</td>
<td>Language and Social Issues</td>
<td>3</td>
<td>Focuses on the theme that individuals identify with groups (in part) on the basis of the language or dialect they use. Examines the role of the individual as a language-using being with the problems of self-identity and of social difference, not only in our multilingual-multicultural country, but in the world as well.</td>
</tr>
<tr>
<td>376</td>
<td>Introduction to the Philosophy of Language</td>
<td>3</td>
<td>(Identical with Phil. 376)</td>
</tr>
<tr>
<td>400</td>
<td>Foundations of Syntactic Theory</td>
<td>3</td>
<td>An introduction to fundamental issues in the theory of syntax, including phrase structure, the opacity conditions, government, control, binding, thematic relations, and theory of logical form. Intended to familiarize the student with the essentials of the Extended Standard Theory and related developments. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see &quot;Writing-Emphasis Courses&quot; in the Academic Guidelines section of this catalog).</td>
</tr>
<tr>
<td>411a-411b</td>
<td>Modern Japanese Grammar</td>
<td>3-3</td>
<td>(Identical with Or.S. 411a-411b)</td>
</tr>
<tr>
<td>414</td>
<td>Foundations of Phonological Theory</td>
<td>3</td>
<td>Investigation of the principles that underlie current phonological theory, concentrating on the representation of sounds and the regular patterns of sound in natural language. Topics include the standard theory of generative phonology, distinctive feature theory, syllable theory, the core skeleton, rule formulation (linear and non-linear) and rule interactions.</td>
</tr>
<tr>
<td>420a-420b</td>
<td>Linguistic Structure of Modern Chinese</td>
<td>3-3</td>
<td>(Identical with Or.S. 420a-420b)</td>
</tr>
<tr>
<td>422</td>
<td>Linguistic Semantics and Lexicology</td>
<td>3</td>
<td>Study of word and sentence meanings, relationship between the lexicon and the grammar, idioms, metaphor, etymology, and change of meaning. P, one course in linguistics. (Identical with Phil. 422)</td>
</tr>
<tr>
<td>423a-423b</td>
<td>Theory of Spanish Syntax</td>
<td>3-3</td>
<td>(Identical with Span. 423a-423b)</td>
</tr>
<tr>
<td>426</td>
<td>Introduction to Arabic Linguistics</td>
<td>3</td>
<td>(Identical with Or.S. 426)</td>
</tr>
<tr>
<td>427</td>
<td>Applied Spanish Linguistics</td>
<td>3</td>
<td>(Identical with Span. 427)</td>
</tr>
<tr>
<td>429</td>
<td>Pedagogical Linguistics: Applied Linguistics for Language Teachers</td>
<td>3</td>
<td>(Identical with Or.S. 429)</td>
</tr>
<tr>
<td>430</td>
<td>Language Variation</td>
<td>3</td>
<td>Study of geographical and social dialects, stylistic differences, and idiolectal variation and the implications of variation for writing grammars and for understanding language change. P, one course in linguistics.</td>
</tr>
</tbody>
</table>
445a-445b. Structure of a Non-Western Language (3-3) [Rpt./2] GC In-depth linguistic analysis of selected phonological, syntactic, and semantic problems in a non-Western language, concentrating on native languages of the Southwest area. P, 400, 414. (Identical with A.In.S. 445a-445b)

451. Acquisition of Speech and Language (3) GC II (Identical with Sp.H. 451)


564. Formal Semantics (3) GC 1987-88 (Identical with Phil. 464)

465. Pragmatics (3) GC 1987-88 Study of language use, its relationship to language structure and context; topics such as speech acts, presupposition, implication, performatives, conversations. (Identical with Phil. 465)

473. Natural Language Processing (3) GC II Introduction to the processes underlying speech production and comprehension: speech sounds, words, parsing, semantics and pragmatics (Identical with Phil. 473 and Psy.c. 473)

476. Language in Culture (3) GC II (Identical with Anth. 476)

477. Discourse and Text (3) GC II 1987-88 (Identical with Anth. 477)

500. Foundations of Syntactic Theory II (3) II Continuation of Ling. 400, with emphasis on recent literature.

514. Foundations of Phonological Theory II (3) II Investigation of the evidence and arguments for non-linear representations (autosegmental and metrical) and of the organization of the phonological component of grammar, including evidence for its interaction with morphological structures and rules.

515. Phonological Phonetics (3) GC II Analysis of the acoustic and articulatory properties of sounds and patterns of sounds that occur in human language. Emphasis on the significance of the properties of sounds for phonological theory, in particular, distinctive feature theory. Role of psycho-acoustic studies as a source of evidence for phonological theory.

540. Language Change and Reconstruction (3) II Introduction to the methods in, theory of, and problems in reconstruction of phonology, syntax, and semantics. Data will be drawn from a variety of the world’s language families, but will concentrate on American Indian languages and languages with little or no written record.

544. Syntactic Analysis (3) I An examination of the syntactic diversity presented by natural human languages and an exploration of the issues that such diversity presents for syntactic analysis. Topics include AUX, word order, constituency, and subjects.

583. Sociolinguistics (3) I (Identical with Anth. 583)

600. Current Issues in Linguistic Research (3) [Rpt./1] Current research in linguistics, with emphasis on relationships among syntax, semantics, and phonology.

696. Seminar
   a. Syntax and Semantics (3) [Rpt./2] I II
   b. Topics in Phonological Theory (3) [Rpt./2] I II
   c. Diachronic Linguistics (3) [Rpt./2] I II
   d. Current Issues in Syntactic Theory (3) II [Rpt./2]
   f. Linguistic Investigations and Applications (3) I II (Identical with Sp.C. 696f, which is home)

697. Workshop
   a. Linguistic Theory (1) I Open to majors only.

MANAGEMENT
(See Management and Policy)
The Department of Management and Policy offers course work focusing on the task of integrating human and material resources in the development, implementation and evaluation of organizational strategies in the public and private sectors. The curriculum is designed to prepare students for a wide variety of managerial and staff positions, as well as for post-graduate work in such fields as business, public administration and law. The department participates in the following undergraduate degrees:

- Bachelor of Science in Public Administration with majors in health services administration, public management, human services administration, criminal justice administration and public recreation administration.*
- Bachelor of Science in Business Administration with majors in operations management* and personnel management.

For degree requirements, please see the College of Business and Public Administration section of this catalog.

The Master of Science with a major in management and policy is also available, and the department participates in the Master of Business Administration, Master of Public Administration, and the Doctor of Philosophy with a major in business administration programs. For admission and degree requirements please see the Graduate Catalog.

The course listing to follow divides courses into groups serving majors in business administration and public administration degree programs. However, students in either program may take courses in any group for which they have the necessary prerequisites.

*At the time of catalog revision, this program was under review. Consult the department for further information.

General Management and Policy


320.* Business Law (3) I II Introduction to law and the legal process; contracts, agency and employment law; unfair trade practices and consumer protection.

400. Quantitative Methods for Administrators (3) I II S (Identical with M.I.S. 400)

420.* Advanced Business Law (3) GC I II GRD Negotiable instruments, partnerships, corporations, and property rights. P, CR 320 or admission to B.P.A. graduate programs. (Identical with Acct. 420)

426.* Wills, Estates, and Trusts (3) GC I Wills, inheritances, estates, and trusts; the administration of estates, including the duties and liabilities of executors and trustees; basic estate and gift tax laws applicable to estate planning.


496.* Proseminar
a. Honors (3) [Rpt./2] I II

500. Management Case Analysis and Presentation (3) I II Written analysis of cases and other reports; development of skills in analysis, decision making, and written and oral presentation, with emphasis on the total situation of each case considered. Open only to students admitted to B.P.A. graduate programs.
535. **International Management (3) I** S Analysis of management opportunities and challenges; evaluation and formulation of strategies of firms expanding internationally.

537. **Finance for New Ventures (3) I** (Identical with Fin. 537)

538. **Marketing, Negotiation and Decision Tactics (3) II** Development of bargaining and decision-making skills through simulated negotiations and role playing. Open only to students in the entrepreneurship program. P, Econ. 500a-500b, Fin. 511, Mktg. 500. (Identical with Mktg. 538)

539. **Planning of New Ventures (3) II** New venture development, financial projections, resource assessment, and long-range planning. Open only to students in the entrepreneurship program. P, Econ. 500a-500b, Fin. 511, Mktg. 500. (Identical with Fin. 539)

554. **Research Methodology (3) I** Behavioral research techniques; bias, validity, reliability, and applicable statistical techniques; critiques of research articles and reports. P, 552.

567. **Design and Control of Production Systems (3) I** (Identical with M.I.S. 567)

568. **Environmental Scanning (3) I** (Identical with Econ. 568)

571. **Business Strategy and Policy Making (3) II** Case method approach to problems and policies facing top management in making and effecting a strategic plan. P, 500, 502, Fin. 511, Mktg. 500. To be taken in the final semester of the M.B.A. program. Open only to students admitted to B.P.A. graduate programs. An M.B.A. integrative course.

696. **Seminar n. Research Design: Statistical Methods (2 to 4) I II**

**Criminal Justice Administration**

331.* **The Crime Problem (3) I** Theory and research on the nature, causes and control of crime from an interdisciplinary perspective.

332.* **Legal Aspects of the Criminal Justice Process (3) I II** Analysis of selected principles of criminal law, criminal procedure and correctional law.

337.* **Criminal Justice Administration (3) II** Theory and practice of criminal justice organizations; police, courts and correctional institutions.

431.* **The Criminal Justice System (3) II** Background, philosophy, and modes of operation in the United States criminal justice system. Emphasis on crime in institutional contexts such as business and labor organizations.

436.* **Crime and Public Policy (3) GC I II** Role of government in the prevention and control of crime.

457. **Law of the Elderly (2) GC II** Examines the law as it affects the elderly in such areas as legislation, finances, housing, death, guardianship, access to services and ethics. Focuses upon the recognition and analysis of legal problems and identification of legal resources. (Identical with Gero. 457)

595. **Colloquium f. Criminal Justice (3) [Rpt./12 units] I II**

693. **Internship b. Criminal Justice (1 to 6) I II**

696. **Seminar g. Criminal Justice Administration (1 to 3) I II**

**Health Services Administration**

354.* **Acute Health Care Policy and Administration (3) I** Delivery modes for acute care, analysis of public policies relating to such care and discussion of general issues in its administration, including inpatient care (hospitals), outpatient care (solo physicians, group practices, HMOs), and emergency care.

454.* **Chronic Health Care Policy and Administration (3) II** Delivery modes for chronic or long-term care, analysis of public policies relating to such care and discussion of general issues in its administration, including institutional care (nursing homes, mental health institutions), home care (community based home health services), hospice care, and other alternatives.

455.* **Preventive Health Care Policy and Administration (3) I** Preventive health care activities, analysis of public policies relating to such care, and discussion of general issues in its administration including health promotion, health education, environmental health, and the nature and functions of public health departments and planning agencies.
Current Issues in Health Services (3) II Current public policy issues in health services administration.

Colloquium
- Health Care (3) [Rpt./12 units] II

Analysis of Health Systems (3) I Introduces the student to the scope and nature of public and private health systems in the U.S.; examines roles of government and private enterprise in the development and operation of health institutions. P, 601

Health and Public Policy (3) II Examines public policy issues in health, including recent developments in health policy and planning at the national, state and local levels, and their impact on administrative behavior. P, 650. (Identical with Ping. 651)

Comparative Management in Health Administration (3) I Assists students in applying general management principles to particular types of health agencies. Models of organizational behavior are used to develop a paradigm for comparative analysis. P, 650.

Efficiency Analysis in Health Administration (3) II Professional-level treatment of economic and related principles as they apply to the health-care industry, and of the impacts of health policy and program alternatives; case study method used. P, Econ. 500a. (Identical with Ping. 655)

Internship
- Health Services Administration (1 to 6) I

Seminar
- Health Services Administration (1 to 3) II

Human Services Administration

Social Welfare Policy (3) II Policy issues and options analyzed in the area of social welfare. Emphasis on specialized needs of vulnerable groups such as children and the socially disadvantaged.

Program Planning and Administration for Human Services (3) I The planning and administrative process in human services programs; needs assessment, program design, implementation, evaluation; principles of managerial control.

Introduction to Administration of Services for the Aging (3) I Administration of services, planning, and public policy related to the multiple issues of growing old in modern society. Field trips.

Community Agencies and Human Services (3) II Examines the structure, function and environment of community organizations and organizational networks in the development and provision of human and social services. (Identical with Ping. 463)

Public Policy and the Elderly (3) I Consideration of public policy as it relates to the needs of elderly persons in modern industrial societies. Emphasis on vulnerable groups such as poor and minority elderly.

Colloquium
- Aging and Society (3) [Rpt./12 units] II

Management of Long Term Care Facilities and Programs (3) II Problems and principles of management of facilities and community based programs providing health and social services to the chronically impaired. P, 650.

Aging and Public Policy (3) I Policy framework for administration of programs, plans, priorities, and legislation related to the needs of the aging in modern society. (Identical with Ping. 662)

Internship
- Long Term Care Administration (1 to 6) I

Human Resource Management/Organizational Behavior

Management and Organizational Behavior (3) II GRD Integration of classical and organizational behavior approaches to management in private and public organizations in various cultures. Special sections of this course are offered for participants in the University Honors Program. P, 275 Econ. 201b.

Personnel Management (3) II GRD Policies and current practices in utilizing human resources effectively at all organizational levels.

Administrative Leadership (3) GC I Elements of leadership, as applied to selected administrative situations.

Personnel Policies (3) GC II An integrative, case-oriented course focusing on problems and policies in the procurement, development, compensation, and motivation of personnel. P, 330 and 6 units in personnel management major.
DEPARTMENTS AND COURSES OF INSTRUCTION

432.* Bargaining and Negotiation in Organizations (3) GC Examination of the state of the art of bargaining and negotiation and the development of bargaining skills in a wide variety of business and interpersonal settings. P, 305.

433.* Topics in Performance Appraisal (3) GC Examination of theoretical and practical bases of various performance appraisal systems and techniques. P, 330.

444.* Group-Process Methods in Management (3) GC II Application of behavioral science knowledge to group functioning in public agencies with emphasis on observation, analysis, feedback and intervention in small groups; the SYMLOG theory and method of group analysis, along with other perspectives from social psychology and sociology. P, 472. (Identical with Soc. 444)

480.* Women In Management (3) I II An integrative course for women who are aspiring to be managers and for men who expect to be dealing with female managers. P, 305. (Identical with W.S. 480)

502. Organization Theory and Behavioral Relations (3) I II The interactions, effects, and interrelationships of managers, employees, and organizational structures and systems. Open only to students admitted to a B.P.A. graduate program.

503. Human Resource Management (3) I Principles, methods, research relevant to management of an organization’s human resources, with emphasis on employment psychology, training, development, compensation. P, 305 or 502.

504. Organization Development and Change (3) I II Concepts and skills relevant to persons concerned with problem diagnosis and organizational development and change. P, 305 or 502.


580a-580b. Theory of Management and Organization (3-3) 580a: Analysis of behavior in organizational systems; review of classical, behavioral, and contingency theories of management with a focus on internal systems phenomena. 580b: Organizations in their environments; analysis of organizations in the context of their environmental interfaces. P, 305 or 502. 580a is not prerequisite to 580b.

600. Behavioral Science Theory and Method in Management (3) [Rpt/1] I Conceptual and theoretical frameworks for the analysis of management problems from a behavioral science perspective. Relevant material drawn from social psychology, sociology, anthropology, and political science.

696. Seminar
   I. Organizational Behavior (3) [Rpt/6 units] I II P, 600.
   m. Organizational Theory (3) [Rpt/6 units] I II P, 600.

Policy and Planning

300.* Introduction to Planning (3) I II Development of public sector planning in the U.S. during the 20th century, with emphasis on contemporary issues and solutions. (Identical with Ping. 300)

485.* Zoning Fundamentals (3) GC I Survey of the zoning process; nature, structure, and function of zoning, problems of zoning administration; new concepts of zoning content and administration. (Identical with Ping. 485)

506. Fundamentals of Physical Planning (3) I Basic considerations in site analysis and planning, and transportation and utility systems; subdivision planning and plat review. (Identical with Ping. 506)

507. Social Service Planning (3) I Survey of the variety of planning efforts designed specifically to increase social welfare through the delivery of services using historical, comparative, and evaluative perspectives. (Identical with Ping. 507)

575. Housing and Residential Areas (3) II Physical, social, and economic aspects of housing development and residential areas and their relationship to other land uses and functions. (Identical with Ping. 575)

602. Analytic Methods in Planning and Management (3) II Methods and models for program planning and policy analysis; forecasting, service demand, facility location in capital investment programming, task sequencing, program analysis and evaluation. P, 457 or 552. (Identical with Ping. 602)

609. Policy Problems in Structure and Change (3) II Problems presented by structure and change in modern urban society from the standpoint of social systems analysis; evaluation of strategy and effectiveness of public policy and planning. (Identical with Geog. 609, Ping. 609)

612a-612b. Projects in Policy and Planning (2-3) Lab. and field projects simulating various aspects of professional practice. Open to majors only. P, 12 units toward M.S. (Identical with Ping. 612a-612b)
693. Internship
   g. Policy and Planning (1 to 4) S Open to majors only. (Identical with Ping. 693g)

696. Seminar
   h. Land-Use Regulation (3) I II P, (Identical with Ping. 696h)
   i. Legal Inquiry in Policy and Planning (3) I II (Identical with Ping. 696i)
   j. Environmental Planning (3) I II (Identical with Ping. 696j)
   k. Planning Administration (3) I II (Identical with Ping. 696k)

Public Management

100. Issues in Public Policy (3) I II Major issues, problems and options facing public sector policymakers and administrators.

401.* Environment and Strategic Management in Organizations (3) I II Administration of organizations dealing with complex operating environments; emphasis on interaction of public and private sector organizations.

405.* System and Program Evaluation (3) I Methodology of evaluating the performance of programs and strategies in the context of policy assessment.


411.* Public Administration and the Mexican-American (3) GC I Hispanic-American cultural and historical impact on public administration in the southwestern U.S. from 1775 to the present; patterns of contemporary Spanish-speaking participation in state and local governmental administration of services. (Identical with M.A.S. 411)

472.* Administration in Public Organizations (3) I II Application of major theories of human behavior in organizations to decision making in public sector organizations from the perspective of upper echelon executive; case study emphasis. P, 305, 410a, Pol. 474. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing- Emphasis Courses" in the Academic Guidelines section of this catalog).

514. Cost-Benefit Analysis (3) II (Identical with A.Ec. 514)

595. Colloquium
   a. Public Management (3) [Rpt/12 units] I II

601. Public Management (3) I Fundamentals of management structure and process in public sector: emphasis on professional practice. Open only to students admitted to a B.P.A. graduate program.

605. Research and Evaluation in Public Administration (3) I Research and evaluative methodologies which support public sector policies and administration, including the philosophical basis of these methods and a research design exercise. P, 552, 601.

610a-610b. Fiscal and Budgetary Administration of Public Agencies (3-3) 610a: Internal fiscal operation and the budgetary cycle of public and nonprofit agencies. P, 601, Acct. 572. 610b: Cost/benefit analysis for public agencies. 610a is not prerequisite to 610b. (Identical with Pol. 610a-610b)

621. Administrative Patterns in the Federal System (3) I Legal, political, and social framework of interjurisdictional and interagency relations; trends, emerging issues, and devices for securing coordination and responsibility.

671. Business, Government and Society (3) I II Relationships between the institutions of business and government; economic, social and political aspects. P, 305 or 502. (Identical with Law 671)

693. Internship
   c. Public Management (1 to 6) I II

696. Seminar
   a. Development Administration (1 to 3) I II
   b. Program Planning and Development (1 to 3) I II
   c. Performance Measurement and Accountability (1 to 3) I II

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

MANAGEMENT INFORMATION SYSTEMS

Professors Jay F. Nunamaker, Jr., Head, Seymour Goodman, Benn Konsynski III, James F. LaSalle, Averill M. Law, Roy E. Marsten
DEPARTMENTS AND COURSES OF INSTRUCTION

Associate Professor Nicholas Aquilano
Assistant Professors Joey George, Barat Kaku, Sudha Ram, Matthew Saltzman, Susan Sanchez, Olivia Sheng, Asso Vakaharia, Doug Vogel, Y. Richard Wang, E. Sue Weber
Lecturers Wayne M. Eirich, William Kelly

Education in management information systems enables students to establish careers involving the analysis, design, implementation, use and management of computerized information systems in an organizational environment. Course work is available at the graduate and undergraduate levels.

The department offers the Bachelor of Science in Business Administration with a major in management information systems. Interested students should follow the program of studies in the College of Business and Public Administration section of the catalog. Nonbusiness students who desire a minor in management information systems should contact the head of the department for a list of courses.

A Master of Science with a major in management information systems is also available. Management information systems is also a part of the Master of Business Administration. A Doctor of Philosophy degree with a major in business administration is available.

111. **Introduction to Computing** (3) I II Description of computer hardware and software; computer terminology; program design; with emphasis on problem definition and flowcharting; introduction to a general purpose programming language and application software systems.

121. **Business Programming** (3) I II GRD Cobol programming language; file organization maintenance, and updating procedures; integrated package concepts with emphasis on relational database management systems. P, 111. (Identical with C.Sc. 121)


301.* **Program and Data Structures** (3) I II Application system development techniques, fundamental data structures; design and implementation of selected software procedures for business applications using Pascal. P, 121, Math. 123. (Identical with C.Sc. 301)

307.* **Computer Organization and Data Communications** (3) I II Computer organization, operating systems principles, systems software, data communications, networks, protocols and distributed processing. P, 301.

327.* **Comparative Programming Languages** (3) I II (Identical with C.Sc. 327)

331.* **Data Management Systems** (3) I II Introduction to database management systems; relational, CODASYL, and hierarchic models; security concurrency, integrity and recovery issues; query interfaces. P, 307. (Identical with C.Sc. 331)

341.* **Information Systems Analysis and Design** (3) I II The analysis and logical design of business data processing, management information and management control systems; project management and cost-benefit analysis; techniques for stating and analyzing information systems requirements; use of automated and non-automated techniques for logical system design. P, 301, CR 307.

342.* **Data Structures** (3) I II (Identical with C.Sc. 342)

375.* **Basic Operations Management** (3) I II GRD Quantitative techniques applied to design, operation, control and updating of operating systems. P, 275, Math. 123.

375.* **Statistical Inference in Management** (3) I II GRD Further topics in statistical analysis and inference applied to managerial decision making. P, 275.

396H. **Honors Proseminar** (3) II

400. **Quantitative Methods for Administrators** (3) I II S Quantitative techniques and their applications. Equations and their graphs, systems of linear equations, matrix algebra, linear programming; fundamental probability, expected value; functions and limits, applications of differential calculus. Open only to M.B.A. and M.P.A. degree candidates. (Identical with M.A.P. 400)

411.* **Information Systems in Society** (3) I II Societal implications of computerized information systems; positive and negative effects of computer utilization; selected applications of computer systems in society and future prospects.

421.* **Simulation Modeling and Analysis** (3) Modeling and analysis of probabilistic real-world systems by means of simulation; building simulation models in a FORTRAN-based package and in the simulation language SIMAN; introduction to model validation and output data analysis. P, 275, 301. (Identical with C.Sc. 421)
422.* Mathematical Programming and Applications (3) Formulation and solution of mathematical programming models with applications to decision problems involving profit maximization or cost minimization. Topics include linear programming, network flow programming, and integer programming. P, 301, Math. 119. (Identical with C.Sc. 422)

441.* Information System Design and Implementation (3) I Design of computer-based solutions to individual and organizational problems; involves an analysis of subsystems user interfaces, hardware/software selection and evaluation, and system implementation; explores interface between systems and individuals and systems and organizations. P, 341.

450. Soviet Technology and Science (3) GC I Introduction to the role of technology and science in the Soviet social, political, and economic environment. Selected assessments of Soviet technical and scientific achievements and problems. (Identical with Russ. 450)


461.* Accounting Information Systems (3) GC I (Identical with Acct. 461)

471.* Policy Formation and Management Information Systems (3) I II Integration of the M.I.S. activity with the functional operations of the business organization; utilization of case studies and a computer simulation model to enhance executive decision making relative to planning, organizing, controlling, and actuating. Open only to BPA majors. P, Fin. 311, M.A.P. 305, Mktg. 361, Senior Standing. Writing Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing Emphasis Courses" in the Academic Guidelines section of this catalog).

473a-473b.* Production and Operations Management (3-3) GC Productive systems, including service type industries; activities entailed in selecting, designing, operating, controlling, and updating systems. 473a: General coverage, including planning, scheduling and control systems. 473b: Case analyses in a manufacturing environment. P, 373.

474.* Work Simplification (3) GC I II Work simplification and motion economy; methods of increasing productivity of employees; flow process charts and flow diagrams; appraisal of fatigue. P, 305.

475.* Productivity Improvement (3) GC II Productivity measurement; monitoring with statistical quality control techniques; improvement through use of small group processes. P, 373.

476.* Management of Service Operations (3) GC I Application of operations management concepts to service organizations and interaction with other functional areas; case analyses of banks, airlines, health care, motels, food service, others. Field trip. P, 373.

477.* Materials and Logistics Management (3) GC I Organization, management, and control of material flow processes; logistical strategies and relationships of procurement, handling, warehousing, transportation, and inventory control. P, 373, 473a.

478.* Project Management (3) GC Definition of programs and projects, organizational forms, developing the work breakdown structure, scheduling techniques (PERT and CPM), control mechanisms such as milestones, cost reports and progress reports. Lectures and case analyses. P, 305, 373.

479.* Sociotechnical Systems (3) GC I Theory and practice of installing high-commitment work systems to increase productivity and improve the quality of working life.

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

501. Management Information Systems (3) I II Introduction to computers and information systems. Use of personal computer productivity tools: word processors, spreadsheets, and database management systems. Current topics such as expert systems and office automation. Open only to students admitted to BPA graduate programs.

507a-507b. Information Systems Architecture and Data Communications (3-3) I II Overview of computer system organization, logic, microarchitecture, macroarchitecture, operating systems, and assembly languages; and hardware and system software concepts will be discussed as they relate to the systems analysis and design process and the development of application software. Provides a broad introduction to data communications with emphasis on the impact of communication technology on information systems. P, CR 531a or consult department before enrolling.

511. Behavioral and Economic Aspects of Information Systems (3) I Principles of organizational theory and strategy as they relate to M.I.S. The role of information in organizations, the information center concept and information system strategic planning; data validation and data completeness; comparison of centralized and decentralized systems; computer pricing policies and cost allocation; economies of scale; legal considerations and computer frauds; security considerations; problems of changing computer systems. Open only to students admitted to BPA graduate programs. P, 441 or 501. (Identical with Acct. 511)
521a-521b. **Advanced Systems Modeling and Simulation** (3-3) The nature of simulation, simulation software, including animation model validation, selecting input probability distributions, random variate generation, statistical analysis of output data. Simulation of manufacturing systems, manufacturing issues addressable by simulation, SIMAN simulation language, and statistical issues in manufacturing simulation. Open only to students admitted to BPA graduate programs. P, 501, M.A.P. 552, Math. 119. (Identical with C.Sc. 521a-521b)

531a-531b. **File Organization and Data Base Management** (3-3) Abstract data types, file organization and memory management; and an introduction to data base management systems. DBMS goals and objectives; organizational implications of data bases; design and implementation of network (CODASYL), hierarchic and relational data bases. Open only to students admitted to BPA graduate programs.

541a-541b. **Computer-Aided Information Systems Analysis and Design** (3-3) Analysis and logical design of M.I.S.; techniques for stating and analyzing information systems requirements; hardware/ software selection and evaluation; system implementation and performance evaluation; strategic information systems and decision support systems. Open only to students admitted to BPA graduate programs. (Identical with C.Sc. 541a-541b)

551a-551b. **Business Systems Programming Methods** (3-3) Business systems programming environment; basic and advanced COBOL; file organization and access methods; external sort and multi-key files. Computer graphic display hardware and software components; graphic data structures; effective data display and general purpose graphics systems. Open only to students admitted to BPA graduate programs. P, 501.

552. **Statistical Decision Making** (3) I II Probability and statistical analysis; random variables, sampling distributions, hypothesis testing, Bayesian analysis, time series, statistical investigation. Open only to students admitted to a BPA graduate program. P, M.I.S. 500, or Math. 119 and 123.

567. **Design and Control of Production Systems** (3) I An introduction to the design of production systems and how decisions about them are influenced by the acquisition and use of accounting data. Aggregate planning and scheduling, inventory control, and forecasting. P, M.A.P. 552. Open only to students admitted to BPA graduate programs. (Identical with M.A.P. 567, Acct. 567)

570. **Management and Evaluation of Information Systems** (3) I II The methodologies of economics and management information systems applied to the problem of designing accounting and management information systems in the hierarchical structure of a profit-maximizing firm. An MBA integrative course. Open only to students admitted to BPA graduate programs. P, 501, Econ. 500a, Acct. 550 (Identical with Econ. 570 and Acct. 570)

572. **Operations Management** (3) I Intended for students without a background in production management. Survey of techniques useful in operating manufacturing and service production.

575. **Stochastic Models in Management Science** (3) I II Markov chains, models or arrival processes, continuous-time Markov chains, queuing theory, models of computer and manufacturing systems. P, Math. 123.

577. **Nonlinear Mathematical Programming** (3) I II S Introduction to the formulation, solution, and implementation of nonlinear and mathematical programming models; representative applications will be studied and solved on the computer. P, 422.

578. **Systems Design for Management** (3) I Decision support system concepts, applications and methodologies for developing and evaluating decision support systems; organizational and technical factors of office automation.


582a-582b. **Multivariate Analysis in Management** (3-3) 582a: Multiple, polynomial, stepwise regression including indicator variables, inference, remedial measures. 582b: Analysis of variance and covariance, principal components, discriminant analysis, canonical correlation. P, 275 or 552. 582a is not prerequisite to 582b.

585. **Material Requirements Planning and Control** (3) II Material management with emphasis on forecasting and inventory theory within a dependent demand environment.

696. **Seminar**
   b. Computers in Auditing (3) P, 541a or Acct. 461.
   d. Advances in Optimization Theory (3) P, 422 or S.I.E. 240 or Math 289.
   e. Recent Advances in Management Science (3) P, 422.
   g. Advanced Topics in Data Management (3) P, 531b.
   h. Master's Report Projects (3) S Open to majors only.
MARKETING

Professors Joseph W. Newman, Head, Dipankar Chakravarti, Gary M. Munsinger, Lyman E. Ostlund, Robert A. Westbrook, John H. Wieland (Emeritus)
Associate Professors Richard A. Scott, Melanie R. Wallendorf
Assistant Professors Bernard J. Jaworski, Deborah J. MacInnis, Jayashree Mahajan, S. Ram

Marketing involves understanding the changing wants of individuals and organizations, the development and distribution of goods and services to meet those wants, and the maintenance of satisfactory customer relationships. Graduates may qualify for positions in product, brand and service management, marketing research and planning, advertising and promotion, sales and sales management, retailing and international marketing.

An undergraduate major in marketing is offered within the Bachelor of Science in Business Administration described in the College of Business and Public Administration section of this catalog. The Master of Science degree with a major in marketing is offered, and the department participates in the Master of Business Administration and Doctor of Philosophy degrees with a major in business administration.

Honors: The department participates in the Honors Program.

361.* Introduction to Marketing (3) I II Role of marketing in the economy and in business and nonprofit organizations; environmental factors affecting marketing; nature of marketing management decisions. P, Econ. 201a.

364.* Creative Advertising (3) I II Use of visual and audio techniques to plan, create and produce effective advertising campaigns. Not acceptable for credit toward marketing major. (Identical with Jour. 364 and M.Ar. 364)

366.* Public Relations (3) I II The nature, role and management of public relations. Case problems and projects give practical experience in developing public relations programs. Not acceptable for credit toward mktg. major. (Identical with Jour. 366 and M.Ar. 366)

370.* Marketing for Nonprofit Organizations (3) I II Application of marketing concepts and tools for public agencies, health services, public transportation, the arts, schools, museums, churches, etc.; role of marketing planning, research, product and service development, pricing, promotion, public relations. Not acceptable for credit toward the marketing major. P, 361.

372.* Small Business Marketing and Management (3) I II Planning, organizing, and establishing a small business; evaluation of existing businesses and franchise operations; market feasibility studies; preparation of a business development plan. Not acceptable for credit toward the marketing major. P, 361.

440.* Marketing Research (3) I II Concepts and techniques of research for marketing decisions; problem definition, determination of information needs, sources, methods of gathering and analyzing data; presentation of findings for management. P, 361, M.A.P. 375.

450.* Buyer Behavior (3) I II Customer behavior and the application of concepts and research findings from the behavioral sciences in the solution of marketing problems. P, 361.


452.* Advertising and Promotion Management (3) I II Role of advertising and special promotions in the economy and business and nonprofit organizations, concepts and strategy for programs, budgets, media selection, evaluation of effectiveness. P, 361.

454.* Management of Sales Operations (3) GC I II The sales function and its relationship to the total marketing program; sales strategies and objectives; development and administration of sales organizations; control and evaluation of sales operations. P, 361.

455.* Management of Distribution Systems (3) GC I Nature and operation of channels in the distribution of goods and services; economic and behavioral problems in wholesaling and retailing; marketing logistics. P, 361.
DEPARTMENTS AND COURSES OF INSTRUCTION

International Marketing Management (3) II Marketing operations for foreign environments; cultural, political and economic factors affecting the international marketer. P, 361.

Retailing Management (3) GC I II Management of the retail store, its environment, personnel, buying, merchandising, pricing, advertising, promotion, selling, expense control and customer service. P, 361; Acct. 200.

Product Management (3) I II Product (services) strategy for achieving financial growth; evaluating opportunities; generating ideas; launching new offerings; managing the product (services) portfolio. P, 361.

Marketing and Public Policy (3) GC I Trends in public opinion, legislation and practices of governmental regulatory bodies; implications for marketing decision making; role of marketing research in public policy development. P, 361.

Marketing Policies and Operations (3) I II An integrative, capstone course focusing on comprehensive marketing problems; development, control, and auditing of marketing organizations and operations. P, 440, 450; 3 additional units of marketing at the 400 level; Fin. 311, M.A.P. 305. Writing-Emphasis Course. P, satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

Marketing Management (3) I Scope, environment and nature of marketing management; customer and market analysis for product, service, price, promotion and distribution decisions. Open only to students admitted to B.P.A. graduate programs.

Management of Marketing Communications (3) I Application of communications theory and research findings in advertising, sales promotion, publicity, personal selling; planning, conduct and administration of programs of information and persuasion. P, 500.

Innovation and Economic Growth (3) I Role of entrepreneurship and innovation in economic growth. Development of the new venture idea and assessment of market potential. Open only to students in the entrepreneurship program. P, Econ. 500a-500b, Fin. 511, Mktg. 500. (Identical with Econ. 536)

Marketing, Negotiation and Decision Tactics (3) II (Identical with M.A.P. 538)

Consumer and Organizational Buyer Behavior (3) I Nature of the purchase decision process for goods and services. Theories, concepts and research methods and findings are examined for use in management and public policy decision making. P, 500.

Product Strategy (3) I II Formulating and implementing strategy for growth; analyzing and influencing market structure; developing, pricing, testing new entries; managing the portfolio. P, 500.

International Marketing (3) I Marketing planning and strategies for foreign environments; cultural, political, economic factors affecting the international marketer, multinational corporation and multinational market groups. P, 500.

Environmental Scanning (3) I (Identical with Econ. 568)

Research and Marketing Management (3) I Specification of management information needs, evaluation of research proposals and findings, methods of gathering and analyzing data, administrative aspects of research and decisions. P, 500, M.A.P. 552.

Colloquium
a. Research in Marketing (1) [Rpt./7] I II

Seminar
a. Marketing Research Methodology (3) I II P, 500, M.A.P. 552.

MATERIALS SCIENCE AND ENGINEERING

Professors Donald R. Uhlmann, Head, William G. Davenport, Louis J. Demer, J. Brent Hiskey (Research), Kenneth L. Keating, Thomas M. Morris (Emeritus), Daniel J. Murphy (Emeritus), David R. Poirier, Subhash H. Risbud, Sigmund L. Smith (Emeritus), Richard A. Swalin, Michael C. Weinberg

Associate Professors David C. Lynch, Srini Raghavan

Assistant Professor Dunbar P. Birnie, Pierre A. Deymier, Mark D. Pritzker (Research), Brian J.J. Zelinski
Materials science is the science of the structure, properties and behavior of metals, semiconductors, ceramics, polymers, and composite materials. The materials scientist strives to expand the knowledge of the properties of existing materials and to develop new materials. Materials engineering emphasizes the fundamental knowledge necessary to produce, select, process and apply materials for societal needs. The materials engineer strives to produce, transform and apply materials to practical use.

The curriculum of the department prepares the student for employment in materials research, development, production and applications. Graduates are also prepared for graduate work in the many facets of materials science and engineering.

Three curriculum options are available to the student in this department: (1) The primary materials processing option prepares the student for work opportunities in the processing of raw substances to produce useful materials. (2) The materials technology option prepares the student for evaluating the structure and properties of materials and tailoring materials to specific applications. (3) The electronic materials option prepares the student for opportunities in the fast-moving fields of semiconductors, optical materials, and ceramics. In each of these options there is provision for including courses in other options to suit a student’s interests and goals.

The department offers the following degrees: Bachelor of Science in Materials Science and Engineering, Master of Science with a major in materials science and engineering, and Doctor of Philosophy with a major in materials science and engineering.

122. Introduction to Materials Science (2) I Introduction to the scientific and engineering concepts of materials. Emphasis on the methods used in attacking engineering problems using unit equations and conversion factors. Open to freshman and sophomore students only.

224. Introduction to Material and Energy Balances (3) I Analysis of materials processing using material and energy balance computations. Stoichiometry, nonreacting and reacting systems, 1st law of thermodynamics, degree of freedom analysis. Applications to the processing of conventional and new materials. P, Chem. 103b, S.I.E. 170R-170L or CR.

240. Thermodynamics of Materials (3) II Introduction to the laws of thermodynamics, entropy, free energy, and the concept of equilibrium as applied to materials for conventional and advanced technological applications. P, 224, Math. 125b or consult department before enrolling.

331R. Fundamentals of Materials for Engineers (3) III Scientific principles which underlie and relate the behavior and properties of materials to their engineering applications. P, Phys. 103a; Chem. 103a or CR.

331L. Engineering Materials Laboratory (1) II Fundamental laboratory techniques for the evaluation of properties and behavior of materials for engineering applications. 1R, 2L. P, 331 L or CR.
DEPARTMENTS AND COURSES OF INSTRUCTION

430aR-430bR. Materials Science (3-3) GC Principles underlying the interrelationships among the structure, properties and behavior of materials and their engineering applications. P, 240 or CR; Phys. 103b; 104b; C.E. 217 or CR.

430L. Materials Laboratory (1) GC II Laboratory experiments on the physical and electrical properties of metals and semiconductors. P, 430bR or CR.

432. Materials Characterization Methods (3) GC II Fundamentals of x-ray diffraction and fluorescence analysis techniques, and electron optical methods employing scanning electron and transmission electron microscopy. 2R, 3L. P, 331R or 430bR or CR.


435. Corrosion (3) GC II The science of corrosion reactions and their application to engineering problems. P, 331R; 412 or Chem. 480b or CR. (Identical with Ch.E. 435)


442a-442b. Process Design (2-1) GC Practice in the application of engineering principles to the design of materials processes. 442a: 1R, 2L. 442b: 1R. P, 420, 331R or 430aR.

450R. Materials Processing (3) GC I Applications of transport phenomena and materials science to solidification and semiconductor processing. Application of solids behavior to deformation processing. P, 410, 331R or 430a; C.E. 217.

450L. Materials Processing Laboratory (1) GC I Laboratory experiments in solidification and mechanical forming processes. P, CR 450R.

452. Nondestructive Evaluation of Materials (3) GC II Introduction to the nondestructive testing and evaluation of the various classes of engineering materials. Methods considered include leak detection, penetrant, electromagnetic, radiographic, ultrasonic, electrical, electronic, eddy current, acoustic emission, and thermal. 2R, 3L. P, 331R or 430bR, or CR.

457. Integrated Circuit Technology Laboratory (3) GC II (Identical with E.C.E. 457)


489. Scanning Electron Microscopy (3) GC I Theoretical and practical aspects of electron-beam microanalysis. Lab emphasizes projects and independent research using scanning electron microscopy and energy dispersive X-ray analysis. 2R, 3L. Field trips. Consult department before enrolling.


532. Solid-Fluid Reactions (3) I (Identical with Ch.E. 532)

533. Imperfections in Solids (3) I Nature and behavior of imperfections in metals, ceramic, and semiconductor crystals and polycrystalline aggregates, and their effects on various properties. P, 430aR.

534. Electronic, Magnetic and Optical Materials (3) II Advanced topics in defects, processing and properties of electronic, magnetic and optical materials. P, 434. (Identical with E.C.E. 534)

535. Advanced Microstructural Characterization (3) I Theory and applications of modern techniques for characterizing chemical and microstructural features of solids; transmission and scanning electron microscopy, microprobe, and Auger analysis. 2R, 3L. P, 430aR, 432. Consult department before enrolling.

550. Statistical Thermodynamics in Materials Science (3) I Introduction to classical and quantum statistical thermodynamics as applied to materials science. Electronic properties of metals and semiconductors; phase transformations. P, 510 or other classical thermodynamics course.
551. Atomistic Computational Techniques in Materials Science (3) II Monte Carlo and molecular dynamics techniques; application to calculation of materials properties (structural, thermodynamic, transport properties). P, 550 or other statistical mechanics or statistical thermodynamics course.


595. Colloquium
   a. Materials Colloquium (1) [Rpt./5] II

MATHEMATICS


Associate Professors William E. Conway, Carl L. DeVito, David Gay, Oma Hama, Christopher Jones, Theodore W. Laetsch, Daniel Madden, John N. Palmer, Tudor Ratiu, Frederick W. Stevenson, Richard B. Thompson, William Y. Velez, Bruce Wood, A. Larry Wright, Lai-Sang Young

Assistant Professors Moysey Brio, Nicholas M. Ercolani, Paul Fan, Luc Haine, William G. McCallum, Robert Valentini, Maciej P. Wolftkowski, Yong-Quan Yin

Lecturers Robert C. Dillon, John L. Leoniard, Stephen G. Tellman

The department offers courses in pure mathematics, applied mathematics, probability and statistics, computer mathematics, mathematics education, and engineering mathematics. Planned minors in numerous professional fields are available; interested persons may receive additional information on request.

Mathematics is available as a major for the following degrees: Bachelor of Arts and Bachelor of Science (College of Arts and Sciences), Bachelor of Science in Engineering Mathematics (College of Engineering and Mines), Bachelor of Arts in Education and Bachelor of Science in Education (College of Education), Master of Arts, Master of Science, Master of Education and Doctor of Philosophy.

The major for the B.A. and B.S. has four options, each consisting of 40 units which includes the following core courses: 124 or 125a, 125b, 145 (first year); 215, 223, 255, 275 (second year); 423 (third year). The options are described below.

The comprehensive mathematics option: 40 units including the core above; 415; 416 or 413; 425; and six additional units of 400-level math. courses (except 404, 405, 410, 422a, 461). For a B.S. degree the supporting minor must be chosen from Group VI or systems engineering or computer science. For a B.A. degree the minor may be chosen from any discipline (other than mathematics) available at the University.

The applied mathematics option: 40 units including the core above; 424; a one-year sequence chosen from 454 and 455, 454 and 456, 464 and 466, or 475a-475b; and at least 6 additional units of 400-level math. courses (except 404, 405, 410, 422a, 461), at least one of which must be 420, 421, 443, 454, 455, 456, 464, 466, 468, 473, 475a, 475b, 478, 479 or 484. Also required are 6 units of physics with calculus and a minor, to be approved by a departmental adviser, in a subject which significantly uses mathematics.

The computer science option: 40 units including the core above; C.Sc. 115 and 227 (first year); C.Sc. 237 (second year); 475a-475b; 415 and either 443 or 447 or 479; C.Sc. 327, 342, 430, and one additional 3-unit computer science elective; and at least one additional 3-unit, 400-level math. course (except 404, 405; 410, 422a, 461). A computer science minor is included in this program.
The probability and statistics option: 43 units including the core above; 464, 466 and 468; and at least 6 additional units chosen from 400-level math. courses (except 404, 405, 410, 422a, 461), Stat. 465, S.I.E. 405, 422, and 440. The minor, to be approved by a departmental adviser, must be in a subject which significantly uses mathematics.

Students planning to do graduate work in mathematics should select the comprehensive mathematics option or include 415 and 425 in their program.

A minor in mathematics with the College of Arts and Sciences: a minimum of 20 units including 124 or 125a, 125b, 215, 223, and at least 6 upper-division units.

The teaching major (for prospective secondary school teachers): 32 units. The lower-division core courses include 124 or 125a, 125b, 215, and 275. The upper division core courses include 305, 330, 362, 396, 397, and 423. Six additional units of 400 level courses are to be selected in consultation with the student’s advisor.

Prospective secondary mathematics teachers must have at least a 2.5 GPA in any four lower-division courses from the following list: 124 or 125a, 125b, 215, 223, 254 or 255, and 275. Students who have not met this standard may not enroll in 305, 330, 396 or 397 without special permission.

The teaching minor: A minimum of 24 units, including 124 or 125a, 125b, 215, 275, 305, and at least two electives from the following: 362 or 404, 410, 430, 446, 461.

The elementary education major area of specialization: 105a-105b; and a minimum of 14 units selected from 119 or 145, 122, either 123 or 124 or 125a, 125b, 160, and 305.

The engineering mathematics major: Requirements are given in the College of Engineering section.

Prerequisites: Because of the nature of mathematics, the department recommends that students refrain from enrolling in any course that carries prerequisites unless those prerequisites have been completed with a grade of “C” or better. Students without university credit in the prerequisites for 101, 105a, 105b 117e, 117f, 118, 119, and 123 may be required to have an appropriate score on the math readiness test to be enrolled in these courses. The department strongly recommends that students not enroll in any prerequisite for courses in which they have already received credit.

Honors: The department participates in the Honors Program.

Students admitted for Spring 1986 or later must have proof of having taken the math readiness test in order to register for mathematics courses numbered below 125b. Test scores are valid for one year.


105a-105b. Understanding Elementary Mathematics (3-3) Development of a basis for understanding the common processes in elementary mathematics. 105a: Concepts of number. 105b: Concepts of geometry and probability. 2R, 3L. Open to elem. majors only. P, fulfillment of university entrance requirements in math without deficiency and an acceptable score on the math readiness test.

116.† Intermediate Algebra (3) I II Not applicable to the math major or minor. Linear and quadratic equations in one and two variables, systems of two equations, polynomials, algebraic fractions, exponential, radicals, and inequalities.

117e.‡ College Algebra (3) I II Review and expansion of 116, functions, mathematical models, systems of inequalities, exponential and logarithmic functions, polynomial functions. Not applicable to math major or minor. P, 116 or an acceptable score on the math readiness test.

117f.‡ Precalculus (4) I II Covers trigonometry plus all of 117e. Intended for students planning to take 124 or 125a. Not applicable to math major or minor. Students with credit in 118 will obtain only 3 units of graduation credit for 117f. P, 116 or an acceptable score on the math readiness test.

‡ Credit will not be given for this course if the student has already passed a higher level math course.

118.† Plane Trigonometry (2) I II Not applicable to the math. major or minor. Students with credit in 117d or 117f will obtain only one unit of graduation credit for 118. P, one entrance unit in geometry, and either 1 1/2 entrance units in algebra, or 118.

119.† Finite Mathematics (3) I II Elements of set theory and counting techniques, probability theory, linear systems of equations, matrix algebra; linear programming with simplex method, Markov chains. P, 117e.

123.† Elements of Calculus (3) I II Introductory topics in differential and integral calculus. P, 117e.

†Students without university credit in the prerequisites for these courses may be required to have an appropriate score on the math readiness test to be enrolled in these courses.
124.* Calculus with Applications (5) Differentiation and integration of elementary functions. Applications to graphing, maximization, areas and volumes, physical problems. Course assumes a background in college algebra and trigonometry and will provide for some review of these topics. P, 117f or 117e and 118, or acceptable score on math readiness test. Credit allowed for 124 or 125a, but not both.

125a.* Calculus (3) An accelerated version of 124. Differentiation and integration of elementary functions. Applications to graphing, maximization, areas and volumes, physical problems. Course assumes a background in college algebra and trigonometry. P, an acceptable score on math readiness test. Credit allowed for 124 or 125a, but not both.

125b. Calculus (3) Continuation of 124 or 125a. Special functions, techniques of integration, infinite sequences and series, power series. P, 124 or 125a.

145.* Discrete Mathematics (3) II Topics to be selected from elementary combinatorics, probability theory, graph theory, and finite geometry. Not recommended for jrs. or sr's. P, CR 124 or 125a.

160.*† Introduction to Statistics (3) I II Basic probability, uses of numerical data, useful probability distributions, estimations and hypotheses testing. Not applicable to the math major. P, 117e.

200. Problem-Solving Laboratory (1) I II Development of creative, mathematical, problem-solving skills, with challenging problems taken from calculus, elementary number theory and geometry. P, 125b.

202. Symbolic Logic (3) I (Identical with Phil. 202)


223. Vector Calculus (4) I II Vectors, differential and integral calculus of several variables. P. 125b. Credit may be received for this course or 225, but not for both.


255.* Analysis of Ordinary Differential Equations (3) I II Basic solution techniques for linear systems, qualitative behavior of nonlinear systems, numerical methods, computer studies; applications drawn from physical, biological and social sciences. P, 215, and 275 or knowledge of FORTRAN.

263.+† Statistical Methods in Biological Sciences (3) I An introduction to descriptive and inferential statistical techniques, with special emphasis on analysis of biological and clinical data. P, 117e.

275. Introduction to Numerical Methods (3) I II Roots of equations, curve fitting, linear systems, numerical integration and differentiation. P or CR 215 and knowledge of a scientific computer programming language at the level of 122 or C.Sc. 115


322. Mathematical Analysis for Engineers (3) I II Linear algebra, vector analysis, line and surface integrals, Fourier series, partial differential equations. Credit allowed for this course or 422a, but not for both. P, 223; 254 or 255.

330. Geometry (3) I Topics to be selected from 2- and 3-dimensional combinatorial geometry, postulational Euclidean geometry, Euclidean transformational geometry, symmetry, and 2-dimensional crystallography. P, 215.

362. Introduction to Probability Theory (3) I II Sample spaces, random variables and their properties, with considerable emphasis on applications. P, 123 or 125b.

396. Proseminar a. Problems in Mathematics Education (1) I II Open only to teaching majors in math. P, 305.

397. Workshop a. Mathematics Education (1) I I Open only to teaching majors in math. P, 305.

402. Mathematical Logic (3) GC I II Sentential calculus, predicate calculus; consistency, independence, completeness, and the decision problem. Designed to be of interest to majors in math. or phil. P, 124 or 125a or Phil. 325. (Identical with C.Sc. 402)

403. Foundations of Mathematics (3) GC I II Topics in set theory such as functions, relations, direct products, transfinite induction and recursion, cardinal and ordinal arithmetic; related topics such as axiomatic systems, the development of the real number system, recursive functions. P, 215. (Identical with Phil. 403)
404. History of Mathematics (3) GC I The development of mathematics from ancient times through the 17th century, with emphasis on problem solving. The study of selected topics from each field is extended to the 20th century. Not applicable to M.A., M.S., or Ph. D. degrees for math majors. P, 125b.

405. Mathematics in the Secondary School (3) GC II Not applicable to B.A., B.S., M.A., M.S., or Ph.D. degrees for math majors. (Identical with T.T.E. 405)

410.* Matrix Analysis (3) GC I General introductory course in the theory of matrices. Advanced-degree credit not available to math majors. P, 123 or 125b.


416. Applications of Algebra (3) GC II Various applications of abstract algebra, e.g. to coding theory, combinatorial designs, crystallography, etc. P, 415.

420. Calculus of Variations (3) GC I 1987-88 Euler equations and basic necessary conditions for extrema, sufficiency conditions, introduction to optimal control, direct methods. P, 223, and 254 or 255.

421. Fourier Series and Orthogonal Functions (3) GC I Linear spaces, orthogonal functions, Fourier series, Legendre polynomials and Bessel functions. P, 223 and 254 or 255.

422a-422b.** Advanced Analysis for Engineers (3-3) GC Laplace transforms, Fourier series, partial differential equations, vector analysis, integral theorems, matrices, complex variables. Not applicable to M.A., M.S., or Ph.D degrees for math majors. Credit allowed for 422a or 322, but not for both. P, 223 and 254 or 255. 422a is not prerequisite to 422b. Both 422a and 422b are offered each semester.

423. Intermediate Analysis (3) GC I Elementary manipulations with sets and functions, properties of real numbers, topology of the real line, continuity, differentiation, sequences and series of real valued functions of a real variable, with emphasis on proving theorems. Not applicable to graduate programs in math. P, 223. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

424.** Elements of Complex Variables (3) GC I Complex numbers and functions, conformal mapping, calculus of residues. P, 223. 

*Credit will be allowed for only one of 424 or 422b. 422a-422b will not be considered a two-semester course at the 400 level in the Master of Arts degree program.

425. Advanced Calculus I (3) GC I Continuity and Riemann integration in one or two dimensions, improper integrals, uniform convergence, differentiation in n-space, inverse function theorem. P, 423.

426. Advanced Calculus II (3) GC II Curves, surfaces, change of variables in multiple integrals; extremal properties; theorems of Green, Gauss, and Stokes; exact differentials. P, 425.

430. Second Course in Geometry (3) GC II 1988-89 Topics to be selected from projective geometry, algebraic geometry, metric geometry or combinatorial topology. P, 215.

434. Introduction to Topology (3) GC II Properties of metric and topological spaces and their maps; topics selected from geometric and algebraic topology, including the fundamental group. P, 423.

436. Metric Differential Geometry (3) GC II Differential geometry of surfaces; nonintrinsic geometry: fundamental forms, Gaussian and mean curvatures; intrinsic geometry: Theorema Egregium, geodesics, Gauss-Bonnet theorem. P, 223, and 254 or 255.

443. Theory of Graphs and Networks (3) GC II Undirected and directed graphs, connectivity, circuits, trees, partitions, planarity, coloring problems, matrix methods, applications in diverse disciplines. P, 215 or 223 or 243. (Identical with C.Sc. 443)


447. Combinatorial Mathematics (3) GC II 1988-89 Enumeration and construction of arrangements or designs, theorems on existence and nonexistence of designs, applications to design of experiments and error correcting codes. P, 215 or 243.


455.* Elementary Partial Differential Equations (3) GC II Theory of characteristics for first order partial differential equations; second order elliptic, parabolic, and hyperbolic equations. P, 223, and 254 or 255.

*Credit allowed for only one from each of the following groups: 117e or 117f; 117f or 118; 119, 145 or 243; 123, 124 or 125a; 160 or 263; 254 or 255; 455 or 456; 410 or 413.

461. Elements of Statistics (3) GC I II Probability spaces, random variables, standard distributions, point and interval estimation, parametric and nonparametric hypothesis testing. Math majors will not receive grad. credit. P, 123 or 125b. (Identical with Stat. 461)


473. Theory of Computation (3) GC I II (Identical with C.Sc. 473)

475a-475b. Mathematical Principles of Numerical Analysis (3-3) GC 475a: Analysis of errors in numerical computations, solution of linear algebraic systems of equations, matrix inversion, eigenvalues, roots of nonlinear equations, interpolation and approximation. P, 215; 223; 254 or 255; and a knowledge of a scientific computer programming language. 475b: Numerical integration, solution of systems of ordinary differential equations, initial value and boundary value problems. (Identical with C.Sc. 475a-475b)

478. Computational Methods of Algebra (3) GC II Applications of machine computation to various aspects of algebra, such as matrix algorithms, character tables and conjugacy classes for finite groups, coset enumeration, integral matrices, crystallographic groups. P, 410 or 413 and a knowledge of a scientific computer programming language. (Identical with C.Sc. 478)

479. Game Theory and Mathematical Programming (3) GC II 1987-88 Linear inequalities, games of strategy, minimax theorem, optimal strategies, duality theorems, simplex method. P, 410 or 413 or 415. (Identical with C.Sc. 479)

484. Operational Mathematics (3) GC I Basic concepts of systems analysis, Fourier and Laplace transforms, difference equations, stability criteria. P, 421 and 424, or 422b.

515a-515b. Modern Algebra (3-3) Structure of groups, rings, modules, algebras; Galois theory. P, 415.

516a-516b. Algebraic Number Theory (3-3) 1987-88 Dedekind domains, complete fields, class groups and class numbers, Dirichlet unit theorem, algebraic function fields. P, 515b.

517a-517b. Group Theory (3-3) 1988-89 Selections from such topics as finite groups, noncommutative groups, abelian groups, characters and representations. P, 515b.

518. Topics in Algebra (3) [Rpt.] I II Advanced topics in groups, rings, fields, algebras; content varies.

519. Topics in Number Theory and Combinatorics (3) [Rpt.] I II Advanced topics in algebraic number theory, analytic number theory, class fields, combinatorics; content varies.


529. Topics in Modern Analysis (3) [Rpt.] I II Advanced topics in measure and integration, complex analysis in one and several complex variables, probability, functional analysis, operator theory; content varies.

534a-534b. Topology (3-3) 1988-89 Point set topology, homotopy, homology. Applications, such as manifolds, duality, fixed point theorems, solutions to differential equations. P, 415 and 434.


538. Topics in Geometry and Topology (3) [Rpt.] I II Advanced topics in point set and algebraic topology, algebraic geometry, differential geometry; content varies.

539. Algebraic Coding Theory (3) II 1987-88 Construction and properties of error correcting codes; encoding and decoding procedures and information rate for various codes. P, 415. (Identical with E.C.E. 539)

555a-555b. Partial Differential Equations (3-3) 1987-88 Theory and examples of linear equations; characteristics, well-posed problems, regularity, variational properties, asymptotics. Topics in nonlinear equations, such as shock waves, diffusion waves, and estimates in Sobolev spaces. P, 522a, 522b or 585a.

556a-556b. Dynamical Systems and Chaos (3-3) 1987-88 Qualitative theory of dynamical systems, phase space analysis, bifurcation, period doubling, universal scaling, onset of chaos. Applications drawn from atmospheric physics, biology, ecology, fluid mechanics and optics. P, 422a-422b or 454.


567a-567b. Statistical Inference (3-3) 1987-88 A decision theoretic approach to estimation and hypothesis testing, sequential methods, large sample methods. P, 423, and 464 or 564a. (Identical with Stat. 567a-567b)


579. Topics in Applied Mathematics (3) [Rpt.] I II Advanced topics in asymptotics, numerical analysis, approximation theory, mathematical theory of mechanics, dynamical systems, differential equations and inequalities, mathematical theory of statistics; content varies.


585a-585b. Principles and Methods of Applied Mathematics (3-3) Boundary value problems; Green's functions, distributions, Fourier transforms, the classical partial differential equations (Laplace, heat, wave) of mathematical physics. Linear operators, spectral theory, integral equations, Fredholm theory. P, 424 or 422b or CR 525a.

586. Case Studies in Applied Mathematics (1 to 3) [Rpt./6 units] I II In-depth treatment of several contemporary problems or problem areas from a variety of fields, but all involving mathematical modeling and analysis; content varies.


588. Topics in Mathematical Physics (3) [Rpt.] I II Advanced topics in field theories, mathematical theory of quantum mechanics, mathematical theory of statistical mechanics; content varies.

589. Nonlinear Wave Motion (3) II 1988-89 Nonlinear partial differential equations describing wave phenomena in water, gases, plasmas, lasers; shocks, modulated wave trains, parametric resonance, solitons and exactly solvable equations. P, 422b or 456 or 455.

596. Seminar
a. Topics in Mathematics (3) [Rpt./1] S

636. Information Theory and Coding (3) II 1988-89 (Identical with E.C.E. 636)

MECHANICAL ENGINEERING
(See Aerospace and Mechanical Engineering)
MEDIA ARTS

Professor Caren J. Deming, Head
Associate Professor Harry Atwood (Emeritus)
Assistant Professors H. Bruce Fowler, Denise J. Kervin
Lecturer F. D. Nott

The department provides instructional programs designed to prepare students to assume creative and leadership roles in the electronic, filmic, and other projected media arts. Course work focuses upon history, theory, criticism, production, and management of the media arts. The department's course offerings lead to the Bachelor of Arts in Media Arts degree. The facilities of the Division of Media and Instructional Services, including KUAT-TV-AM/FM, and film production facilities are utilized for many laboratory classes. Advanced students have opportunities to obtain preprofessional experience through the department's internship program. Film courses are taught by Professor J. Michael Gillette and Associate Professor Peter Lehman of the Drama Department, as well as by media arts faculty members.

The Bachelor of Arts is for students planning careers in broadcast journalism or seeking a well-balanced liberal arts education in preparation for graduate study at the M.A. or Ph.D. levels.

Requirements: In addition to the general education requirements for the Bachelor of Arts in Media Arts, as described in the Faculty of Fine Arts (College of Arts and Sciences) section of this catalog, students must complete Comm. 100 and 102 and one of the following English composition courses beyond the freshman requirement: Engl. 207, 209, 210, 307, or 308. Requirements in the major include 32-33 units of media arts courses, including 100, 101, 105, 200, 362, either 210 or 214, and 18 emphasis units selected under advisement.

At least 12 units must be upper-division courses. No more than 6 units of internship and independent study course work (493 and 499) may be counted toward the major; and no more than 6 units of production and practicum course work (210, 213, 214, 215, 241, 250, 302, 311, 314, 315, 316, 413, 414, 415a, 415b, 475, 494, 497) may be counted toward the major. No more than 48 units in media arts may be counted toward the degree. At least 18 units in the major must be completed in residence. It is recommended that students develop typing ability prior to taking 200-level courses in the department.

From time to time the department offers specialized courses to meet student demand or the needs of the general community. Persons interested in specialized course offerings should contact the department head.

The teaching minor: 101, 200, 214, 362, 376, and electives for a minimum total of 24 units.

Honors: The department participates in the Honors Program.

Basic production facilities and equipment are provided by the department. Students are responsible for the cost of film/tape stock, processing, and other necessary supplies.

History/Theory/Criticism

100. Orientation to Study in Media Arts (1) I II Orientation to undergraduate programs, productive study methods, and use of professional literature and other resource materials in media arts.

101. Introduction to Media Arts (3) I II S Survey of radio, television, film. Examination of the media, their history, technology, effects on society and culture, and ethics.

105. Introduction to Writing in Media Arts (1) III introduction to media writing with emphasis on script formats for radio, television, and film.

106. Mass Media and Society (3) II S Survey of the relationships between mass media and society, effects of mass media on individuals, institutions, culture, social structure.

109. Survey of Film History (3) II A survey of the history of motion pictures. Films will be chosen from a variety of nations and time periods to illustrate the diversity of film styles. 2R, 3L, P, Dram. 108.

200. Fundamentals of Theory and Aesthetics in Media Arts (3) I II Survey of the elements which make up video, film, and audio images: light, color, area, depth, movement, and sound in message design and structure.

207. Western Civilization and the Arts: The Twentieth Century (3) I II (Identical with F.A. 207)

307. Western Civilization and the Arts: Paleolithic through Renaissance (3) I II (Identical with F.A. 307)
DEPARTMENTS AND COURSES OF INSTRUCTION

308. Survey of Media Law and Regulation (3) I II Introduction to the legal and regulatory framework of the electronic media and film: licensing, cross-ownership, public interest, self-regulation, consumer influence, and related topics.

317. Western Civilization and the Arts: Baroque Through Nineteenth Century (3) I II (Identical with F.A. 317)


322. Major American Broadcast Genres (3) II Historical survey of major radio and television program types, with emphasis on serial and series forms: drama, melodrama, western, crime drama, comedy, and sports. 2R, 3L. P, 200.

325. History of American Broadcasting (3) I S Examination of the American broadcast industry; technical innovation, the rise of stations and networks, financial base, programming, regulation, and changes in audience.


420. Media Arts Criticism (3) GC II Analysis of major types of journalistic and academic criticism; practice in writing reviews and scholarly essays. P, 200, 321, 322. Writing-Emphasis Course. P, satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


Electronic Journalism

205. Reporting the News (3) I II. (Identical with Jour. 205)


381. Reporting for Radio-Television News (3) I Advanced procedures and techniques utilized in news gathering; production of newscasts, event coverage, newsroom organization. Performance practice is emphasized in laboratory exercises. 2R, 3L. P, 205, 280 or 362. (Identical with Jour. 381)

382. Producing Public Affairs and Documentary Programs (3) II Advanced work in the production of documentary and public affairs programs; idea formulation, budgeting, writing, researching, with emphasis on organization of production team and practical production considerations. 2R, 3L. Open to majors only. P, 314, 380, or 381.

470. The Press and Society (3) GC I II (Identical with Jour. 470)

Production, Practicum, and Internship

210. Beginning Film Techniques (3) [Rpt./1] I II Silent motion picture production techniques. Individual and/or team projects to include completion of 3 to 5 short super-8 silent films. University provides camera, editing, and projection equipment; student provides film and pays all processing and lab charges. P, 200.


214. Beginning Video Production (3) I II Introduction to the elements of video production, including professional practices, production elements, and personnel in television stations and video centers. 2R, 3L. P, 101, 200.

239. **Speaking for Radio and Television (3)** I II (Identical with Dram. 239)

241. **Beginning Photography (3)** [Rpt./2] I II (Identical with Art 241)


302. **Recording Studio Production (3)** I II (Identical with Mus. 302)

311. **Lighting for Media Production (2)** I Function and qualities of light; typical application in photography, television, motion pictures, architecture, and interior design. P, 200.

314. **Intermediate Television Production (3)** I II Production of various types of television programs, including techniques and theory of studio and field operations, use of equipment (studio and EFP) and personnel relationships, with emphasis on the role of the television producer. 2R, 3L. Open to majors and minors only. P, 214, 362, and acceptance of portfolio by Portfolio Committee.

315. **Intermediate Film Production (3)** I II Production of films, with emphasis on sound, editing techniques, and visual design. Students will produce a short film. 2R, 3L. P, 215.


413. **Advanced Audio Production (3)** GC I II Advanced audio recording and production, mixing theories, sound processing for various types of productions. 2R, 3L. P, 101, 200, 213.

414. **Advanced Television Production (3)** I II Production of television programs of various kinds, with emphasis on the role of the director. 2R, 3L. P, 314, and acceptance of portfolio by Portfolio Committee.

415a-415b. **Advanced Film Production (3-3)** Advanced studies and practice in motion picture production. Students will produce a team project 16mm sound release print of an original film concept developed during the class. The University provides camera and editing equipment. Students pay all film and lab costs. Open to majors only. P, 315.

475. **Screen Acting Techniques (3)** GC II (Identical with Dram. 475)

497. **Workshop**
   a. Community Audio-Video Production (1 to 5) [Rpt./8 units] I II P, 414 and acceptance of portfolio by department Portfolio Committee.
   b. Video for Law Enforcement (1) GC

**Media Management Courses**

364. **Creative Advertising (3)** I II Open only to students who meet the requirements for advanced standing as specified in the *College of Business and Public Administration* section of this catalog. (Identical with Mktg. 364)

366. **Public Relations (3)** I II Open only to students who meet the requirements for Advanced Standing as specified in the *College of Business and Public Administration* section of this catalog. (Identical with Mktg. 366)

376. **Audience Measurement (3)** I Interpretation and utilization of broadcast ratings, surveys, polls and other measures of the attitudes, opinions and behaviors of media audiences; relationships to social and management concerns. P, 106.

471. **Film/Video Production Financing (3)** GC I II (Identical with Dram. 471)

472. **Broadcast and Cable Management (3)** I II Investigation of media management techniques. Scheduling, organizational structure, networks and affiliates, ethics, legal constraints, syndication, personnel and related topics. P, 308.

476. **Broadcast and Cable Programming (3)** GC I Investigation of principles, techniques, and current issues in programming for radio and television stations (commercial and public) and cable systems. P, 101, 106, 376.

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**MEDIA ARTS**

**MEDICAL TECHNOLOGY**

*(See Health-Related Professions)*
DEPARTMENTS AND COURSES OF INSTRUCTION

MEDICINE

Interdepartmental

495. Colloquium
   a. Introduction to the Neurosciences I (2) GC P, Consult department before enrolling. (Identical with Anat. 495a and Psio. 495a)
   b. Introduction to the Neurosciences II (2) GC P, 495a or consult department before enrolling. (Identical with Neur. 495b, Psio. 495b and Psyi. 495b)

596. Seminar
   Many interdepartmental seminars are numbered at both the 500 and the 800 levels. See 896 below for a complete listing.

801. Preparation for Clinical Medicine (1 to 12) I II No grade is given until the full 12 units are completed.

802. Human Behavior and Development (6) I II

830. Supplementary Registration (1 to 9)

896. Seminar
   a. Introduction to Forensic Pathology (1 to 3) II
   b. -Physical and Biological Basis of Nuclear Medicine (2)
   c. Introduction to Computers in Medicine (2)
   d. Pathogenesis and Approach to Immunological Diseases (2)
   f. * Clinical Epidemiology (2)
   h. -Human Sexuality (2)
   n. Research Methods for Clinical and Epidemiological Studies (2) II
   s. Fluid and Electrolyte Balance and Renal Immunology (2)
   t. Pathophysiology of Respiratory Diseases (2)

*Available as both 596 and 896.

Anatomy

See Anatomy elsewhere in this catalog.

Anesthesiology

Professors Burnell R. Brown, Jr., Head, I. Glenn Sipes
Associate Professors Randall C. Cork, A. Jay Gandolfi, Stuart R. Hameroff, Charles W. Otto
Assistant Professors Joseph A. Gallo, Jr., William S. Gegg (Clinical), Karen M. Knieriem (Clinical), Lawrence B. Weiss

800. Research (1 to 6) [Rpt./1]

810. Clerkship
   a. Anesthesiology (1 to 18)

815. Subspecialty
   p. Critical Care Medicine (1 to 18) (Identical with I.Med. 815p)

891. Preceptorship
   a. Anesthesiology and Subspecialties (1 to 18)
   c. General Anesthesiology (4-6)

Biochemistry

See Biochemistry elsewhere in this catalog.
Family and Community Medicine

Professors Anthony F. Vuturo, Head, Herbert K. Abrams, John T. Boyer, George D. Comerci, Pedro Luis Escobar (Clinical), Eric P. Gall, Melvin H. Goodwin, Gail G. Harrison, Wadie W. Kamel, Thomas E. Moon, Andrew W. Nichols, Augusto Ortiz (Clinical), James R. Shaw, William A. Stini, Hugh C. Thompson, Ronald R. Watson (Research)

Associate Professors Peter J. Attarian, Frank A. Hale (Research), Daniel O. Levinson, Ronald E. Pust, Cheryl K. Ritenbaugh (Research)

Assistant Professors Peter J. Attarian, Frank A. Hale (Research), Daniel O. Levinson, Ronald E. Pust, Cheryl K. Ritenbaugh (Research)

Assistant Professors George H. Adams (Research), Kay A. Bauman (Clinical), Dorian H. Cordes, Barbara R. Hartmann (Research), Rena J. Gordon (Research), Evan W. Kligman, Craig L. McClure, J. Kristin Olson-Garewal (Clinical), Robert C. Rhode (Clinical), Arthur B. Sanders, Lee Sennott-Miller (Research), Janet H. Senf (Research), Louise H. Warrick (Research), Barry D. Weiss

Lecturers Beverly S. Bechtel, Ruth M. Becker, Lianna M. Edwards, Jil Feldhausen, Lois W. Kamel, Bertha Leis, Dalton McClelland, Karen E. Snow, Bernhardt E. Stein

487. Poverty and Health (3) II (Identical with Nurs. 487)

500. Research (2 to 16) [Rpt./2]. P, basic science courses.

588. Clinical Anthropology (3) I II (Identical with Nurs. 588)

596. Seminar
  g. Occupational Disease (1) II Open to medical or industrial hygiene students only. Consult department before enrolling.
  h. Prevention and Control of Disease (1) I Consult department before enrolling.
  Note: Some seminars are numbered at both the 500 and the 800 levels. See 896 below for a complete listing.

800. Research (2 to 16) [Rpt./2].

803. Clinical Clerkship (6 to 9)

811. Subinternship
  a. Family Medicine (3 to 6) I II S

815. Subspeciality
  b. The Dying Patient (1 to 6) [Rpt./1]
  d. Community Health Problems (6 to 12)
  g. Community-based Care of the Older Patient (3 to 12) [Rpt./12 units] Field trips. Consult department before enrolling.

891. Preceptorship
  a. Primary Care (6 to 12)
  b. Family Medicine (3 to 12) P, 4th year medical student. Consult department before enrolling.
  c. Epidemiology at CDC (3) I II P, open to majors in medicine, public health, and nursing. Consult department before enrolling.
  d. Rural Care (4 to 12)
  f. Clinical Preceptorship in International Health (6 to 12)

896. Seminar
  a. International Health (3) S Open to health majors only.
  b. * Epidemiologic Methods (3) I II
  c. Approaches to Managing Behavior Problems of Children and Adolescents (2)
  d. Wholistic Health (2) II Open to majors only. Consult department before enrolling.
  f. The Doctor-Patient Relationship (2)
  k. * Nutrition in Disease (1-2) [Rpt./1] P, Bioc. 801, Psio. 601/801.
  l. * Alternative Strategies for Coping with Illness: A Cross-Culture View (2) II
  m. * Practice of Community-Oriented Medicine in Rural Areas (2) II
  n. * Community and International Nutrition (1 to 3) II
  g. * Occupational and Environmental Health (3) S Consult department before enrolling.
  r. * Basic Principles of Epidemiology (3) [Rpt./1]
  I. * Tropical Disease Problems (2)
  u. * Current Issues in Health Services (2)

*Available as both 596 and 896.

Internal Medicine

Knudson, Michael Lebowitz, Frank I. Marcus, Frank Meyskens, Eugene Morkin, Charles A. Nugent, David A. Ogden, William Roeske, Sydney E. Salmon, Jay W. Smith, Lawrence Stern


Lecturers Benjamin Burbank, James Corrigan (Pediatrics), David Flieger, Gerald Goldstein, Milan Novak, Gail E. Riggs

596. Seminar
   a. Pathophysiology and Immunology of the Clinical Manifestations of Coccidioidomycosis (2) II

800. Research (3 to 30) [Rpt./30 units]

803. Clinical Clerkship (12)

810. Clerkship
   b. Ambulatory Diagnosis and Therapeutics (6)
   c. Geriatrics and General Medicine Extended Care (4) [Rpt./1] P, I.Med. 803.

811. Subinternship
   a. Internal Medicine (6-12)
   c. Coronary Care Unit (4)
   i. Medical Intensive Care Unit (4)
   m. General Medicine (4)

815. Subspecialty
   a. Clinical Cardiology Elective (4-8)
   b. Clinical Dermatology (3)
   c. Endocrinology (4-12)
   d. Clinical Gastroenterology (4-8)
   e. Hematology-Oncology (6)
   g. Infectious Diseases (4-12)
   h. Pulmonary Diseases (4)
   j. Pulmonary Laboratory and Consultation Service (3-6)
   k. Nephrology, Renal Diseases (3-6)
   l. Clinical Allergy (1-6) (Identical with Ped. 815l)
   m. Medical Subspecialties (3-6) [Rpt.]
   n. Physical Medicine and Rehabilitation (4-6) [Rpt./1] CDT P, 3rd or 4th year medical school.
   p. Critical Care Medicine (3-6) (Identical with Anes. 815p)
   q. Cardiology Consultation (4)
   r. Neurological and Neuromuscular Disorders (3 to 6) P, I.Med. 803. (Identical with Neur. 815r)
   s. Rheumatology (4-6) P, I.Med. 803.
   t. Nephrology (4)

891. Preceptorship
   a. General Medicine and/or Subspecialties (3-12) [Rpt./2]
   b. Ambulatory Internal Medicine: Clinical Problems (6)

896. Seminar
   a. Pathophysiology and Immunology of the Clinical Manifestations of Coccidioidomycosis (2) II

Microbiology and Immunology
   See Microbiology and Immunology elsewhere in this catalog.

Neurology

Professors Alan B. Rubens, Head, Peggy Ferry (Pediatrics), William A. Sibley
Associate Professor Colin R. Bamford
Assistant Professors William Feinberg, Enrique L. Labadie, Kalarickal Oommen, Steven Rapesak
Lecturer Robert H. Hamilton
800. Research (1 to 12) [Rpt. /1] (See College of Medicine Electives Manual)

803. Clinical Clerkship (3 to 6).

810. Clerkship
   a. Neurology (3 to 6).

815. Subspecialty
   n. Spinal Cord Injury (3) (Identical with Surg. 815n which is home)

891. Preceptorship
   a. Neurology (1 to 18) [Rpt./2]

Obstetrics — Gynecology

Professors C. D. Christian, Head, Jack Pearson, Lewis Shenker
Associate Professors Diane S. Fordney, William C. Scott, Louis Weinstein
Assistant Professors Allan Hartsough (Clinical), Susan Hunter (Clinical), Herbert E. Pollock,
Kathryn Reed
Instructors Steven Calvin

800. Research (1 to 18) [Rpt./1]

803. Clinical Clerkship (6 to 9)

810. Clerkship
   a. Preparation for Practice (1 to 18)

815. Subspecialty
   a. Clinical Infertility (4 to 6) I II S

891. Preceptorship
   a. Obstetrics and Gynecology (1 to 18)
   b. Gynecology-Endocrinology (6)

Ophthalmology

Professor Barton L. Hodes, Head, Albert M. Potts (Clinical)
Associate Professor Andrzej W. Fryzckowski (Research)
Assistant Professors Richard W. Allinson, William D. Mathers, Sam E. Sato, Kenneth B. Simons

800. Research (6 to 18) I II

815. Subspecialty
   a. Ophthalmology (3 to 6)

891. Preceptorship

Pathology

Professors Jack M. Layton, Head, Peter H. Bartels, John R. Davis, Paul R. Finley, Richard C.
Froede, Lewis Glasser, Douglas W. Huestis, Raymond B. Nagle, Samuel H. Paplanus,
C. George Ray, Kenneth J. Ryan, Richard E. Sobonya, David C. White (Clinical)
Associate Professors James M. Byers, Ill, Anna R. Graham, Thomas M. Grogan, Mary Jane Hicks,
Douglas H. McKelvie, Claire M. Payne (Research)
Assistant Professors Jerry L. Bangert (Clinical), Thomas E. Henry (Clinical), Allen M. Jones
(Clinical), Maria L. Paquin (Clinical), Ronald Schifman, Catherine M. Spier, Karen K.
Steinbronn
Lecturer Louis Hirsch

489. Introduction to Forensic Science: Pathology, Anthropology, Toxicology and Law (2) GC I II
   Opportunity for the criminal investigator and attorney with a background in forensic pathology to better
   understand the results of trauma, toxic substances and environmental catastrophes. Taught off campus
   only.

801. General and Systemic Pathology (10) I II
DEPARTMENTS AND COURSES OF INSTRUCTION

810. Clerkship
   a. Anatomic Pathology (1 to 18)
   b. Clinical Pathology (1 to 18)
   c. Special Topics (1 to 18) [Rpt.]. P, 801.

891. Preceptorship
   a. Pathology (1 to 18) [Rpt./2]

Pediatrics

Professors Lynn M. Taussig, Head, Hugh D. Allen, Anna Binkiewicz (Clinical), George D. Comerci, James J. Corrigan, Jr., Burris R. Duncan, Peggy Ferry, Vincent A. Fulginiti, Stanley J. Goldberg, Marilyn Heins, Otakar Koldovsky, Richard J. Lemen, Elmer S. Lightner, C. George Ray, Daniel F. Reardon (Clinical), Hugh C. Thompson, Alayne Yates

Associate Professors Sergio A. Bustamante, Michael W. Cohen (Clinical), M. Eleanor Grimm (Clinical), Gail Harrison, John J. Hutter, Stanley M. Lee, Mary E. Rimsza (Clinical)

Michael J. Schumacher, Elsa Sell, John N. Udall, Jr.

Assistant Professors Alan D. Bedrick, Helen L. Britton (Clinical), John R. Britton, Nancy Dambro (Clinical), Clifford DeBenedetti (Clinical), Richard L. Donnerstein, Carlos A. Flores, Ronald Harrison, H. Eugene Hoyne (Clinical), William N. Marshall (Clinical), Gerald R. Marx, Paul S. Meltzer (Research), Wayne J. Morgan, Paul F. Pollack, Sam Sato, Eve Shapiro (Clinical), Ziad M. Shehab, Robert Van derVoort (Clinical), Rickey L. Williams

Lecturers James C. Cunningham (Clinical), Victor A. Elsberry, Fran Farrell, Maureen J. Rutter, Mary Ann Martinez, Michele Raddish (Clinical), Sydney E. Salmon, Peter Yorgin (Clinical)

800. Research (1 to 18) (See College of Medicine Electives Manual)

803. Clinical Clerkship (6 to 9)

810. Clerkship
   a. Externship in Inpatient Pediatrics (6) P, 803
   c. Pediatric Care in a Cross-Cultural Setting (6)
   d. Inpatient Pediatrics (6)

811. Subinternship
   a. Ambulatory Pediatrics (1 to 18)
   b. Behavioral and Developmental Pediatrics (1 to 18)

815. Subspecialty
   a. Advanced Neonatology (6)
   b. Pediatric Infectious Diseases (6)
   d. Cardiac Ultrasound Echo and Doppler (4 to 6)
   e. Pediatric Cardiology (6)
   f. Pediatric Neurology (6)
   g. Pediatric Hematology/Oncology (6)
   h. Poison Center (4 to 6) P, Ped. 803
   k. Pediatric Clinical Pharmacology (1 to 12) [Rpt./1]
   l. Clinical Allergy (1 to 6) (Identical with I.Med. 8151, which is home)
   p. Pediatric Endocrinology (1 to 18)

891. Preceptorship
   a. Pediatrics (1 to 18)
   b. Preparation for Practice (1 to 18)

Pharmacology

See Pharmacology elsewhere in this catalog. Toxicology courses are listed under Pharmacology and Toxicology.

Physiology

See Physiology elsewhere in this catalog.
Psychiatry

Professors Alan I. Levenson, Head, Allan Beigel, Larry E. Beutler, Henry W. Brosin, John C. Racy, Alayne Yates

Associate Professors Diane S. Fordney (Obstetrics and Gynecology), Henry I. Yamamura (Pharmacology)

Assistant Professors Peter J. Attarian (Family and Community Medicine), Shirley N. Fahey, Milton Frank


495. Colloquium
b. Introduction to Neurosciences II (2) GC (Identical with Med. 495b, which is home)

800. Research (1 to 12) (See College of Medicine Electives Manual)

803. Clinical Clerkship (6 to 9) [Rpt./1].

810. Clerkship
   a. Clinical and Community Psychiatry (1 to 18)
   b. Child Psychiatry (1 to 18).

815. Subspecialty

891. Preceptorship
   a. Psychiatry (1 to 18) [Rpt./2] P, 803.

Radiation Oncology

Professors J. Robert Cassady, Head, Silvio Aristizabal, Thomas C. Cetas, Eugene W. Gerner

Associate Professors George T. Bowden, Jeffrey Trent

Assistant Professors Anne E. Cress, Kullervo Hynynen, Wendell Lutz, David Shimm, Del V. Steinbronn, Jeffrey Williamson

Instructors Helen S. Sykes

Lecturer Douglas McKelvie (Animal Resources)

501. Radiation Biology (3) II Basic principles of radiation effects in mammalian cell and tissue systems, with emphasis on biochemical aspects, such as DNA damage and DNA repair, and cellular responses, such as cell kinetics defects and radiation repair and recovery; radiation and chemical (especially radiomimetic drugs) carcinogenesis. P, introductory biology and chemistry.

551. Environment Carcinogenesis (3) II 1988-89 See Ronc. 851 for description. (Identical with Micr. 551)

555. Cancer Biology (3) II 1988-89 (Identical with Micr. 555)

596. Seminar
   h. Control of Proliferation in Animal Cells (1 to 2) I P, consult department before enrolling. (Identical with Micr. 596h)

815. Subspecialty
   a. Introduction to Radiation Oncology (1 to 16)

851. Environmental Carcinogenesis (3) II 1988-89 Phenomenological and mechanistic aspects of cancer etiology as induced by physical and chemical agents in our environment, with special emphasis on possible molecular and cellular mechanisms involved in cancer etiology. P, consult department before enrolling.

896. Seminar
   h. Control of Proliferation in Animal Cells (1 to 2) I (Identical with Micr. 896h)
DEPARTMENTS AND COURSES OF INSTRUCTION

Radiology

Professors M. Paul Capp, Head, George R. Barnes, Jr. (Clinical), Harrison H. Barrett (Optical Sciences), Theodore Bowen (Physics), Kai Haber, Bruce J. Hillman, Theron W. Ovitt, Dennis D. Patton (Optical Sciences), Michael J. Pitt (Surgery), Arthur J. Present (Emeritus), Joachim F. Seeger, William L. Wolfe, Jr. (Optical Sciences), James M. Woelfenden

Associate Professors John C. Bjelland, William J. Dallas, Robert É. Henry, Tim B. Hunter, Gerald D. Pond, Hans Roehrig (Research), James R. Standen (Clinical), Bryan Westerman

Assistant Professors H. Bradford Barber (Research), Raymond Carmody, George W. Seeley (Optical Sciences, Research), Peter Yang

Instructors Jason L. Stemmer, Mark Yoshino

Lecturers Harry R. Claypool (Anatomy), Jack N. Hall, Joseph Vilani

Research Specialist Kevin M. McNeill

800. Research (1 to 6) [Rpt./1]

815. Subspecialty
   a. Diagnostic Radiology (6)
   b. Nuclear Medicine (1 to 6)

891. Preceptorship
   a. Radiology (1 to 18) [Rpt./] P, 815a

Surgery


Associate Professors Kenneth V. Iserson, James M. Malone, Edward C. Percy, Arthur B. Sanders, Thomas H. Stanisic, John B. Sullivan

Assistant Professors James B. Benjamin, Michael K. Brawer, Gary L. Dunnington, J. David Gibeault, Robert P. Iacono, Timothy B. Icenogle, Stanely P. L. Leong, Mark M. Levinson

Instructors John M. Donovan

800. Research (1 to 12) P, 803. (See College of Medicine Electives Manual)

803. Clinical Clerkship (6 to 9)

807. Specialty Clerkship (3) P, basic science courses.

810. Clerkship
   a. General Surgery (6)

811. Subinternship

815. Subspecialty
   a. Urinary Stone Disease (6)
   b. Cardiothoracic Surgery (6)
   c. Neurosurgery (6)
   d. Surgical and Medical Problems in Fluid and Electrolyte Balance (1 to 3) [Rpt./1]
   e. Urology (6)
   f. Orthopedics (3)
   g. Cardiovascular Physiology and Research (1 to 12)
   h. Lymphvascular System in Health and Disease (6 to 12)
   j. Otothinalaryngology (3)
   k. Sports Medicine (Section of Orthopedic Surgery) (1 to 6) [Rpt./1]
   l. Orthopedic Bioengineering (3 to 6) P, Nine weeks of surgery clerkship, 803 and/or 807
   m. Trauma (3 to 6)
   n. Spinal Cord Injury (3) Open to majors only. P, senior standing. (Identical with Neur. 815n)
   r. Clinical Experience in Rehabilitation Medicine (1 to 4)
   t. Emergency Medicine (3 to 12)
   v. Clinics in Medical Ignorance (3 to 4) II P, junior standing.

891. Preceptorship
   a. Surgery and Subspecialties (1 to 18) [Rpt./]

896. Seminar
   a. Medical Ignorance (2) [Rpt./] II
MEXICAN AMERICAN STUDIES

MEDIEVAL STUDIES

Committee on Medieval Studies (Graduate)

Professors Sigmund Eisner (English), Chairperson, John Boe (Music)
Associate Professors Jonathan Beck (French and Italian), Alan E. Bernstein (History), Richard C. Jensen (Classics), Stephen H. West (Oriental Studies)

The Graduate Committee on Medieval Studies does not offer any major at this time. Programs constituting appropriate minors are available for doctoral students with majors in other disciplines. For further information concerning the minor, please see the Graduate Catalog.

METALLURGICAL ENGINEERING
(See Materials Science and Engineering)

MEXICAN AMERICAN STUDIES

Mexican American Studies and Research Center

Professors Macario Saldate IV (Educational Foundations and Administration), Director, Jose D. Garcia (Physics), James Officer (Anthropology), Eliana S. Rivero (Spanish and Portuguese), Cecil Robinson (Emeritus, English), Renato I. Rosaldo (Emeritus, English), Carlos Velez (Anthropology), Thomas Weaver (Anthropology), Roger Yoshino (Sociology)
Associate Professors Celestino Fernandez (Sociology), John A. Garcia (Political Science), Juan R. Garcia (History), Roseanne Gonzalez (English), William Velez (Mathematics)
Assistant Professors Frances Aparicio (Spanish and Portuguese), Roberto Fernandez (Sociology), Joaquin Ruiz (Geosciences), David Torres (Management and Policy)
Lecturers Adalberto M. Guerrero (Spanish and Portuguese), Richard Lopez

Under the auspices of the Mexican American Studies and Research Center, the Mexican American studies curriculum is an interdisciplinary exploration of the Mexican American experience. Its general goal is to provide a socially pertinent education with humanistic and practical content which will enrich the total university curriculum as well as prepare students to serve the total community.

The major: 30 units in M.A.S., including 180a-180b and nine units chosen from 161, 233, 332, and 443, 477b, or 485. At least 15 units must be in upper-division courses. Group Ill requirement must be fulfilled in Spanish.

The minor: A supportive minor in Mexican American studies to augment other academic areas or majors is encouraged. The minor requires 21 units, including 180a-180b and 6 units chosen from 161, 233, 332, and 443, 477b, or 485.

160. Minority Relations and Urban Society (3) I I (Identical with Soc. 160)
161. The Chicano in American Society (3) II (Identical with Soc. 161)
180a-180b. Introduction to Mexican American Studies (3-3) Introduction to Mexican American studies from various perspectives. 180a: The human sciences. 180b: Research issues and interpretation in the field; public policy and Mexican origin populations; and social sciences and the professions and impact on the Mexican American community.
213. Oral Communication in Spanish (4) I II (Identical with Span. 213)
233. History of the Mexican American (3) I (Identical with Hist. 233)
303a-303b. Comprehensive Spanish for the Bilingual (3-3) I I (Identical with Span. 303)
319. Mexican American Culture (3) I (Identical with Anth. 319)
DEPARTMENTS AND COURSES OF INSTRUCTION

325. Foundations of Bilingual Education (3) (Identical with L.R.C. 325)
330. Minority Groups and American Politics (3) I (Identical with Pol. 330)
332. Politics of the Mexican American Community (3) II (Identical with Pol. 332)
368. Colonial Mexico (3) I (Identical with Hist. 368)
369. Mexico Since Independence (3) II (Identical with Hist. 369)
404. Sociology of the Southwest (3) GC I (Identical with Soc. 404)
406. Foundations of Reading Instruction in Spanish (2) GC II Student must be registered in the College of Education. (Identical with L.R.C. 406)
411.* Public Administration and the Mexican American (3) GC I (Identical with M.A.P. 411)
423. Peoples of Mexico (3) GC II (Identical with Anth. 423)
432. Pre-Columbian Culture and Myths (3) GC II 1988-89 (Identical with Span. 432)
434. Cultural and Literary Origins of Hispanic Southwest (3) GC I 1987-88 (Identical with Span. 434)
441. Children's Literature in Spanish (3) GC I (Identical with Span. 441)
442. Mexican-American Poetry (3) GC I 1988-89 (Identical with Span. 442)
443. Mexican-American Literature (3) GC II (Identical with Span. 443)
444. Mexican-American Narrative (3) GC I 1988-89 (Identical with Span. 444)
446. Mexican-American Theatre (3) GC I 1989-90 (Identical with Span. 446)
447. Contemporary Mexican Literature (3) GC II S (Identical with Span. 447)
448. Government and Politics of Mexico (3) GC I (Identical with Pol. 448)
449. Mexican and Mexican-American Film (3) GC II 1987-88 (Identical with Span. 449)
453. Mesoamerican Archaeology (3) GC I (Identical with Anth. 453)
460. History of the Hispanic Borderlands (3) GC II (Identical with Hist. 460)
461. Race and Ethnic Relations (3) GC III (Identical with Soc. 461)
473. Spanish for the Bilingual Classroom Teacher (3) GC II (Identical with Span. 473)
485. Mexicana/Chicana Women's History (3) GC I CDT Historical survey and sociological analysis of past and present experiences of Mexicanas and Chicanas in the United States (Identical with W.S. 485) Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
495. Colloquium
c. The Mexican American (3) GC I II (Identical with Hist. 495c, which is h̃ome)
695. Colloquium
r. Bilingualism in the United States (3) [Rpt./3] S

MICROBIOLOGY
(See Microbiology and Immunology)

MICROBIOLOGY AND IMMUNOLOGY

Professors John Spizizen Head, Harris Bernstein, Charles P. Gerba (Nutrition and Food Science), Junetsu Ito, Wayburn S. Jeter (Pharmacology and Toxicology), Rein Kilkson (Physics), Peter P. Ludovici (Emeritus), William Meinke, George B. Olson, Kenneth Ryan (Pathology), Irving Yall (Emeritus)
Associate Professors Robert J. Janssen, Norval A. Sinclair, Associate Head, James T. Sinski, J. Glenn Songer (Veterinary Science)
Assistant Professors Richard Friedman
Lecturers Judith Bradshaw, Vivian Gage, Lee M. Kelley

The Department of Microbiology and Immunology offers a course of study applicable to
general and applied sciences in agriculture, allied health, biology and medicine. The major
provides a strong foundation for graduate study in microbiology, immunology, molecular biology
and genetics, as well as a preprofessional program for students seeking admission to schools
of medicine and dentistry.

The graduate program in microbiology and immunology has three major areas of emphasis:
(1) molecular, genetic and physiological microbiology, (2) environmental, pathogenic and industrial
microbiology, and (3) immunology. Faculty expertise to direct research in these areas is drawn
from many departments and colleges on campus.

The department offers the Bachelor of Science, Master of Science, Specialist in
Microbiology, and Doctor of Philosophy degrees with a major in microbiology.

The major: 35 units, including 110, 317, 427R, 419R, 495a. The remaining units must be
chosen from the following and must include at least four laboratory courses (designated *): 403R,
438, 450*, 451*, 470, 471*, and 473. Micr. 181, 182 (biology core), Chem. 103a-103b, 104a-104b,
241a-241b, 243a-243b and 325 and 326 or 322 and 323, 460 or 462a or 462b or N.F.S. 406a
or 406b, Phys. 102a-102b or Phys. 103a-103b and 8 units of mathematics to include Math. 125a
are also required.

† At the time of catalog revision, this degree was under review. For information concerning this degree, consult the department.

110. Introduction to Microbiology (5) I II Introduction to general, applied, and pathogenic microbiology
and immunology. 4R, 4L.
181. Life: The Science of Biology I (4) (Identical with M.C.B. 181)
182. Life: The Science of Biology II (4) (Identical with Ecol. 182)
317. General Microbiology (3) II Characteristics of microorganisms and their activities in natural and applied
357. Communicable Diseases (3) I II The nature and prevention of communicable diseases. Open to
nonmajors only.

396H. Honors Seminar (3) I II

403R. Biology of Animal Parasites (3) (GC I (Identical with V.Sc. 403R)
410a-410b. Advanced Cell Biology (3-3) GC (Identical with M.C.B. 410a-410b)
417. Laboratory Techniques in Microbial Physiology (2) GC II Instrumentation and technology in
419R. General Immunology (3) GC I Basic concepts of the immune system. Presentation of the roles antigen,
immunoglobulins, complement, lymphokines and types of immune cells play in humoral and cell-
mediated immunity. P, 317, Chem. 241b, 243b. (Identical with V.Sc. 419R)
419L. General Immunology Laboratory (2) GC I Laboratory techniques in immunology. P, 419R or CR.
(Identical with V.Sc. 419L)
420R. Pathogenic Bacteriology (3) GC II Etiology and pathogenesis of bacterial diseases in humans,
420L. Pathogenic Bacteriology Laboratory (2) GC II Isolation and identification of pathogenic bacteria;
techniques in pathogenic bacteriology. P, 420R or CR. (Identical with V.Sc. 420L)
423R. General Pathology (3) GC II (Identical with V.Sc. 423R)
423L. General Pathology Laboratory (1) GC I (Identical with V.Sc. 423L)
425. Environmental Microbiology (3) GC I Current concepts in water quality, aerobiology and microbial
427R. General Mycology (3) GC I General mycology, with emphasis on the microfungi. P, 110.
427L. General Mycology Laboratory (2) GC I General mycology lab., with emphasis on the microfungi. P,
427R or CR.
428R. Advanced Microbial Genetics (3) GC II (Identical with M.C.B. 428R)
428L. Advanced Microbial Genetics Laboratory (2) GC I (Identical with M.C.B. 428L)
429. Introductory Virology (3) GC I Essential features of viruses, and their relationships to the diseases
of humans, other animals, plants and microorganisms. P, 110, Chem. 241b, 243b.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Units</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>Introduction to Biophysics</td>
<td>2</td>
<td>GC I (Identical with Phys. 430)</td>
<td></td>
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<tr>
<td>435</td>
<td>Soil Microbiology</td>
<td>3</td>
<td>GC I (Identical with S.W. 435)</td>
<td></td>
</tr>
<tr>
<td>438</td>
<td>Ecology of Infectious Disease</td>
<td>3</td>
<td>GC II 1987-88 Factors involved in the epidemiology of infectious disease</td>
<td>P, 419R or 420R. (Identical with V.Sc. 438)</td>
</tr>
<tr>
<td>450</td>
<td>Medical Mycology</td>
<td>4</td>
<td>GC II The isolation and identification of fungi of medical importance</td>
<td>P, 110. (Identical with V.Sc. 450)</td>
</tr>
<tr>
<td>451</td>
<td>Diagnosis and Control of Plant Diseases</td>
<td>3</td>
<td>GC I (Identical with PL.P. 451)</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>Food Microbiology and Sanitation</td>
<td>3</td>
<td>GC II (Identical with N.F.S. 470)</td>
<td></td>
</tr>
<tr>
<td>471</td>
<td>Food Microbiology and Sanitation Laboratory</td>
<td>2</td>
<td>GC 11 1988-89 (Identical with N.F.S. 471)</td>
<td></td>
</tr>
<tr>
<td>473</td>
<td>Recombinant DNA Techniques</td>
<td>3</td>
<td>GC II (Identical with M.C.B. 473)</td>
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<tr>
<td>495</td>
<td>Colloquium</td>
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<tr>
<td></td>
<td>a. Senior Colloquium (1) [Rpt/1]</td>
<td></td>
<td>III Writing- Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see &quot;Writing-Emphasis Courses&quot; in the Academic Guidelines section of this catalog).</td>
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<tr>
<td>501</td>
<td>Medical Microbiology</td>
<td>6</td>
<td>I The biological characteristics of microorganisms of importance in human health and disease; the reaction of the host to infectious agents and the mechanisms of host defense; diagnosis and management of infectious disease. Lectures, discussions, and lab. experiments. P, Chem. 241b, Bioc. 501.</td>
<td></td>
</tr>
<tr>
<td>530</td>
<td>Biophysical Theory</td>
<td>2</td>
<td>GC II (Identical with Phys. 530)</td>
<td></td>
</tr>
<tr>
<td>550</td>
<td>Molecular Mechanisms of Microbial Pathogenesis</td>
<td>3</td>
<td>I 1988-89 Review of current concepts in specific areas of microbial pathogenesis, including action of exo-and endotoxins, cell surface interactions, phagocytosis and host microbial functions. P, Bioc. 460.</td>
<td></td>
</tr>
<tr>
<td>551</td>
<td>Environmental Carcinogenesis</td>
<td>3</td>
<td>I 1987-88 (Identical with Radi. 551)</td>
<td></td>
</tr>
<tr>
<td>555</td>
<td>Cancer Biology</td>
<td>3</td>
<td>I 1988-89 Fundamental biological aspects of neoplastic growth at the organ, cellular, and molecular levels; emphasis on the etiology, behavior, and therapy of neoplasms. (Identical with Anat. 555, I.Med. 555, and R.Onc. 555)</td>
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<tr>
<td>570</td>
<td>Molecular Genetics</td>
<td>3</td>
<td>I 1988-88 Molecular genetics and biology of the bacterial viruses; molecular mechanisms of gene regulation, DNA replication, DNA repair, mutation and genetic recombination; current research in bacterial genetics (lysogeny, transduction, conjugation, use of transposons and gene fusions in genetic analysis and transformation); introduction to gene cloning and its uses in analysis of gene structure and regulation. (Identical with Gene. 570)</td>
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<tr>
<td>571</td>
<td>Molecular Gene Cloning</td>
<td>3</td>
<td>I 1988-89 Current gene cloning technology; restriction endonucleases, cloning vehicles (plasmid vectors, bacteriophage vectors, and single-stranded phage vectors), gene amplification and expression of cloned genes. (Identical with Gene. 571)</td>
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<tr>
<td>577</td>
<td>Advanced Microbial Physiology</td>
<td>2</td>
<td>I 1988-88 Studies of metabolic pathways of selected microorganisms with an emphasis on industrial applications. P, 517.</td>
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</tr>
<tr>
<td>580</td>
<td>Molecular Virology</td>
<td>3</td>
<td>I 1987-88 The current status of basic research in virology at the molecular level. P, Chem. 460.</td>
<td></td>
</tr>
<tr>
<td>582</td>
<td>Immunotoxicology</td>
<td>2</td>
<td>I (Identical with Tox. 582)</td>
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<tr>
<td>596</td>
<td>Seminar</td>
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<tr>
<td></td>
<td>a. Current Problems in Molecular Biophysics (1) I II (Identical with Phys. 596a, which is home)</td>
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<tr>
<td></td>
<td>h. Control of Proliferation in Animal Cells (1 to 2) I (Identical with R.Onc. 596h, which is home)</td>
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<tr>
<td>630</td>
<td>Immunology of Infectious Disease</td>
<td>4</td>
<td>I 1988-89 Methods for investigating changes in humoral and CMI during the disease process. Laboratory and library work for the preparation of a grant using NIH or NSF format. 12L. P, 419, 560 or 561, Bioc. 460. Consult department before enrolling. (Identical with V.Sc. 630)</td>
<td></td>
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</tbody>
</table>
MILITARY SCIENCE, NAVAL SCIENCE AND MILITARY AEROSPACE STUDIES

672. Food Safety (2) 1987-88 (Identical with N.F.S. 672)


695. Colloquium
   a. Readings in Microbiology (1) [Rpt.] I II
   b. Immunopathology (1) I II
   c. Molecular Genetics of Microorganisms (1) I II
   d. Molecular and Cellular Immunology (1) I II
   f. Tumor Virology (1) I II
   g. Host-Parasite Interactions (1) I II

696. Seminar
   a. Research Seminar (1) [Rpt.] I II

801. Medical Microbiology (6)

851. Environmental Carcinogenesis (3) II 1988-89 (Identical with Radi. 851)

891. Preceptorship
   a. Microbiology and Immunology (3 to 12) [Rpt./12 units]

896. Seminar
   h. Control of Proliferation in Animal Cells (1 to 2) I (Identical with Radi. 896h, which is home.)

MILITARY SCIENCE, NAVAL SCIENCE AND MILITARY AEROSPACE STUDIES

Military science (Army), naval science (Navy and Marine Corps) and aerospace studies (Air Force) are open to male and female students seeking a commission. ROTC courses can be counted as elective credit toward graduation in most academic majors. Lower-division courses carry no service commitment. Veterans may receive credit for the first two years of the four-year ROTC program. Textbooks and uniforms are provided by the departments. For further information about the four-year ROTC programs, the special two-year ROTC programs, entry requirements for upper-division courses, and ROTC scholarships, see the catalog section on School of Military Science, Naval Science and Aerospace Studies or contact the department.

Military Science

Professor Thomas V. Flores
Assistant Professors Reid K. Mrsny, Raymond E. Quesenberry, Edgar H. Rawl, Bruce E. Ryset, Michael O. Sexton, Hollis E. Simmons

100a-100b. Introduction to Military Science (3-3) Organization of the Army; principles and techniques of applied leadership; customs, traditions and military courtesy; basic marksmanship; first aid, land navigation; small-unit tactics; practicum. 2R, 1L. Consult department before enrolling.

200a-200b. The National Defense Establishment and Management through Military Leadership (3-3) Military staff organization and operation; procedures and conduct of military briefings; benefits, responsibilities, and obligations of a commissioned officer; small unit leadership and motivation; practicum. 2R, 1L. Consult department before enrolling.

300a-300b. Fundamentals and Dynamics of Military Operations (3-3) Topographical map interpretation; fundamentals of small-unit operations; communication media, motivation and behavior in the military environment; military planning and execution; practicum. 3R, 1L. Consult department before enrolling.

301. Army ROTC Advanced Camp (4) S Six-week summer camp at Ft. Lewis, Washington, required for commissioning as an officer in U.S. Army. Open only to Advanced Course Army ROTC cadets.

400a-400b. Military Administration and Preparation for Service (3-3) Development of skills required to function as a manager; motivation and behavior in a military environment; highlights personal integrity, honor and professional ethics; military legal system; unit management; practicum. 3R, 1L. Consult department before enrolling.

Military Aerospace Studies

Professor Charles L. Fox
Assistant Professors Kenneth I. Nonaka, Janet L. Tobin, Robert L. Youmans, Douglas E. Smith
DEPARTMENTS AND COURSES OF INSTRUCTION

101a-101b. First Year GMC*, History of Aviation (2-2) Survey of the development of aviation from the advent of the air age to the present, with emphasis on military aviation and its relationship with political and economic aspects of historical world situations. 1R, 1L 101a is not prerequisite to 101b.

201a-201b. Second Year GMC*, Air Force Today (2-2) Survey of the doctrine, mission, and organization of the U.S.A.F.; U.S. strategic offensive and defensive forces; U.S. general purpose and aerospace support forces. 1R, 1L 201a is not prerequisite to 201b.

300a-300b. Third Year POC**, Leadership and Management (3-3) Theory and application of leadership and management, with emphasis on human relations, motivation, communication for managers, organizational behavior and management processes. 3R, 1L Consult department before enrolling.

400a-400b. Fourth Year POC**, American Defense Policy (3-3) Critical analysis of various aspects of the military in American society and its application and effects on the world political and economic environment. 3R, 1L Consult department before enrolling.

*General Military Course
**Professional Officer Course

Naval Science

Professor D. H. Barnhart
Associate Professor Jim Farlee
Assistant Professors Fiona Andrews, Patrick Boyle, G. Garza, George Nelson, John Quigley, Jr.
Instructors Keith Crim, Walter McKinney

100a-100b. Naval Laboratory I (1-1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

101. Introduction to Naval Science (2) I Introduction to the naval profession and to concepts of seapower, with emphasis on mission, organization, and warfare components of the Navy and Marine Corps; naval courtesy and customs, military justice, leadership, and nomenclature.

102. Naval Ship Systems I: Engineering (3) II Ship characteristics and types including ship design, hydrodynamic forces, stability, compartmentation, propulsion, electrical and auxiliary systems, interior communications, ship control, and damage control; basic concepts of the theory and design of steam, gas turbine, and nuclear propulsion.

200a-200b. Naval Laboratory II (1-1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.


202. Seapower and Maritime Affairs (3) II U.S. Naval history from the American Revolution to the present. Discussion of the theories of Mahan, political issues of merchant marine commerce, and a comparison of U.S. and Soviet naval strategies.

300a-300b. Naval Laboratory III (1-1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

301. Navigation and Naval Operations I (3) I Theory, principles, and procedures of navigation. Students learn piloting navigation including the use of charts, visual and electronic aids, the theory and operation of magnetic and gyro compasses, and celestial navigation.

302. Navigation and Naval Operations II (3) II International and island rules of the road, relative-motion vector-analysis, formation tactics, and ship employment. Introduction to naval operations and ship handling. P, N.S. 301

310. Evolution of Warfare (3) I The development of warfare to present, focusing on theorists, strategists, tacticians, and technological developments. Student acquires sense of strategy and impact of precedent on military actions.

400a-400b. Naval Laboratory IV (1-1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

401. Leadership and Management I (2) I Organizational behavior and management in the context of the naval organization. A survey of management functions of planning, organizing, and controlling; and introduction to individual and group behavior in organizations; motivation and leadership.
Leadership Management II (2) II Naval officer responsibilities in naval administration: counseling methods, military justice administration, naval human resources management, directives and correspondence, naval personnel administration, material management and maintenance. P, N.S. 401 or M.A.P. 305.

Amphibious Warfare (3) II Historical survey of the development of amphibious doctrine and amphibious operations, with emphasis on the evolution of amphibious warfare in the 20th-century; present day potential and limitations on amphibious operations, including the rapid deployment force concept. Field trip.

MINING AND GEOLOGICAL ENGINEERING

Professors Ian W. Farmer, DeVerle P. Harris, Y. C. Kim, Richard Newcomb, William C. Peters (Emeritus), Michael Rieber
Associate Professors Charles E. Glass, Head, Jaak J. K. Daemen, Ben K. Sternberg
Assistant Professors Meliton M. Garcia (Adjunct), Satya Harpalani, Pinnaduwa Kulatilake

Geological Engineering

Geological engineering entails the application of geological science to the analysis and design of engineering programs and structures in such fields as civil engineering, hydrology, ground control and stabilization, earthquake engineering and other applications that are affected by natural geologic forces and processes. Graduates in geological engineering are usually employed in earth and environmental engineering fields in such areas as foundation design, site examination for dams and power plants, water resource development, urban planning, hazardous waste studies and many others.

The department offers the Bachelor of Science in Geological Engineering, Master of Science and Doctor of Philosophy degrees with a major in geological engineering. Undergraduate degree requirements are listed in the College of Engineering and Mines section of this catalog.

MINING AND GEOPHYSICAL ENGINEERING

MINING AND GEOLOGICAL ENGINEERING

Professors Ian W. Farmer, DeVerle P. Harris, Y. C. Kim, Richard Newcomb, William C. Peters (Emeritus), Michael Rieber
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The department offers the Bachelor of Science in Geological Engineering, Master of Science and Doctor of Philosophy degrees with a major in geological engineering. Undergraduate degree requirements are listed in the College of Engineering and Mines section of this catalog.

124. Introduction to Geological Engineering (2) I Survey of current geological engineering technology applied to the development of mineral resources and to the interaction of man and the environment. Glass

325. Principles of Health and Safety in the Mineral Industry (2) I (Identical with Mn.E. 325)

330. Introduction to Remote Sensing (3) I (Identical with Geog. 330)


415. Rock Excavation (3) GC I (Identical with Mn.E. 415)


420. Geophysical Exploration: Potential Field Methods (4) GC I (Identical with Geos. 420)

422. Geophysical Engineering (4) GC I Principles of gravity, magnetic, electrical, electromagnetic, and reflection and refraction seismic methods; acquisition and interpretation of data to define geologic structures for engineering projects and to evaluate resources. 3R, 3L. P, Phys. 103a-103b or 110 and 116; Math. 223. Sternberg


425. Geotechnical Investigations (3) GC II Investigation and analysis of geologic factors in the design and construction of engineering projects. 1R, 6L. Farmer

427. Geomechanics (4) GC I (Identical with Mn.E. 427)
DEPARTMENTS AND COURSES OF INSTRUCTION

460. Health Hazards in the Mine Environment (2) GC II 1987-88 (Identical with Mn.E. 460)

461. Accident Prevention in the Mine Environment (2) GC II 1988-89 (Identical with Mn.E. 461)

470. Computer Methods in Geological Engineering (3) GC Use of computers to solve problems in geological engineering, including computer contouring, map filtering and enhancement, and multivariate analysis of geologic data. P, introductory courses in computer programming, math, and earth science. Sternberg

507. Applied Multispectral Imagery (3) GC Application to mineral exploration, engineering geology, groundwater location, and pollution monitoring. P, 407. (Identical with Geos. 507) Glass

522. Well Logging Interpretation (3) GC Basic well logging theory. Fundamentals of quantitative formation evaluation. Detailed investigation of aspects of well logging applicable to student's research interests. P, consult department before enrolling. (Identical with Geos. 522)

527. Fundamentals of Geomechanics (4) GC (Identical with Mn.E. 527)

550. Earthquake Engineering (3) GC I 1987-88 Applied course in earthquake causes and effects, integrating the fields of seismology, engineering, and seismic geology. P, Math. 254. Glass

560. Electrical Exploration Methods (3) GC Electrical properties of minerals and rocks, resistivity and resistivity exploration, induced polarization and complex resistivity, magneto-telluric methods, and electromagnetic prospecting methods. P, 420 or 422. Consult department before enrolling. (Identical with Geos. 560) Sternberg

569. Probabilistic Methods in Geotechnical Engineering (3) GC II 1987-88. (Identical with C.E. 569)

660a-660b. Estimation of Mineral Resources by Quantitative Methods (3-3) I 1987-88 (Identical with Mn.Ec. 660a-660b)

696. Seminar
   a. Research Seminar (1 to 3) [Rpt.] I II

Mineral Economics

Mineral economics is a field of applied economics encompassing the interface of minerals engineering and earth science with the business of mineral production and the setting of public policy. Mineral economists are employed in such fields as mineral investment analysis, planning and forecasting for mineral development, mineral commodity supply and demand analysis, and statistical modeling of exploration and mining ventures, and in international trade in metals and fuels.

The Master of Science and Doctor of Philosophy degrees are offered with a major in mineral economics. For admission and degree requirements, please see the Graduate Catalog.

418. Mine Investment Analysis (3) GC II (Identical with Mn.E. 418)


550. Economics of the Metal Industries (3) GC Reserves, resources, and major deposits, production technologies, market structure, industrial organization, consumption trends, recycling, foreign trade, and geopolitics of selected industries. P, A.Ec. 504.


584. Economics of Coal, Nuclear, and Alternative Energy Sources (3) GC Reserves and resources, economics of production, utilization and conversion, externalities, market structure, policy issues for alternative energy sources such as oil shale, tar sands, coal gasification, and solar. P, A.Ec. 504.

586. Economics of Petroleum and Natural Gas (3) GC Reserves and resources of petroleum and natural gas, production technology, market structure, industrial organization, pricing, competitive behavior, consumption trends, and policy issues. P, A.Ec. 504.

MINING AND GEOLOGICAL ENGINEERING

600. **Readings in Mineral Economics** (3) II Selected readings in the economics of mineral resource exploration and exploitation, environmental protection, national mineral policy, world mineral development, and international trade. P, Econ. 361.

650a-650b. **Advanced Principles of Mineral Economics** (3-3) Risk analysis; optimum production, depletion and exhaustion; productivity and technical change; imperfect competition in mineral markets; resource distribution, trade and mineral policy. P, Econ. 501a or A.Ec. 504.


696. **Seminar**

a. **Research Seminar** (1 to 3) [Rpt./3 units] II
b. **Advanced Topics in Mineral Evaluation and Risk Analysis** (1 to 3) [Rpt./3 units] II
c. **Mineral and Energy Policy Analysis** (1 to 3) [Rpt./3 units] II
d. **Advanced Mineral Commodity Analysis** (1 to 3) [Rpt./3 units] II
e. **Topics in Mineral and Energy Supply** (1 to 3) [Rpt./3 units] II
f. **Decision Analysis and Operations Research in Mineral Exploration** (1 to 3) [Rpt./3 units] II
g. **Process Analysis and Costing** (1 to 3) [Rpt./3 units] II

**Mining Engineering**

Mining engineering is that branch of engineering responsible for the planning, design, development and operation of mining and other underground facilities. Employment opportunities available to mining engineering graduates may be found in the fields of design and development of both underground and surface mines systems, management of mines, construction projects, and tunneling and underground chamber projects, heavy equipment development and finance.

The degrees of Bachelor of Science in Mining Engineering, Master of Science and Doctor of Philosophy are offered with a major in mining engineering. Undergraduate degree requirements are listed in the *College of Engineering and Mines* section of this catalog.

120. **Elements of Mining** (2) II Historical development of mining; unique problems of the extractive industry; introduction to minerals industry technology. Field trip.

220. **Mining Methods** (3) I Introduction to the techniques, unit operations, and systems involved in underground and surface mining of minerals and coal. Field trips. 2R, 3L. P, Mn.E. 120.


310. **Mine Surveying** (2) II Mine surveying problems and practices; closed traverse of underground mine; shaft plumbing, stope and raise surveying. P, 120, C.E. 151.

315. **Rock Fragmentation** (2) I Theory, properties, and uses of industrial explosives, blasting devices and nuclear devices for rock fragmentation. Field trips.

333. **Elements of Coal Mining** (3) I 1987-88 Coal geology, properties and use. Surface and underground methods and equipment: strip mining; roof control; ventilation; methane impact on safety; conventional, longwall mining. Preparation and reclamation. P, 220, E.C.E. 207. Daemen

397. **Workshop**
a. **Unit Operations** (1-3) II P, 220.

401. **Analysis of Mine Operations** (3) GC I Use of operations research principles and techniques to analyze various problems in mine operations. P, 402. Harpalani

402. **Probability and Statistical Concepts in Geologic Media** (4) GC II (Identical with G.En. 402)
358 DEPARTMENTS AND COURSES OF INSTRUCTION


418. Mine Investment Analysis (3) GC II Economic factors, including taxation, mineral depletion allowance, and finance in the mining industry; includes fundamentals of engineering economics, capital budgeting, and risk analysis. P, 430. (Identical with Mn.Ec. 418)

435. Mine Design (3) GC II Computer-aided design of a modern mine; feasibility study, pit limit design, mining sequence development and short-term mine planning. 2R, 3L. P or CR, 430, 440. Kim

427. Geomechanics (4) GC I Mechanical behavior of rock and rock masses; response to load changes: deformations, failure, discontinuity slip; in situ stress state; rock testing; geomechanical classifications; engineering applications: slopes, pillars, tunnels, dam foundations; reinforcement design. 3R, 3L. P, C.E. 217, Geos. 221. [Identical with G.En. 427] Daemen

430. Mine Examination and Valuation (3) GC I Principles and procedures in mineral property valuation, geostatistical ore reserve estimation, engineering, economy, investment analysis; use of a microcomputer. P, 402, 220. Kim


500. Economics of Mineral Resource Development and Production (4) GC I (Identical with Mn.Ec. 500)

501. Analysis of Mining Decisions (3) I Use of geostatistics, system simulation languages and computers to analyze various mining decisions related to reserve estimation and mine planning. P, 402, 430, 401. Kim

527. Fundamentals of Geomechanics (4) II Mechanical behavior of geological materials: stress and strain analysis; friction; elasticity, strength and failure; discontinuity slip. Laboratory testing and applications to selected mining or geological problems. 3R, 3L. P, 427 or C.E. 340, Geos. 221. [Identical with G.En. 527] Daemen

622. Advanced Kriging Techniques (3) II Theory and application of advanced kriging techniques to mining and earth science related problems; universalis, lognormal, indicator, co and probability kriging. P, 402, 430, 501 or Math. 579. Kim


696. Seminar
   a. Research Seminar (1 to 3) [Rpt.] I II

MOLECULAR AND CELLULAR BIOLOGY

Professors H. Vasken Aposhian, Wayne R. Ferris, Mac E. Hadley, Richard B. Hallick (Biochemistry), John Hildebrand (Arizona Research Lab), Konrad Kock, Neil H. Mendelson, David W. Mount, James W. O'Leary (Environmental Research Lab), Peter E. Pickens, Diane H. Russell (Pharmacology), Nobuyoshi Shimizu

Associate Professors Thomas J. Lindell, Acting Head, Hans J. Bohnert (Biochemistry), Don P. Bourque (Biochemistry), Wah Chiu (Biochemistry), William J. Grimes (Biochemistry), Jennifer D. Hall, Martínez J. Hewlett, John W. Little (Biochemistry), Kaoru Matsuda, Frank L. Meyskens (Internal Medicine)

Assistant Professors Danny L. Brower, Gail Burd, James F. Deatherage (Biochemistry), Carol L. Dieckmann (Biochemistry), Martha Hawes, Karen Oishi, Elizabeth Vierling (Biochemistry)
The University Department of Molecular and Cellular Biology offers the Bachelor of Science, Master of Science, and Doctor of Philosophy degrees with a major in molecular and cellular biology. The major: 181, 182, 320, 410a-410b, 495a and at least two units of an upper division laboratory course( such as 413, 473 or 494); Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b or 103a-103b, 180a-180b; Math. 125a-125b. With the assistance of a major adviser, the student must select a minimum of 30 units, including at least 8 units of upper-division molecular and cellular biology courses. Majors are strongly advised to include Chem. 480a-480b in their program. The minor: The department has a structured split minor involving chemistry, physics, and mathematics. The department has designated courses 494 (practicum) and 495a as writing-emphasis courses. Honors: The department participates in the Honors Program.

181. Life: The Science of Biology I (4) I Introduction to the cell and its properties, basic genetics, the immune system, recombinant DNA technology with illustrations from plants, animals and humans. (Identical with Bioc. 181, Ecol. 181, Micr. 181)

182. Life: The Science of Biology II (4) II (Identical with Ecol. 182)

320. Genetics (4) I (Identical with Ecol. 320)

404. Contemporary Biology and Human Affairs (3) GC II Advances in biomedical research will be reviewed and their ethical, social and legal implications discussed. P, one course in bioc. or biology; botany not acceptable.

410a-410b. Advanced Cell Biology (3-3) GC Regulation at the cellular and molecular levels; gene expression; nature, function, and integration of organelles and ultrastructural components of the cell. P, 181, Chem. 241b or 480a. (Identical with Micr. 410a-410b)

412. Radioisotopes in Biology (3) GC I Advanced techniques in the application of radioactive tracers to problems of molecular biology; kinetics of labeling, fractionation procedures; detection systems and processing of data. P, Chem. 103b, 104b, Phys. 102a-102b.

413. Advanced Cell Biology Laboratory (2) GC I Modern lab. techniques for genetic and molecular analyses of mammalian cells in culture. 6L. P, CR 415.


428R. Advanced Microbial Genetics (3) GC II Modern concepts of microbial genetics: basic genetic theory, the molecular architecture, biosynthesis and genetic regulation of bacterial cell structure, control of growth and cell division. P, 181, Micr. 328, Ecol. 320 or 321. (Identical with Ecol. 428R, Gene. 428R, and Micr. 428R)

428L. Advanced Microbial Genetics Laboratory (2) GC I Individual research projects within the framework of microbial genetics, with emphasis on the genetic system of Bacillus subtilis. (Identical with Ecol. 428L and Micr. 428L)


460. Plant Physiology (4) GC I Introduction to water relations, photosynthesis, respiration, growth and development of higher plants. 3R, 3L. P, Chem. 241a, 243a. (Identical with Ecol. 460)

461. Introduction to Neurobiology (3) GC I Physiology and anatomy of invertebrate and vertebrate nervous systems. P, 8 units of biology.


463a-463b. Human Physiology Laboratory (1-1) GC (Identical with Ecol. 463a-463b)

464a-464b. Human Physiology (3-3) GC (Identical with Ecol. 464a-464b)

465. Neuroethology (2) GC II Selected topics in current neuroethological research on vertebrate and invertebrate nervous systems. P, 463, or consult department before enrolling.
DEPARTMENTS AND COURSES OF INSTRUCTION

467R. Endocrinology (3) GC II (Identical with Anat. 467R)

467L. Endocrinology Laboratory (1) GC II (Identical with Anat. 467L)

469. Developmental Neurobiology (2) GC II Development of the nervous systems of invertebrates and vertebrates from embryonic stages to the adult. P, 8 units of biology.

473. Recombinant DNA Techniques (3) GC II Relevant techniques for the isolation, purification and cloning of genes in E. Coli hosts. Cloned DNA will be characterized by restriction mapping and hybridization techniques. FR, 6L. Consult department before enrolling. P, 410a, Bioc. 462a. (Identical with Bioc. 473, Gene. 473, and Micr. 473)

495. Colloquium
   a. Current Subjects in Molecular and Cell Biology (1) II Open to majors only. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

514. Supramolecular Structure (2) II 1988-89 Application of diffraction techniques in the study of structure and function of biological macromolecules.

550. Topics in Pigment Cell Biology (2) I (Identical with Anat. 550)


558. Advanced Subjects in Endocrinology (2) [Rpt.] I (Identical with Anat. 558)


563. Plant-Water Relations (3) II Analytic approach to the study of water movement into and through plants; development of internal water deficits and their significance to physiological processes. P, 460. (Identical with Ws.M. 563)


568. Nucleic Acids (3) II (Identical with Bioc. 568)

570. Molecular Biology of the Cell Membrane (3) I 1988-89 (Identical with Bioc. 570)

595. Colloquium
   a. Topics in Molecular Biology (1) [Rpt.] II Open to majors only.
   b. Topics in Electron Microscopy (2) [Rpt.] II 1987-88 P, Math. 125b, Phys. 102b or 103b. (Identical with Bioc. 595b)

696. Seminar
   a. Recent Research (1) [Rpt.] III

761. Methods in Molecular and Cellular Biology (3) II Current techniques for qualitative and quantitative studies. 9L. Open to majors only.

MOLECULAR AND MEDICAL MICROBIOLOGY
(See Microbiology and Immunology)

MOLECULAR BIOLOGY
(See Molecular and Cellular Biology)

MUSIC

The School of Music, a division of the Faculty of Fine Arts, offers course work leading to the following degrees: Bachelor of Music with majors in jazz studies, music education, performance, and theory and composition; Bachelor of Arts in Music; Master of Music; Doctor of Musical Arts; and Doctor of Philosophy. The School of Music participates with the Committee on Dance in providing course work for the drama-musical theatre major offered by the Department of Drama for the Bachelor of Fine Arts Degree. The school is a member of the National Association of Schools of Music and the requirements for entrance and graduation as set forth in this catalog are in accordance with the published standards of that association.

**ENTRANCE REQUIREMENTS:** Entrance examinations in musicianship and the major performance area are required. All freshmen and transfer music majors (except piano and organ performance majors) must audition for placement in class or group piano instruction. These courses must be taken concurrently with 120a-120b and 220a-220b. Students desiring the B.A. in Music or the B.M. with a major other than performance must meet the requirements for registration in 181 in their major performance area. B.M. students majoring in performance must meet the requirements for registration in 185 in their major performance area. Admission to the 181 level requires minimum performance skill equivalent to at least two years of recent private study and/or four years of recent membership in school or community organizations. Admission to the 185 level requires a minimum of five years of private study or ensemble/solo experience resulting in sufficient advancement that the student shows promise of being at a professional level after completion of four years of undergraduate study. Detailed information regarding entrance and degree requirements is available from the Director of the School of Music (Music Bldg. Room 109).

**RESIDENCY REQUIREMENTS:** Majors must complete a minimum number of units in residence, as specified in the following schedule: performance — 21 units in the major; jazz studies — 22 units in the major; music education — 19 units in the major, plus T.T.E. 493b; and theory and composition — 23 units in the major.

**ENSEMBLE PARTICIPATION:** All students enrolled in performance studies are required to participate in a conducted ensemble (200, 400, 500) unless excused by the Director of the School of Music. (Accompanying or coached ensembles may fulfill this requirement for keyboard majors per the degree requirements.)

**SPECIAL REGULATIONS:** Credit for private or group instruction is granted only to students who are eligible to register for regular University credit. Students registered for performance studies may be assigned to private or group instruction and required to attend master classes and recitals as arranged by the instructor. Students may, at the discretion of their major adviser or performance instructor, be required to register for Mus. 201 and to appear in and attend performances as arranged by their instructor. Lessons missed by the student will not be rescheduled unless the instructor has been notified by the student 24 hours before the regular time of the lesson. Lessons missed by the instructor will be rescheduled within the semester. Lessons falling on a legal holiday will not be rescheduled.

**DEGREE PROGRAMS:** The curricula for the B.M. include a common core of studies which is intended to coordinate all aspects of musical training in a program of comprehensive musicianship.

- **The teaching minor:** 25 units, including 110a-110b, 120a-120b, 130a-130b, 338m, 370, 371, or 372, 2 units of conducted ensemble, 4 units of 181 or above.

**BACHELOR OF MUSIC**

- **Common First Year Curriculum:** All B.M. majors will complete the following core of courses during the freshman year: 110a-110b (except keyboard majors), 120a-120b, 130a-130b, 4-8 units in the major instrument or voice, 2 to 4 units of conducted ensemble, and 12 to 14 units of general education requirements, as outlined under the Bachelor of Music degree in the *Faculty of Fine Arts* section of this catalog.
Students should apply for admission to a specific major field of study prior to registration for sophomore courses.

**Basic Requirements:** All candidates for the B.M. must complete the following basic requirements: (1) general education requirements, as outlined under the Bachelor of Music degree in the *Faculty of Fine Arts* section of this catalog. (2) 110a-110b, 120a-120b, 130a-130b, 210a-210b (except for voice performance majors), 220a-220b, 320, 330a-330b. (3) One of the majors outlined below. All B.M. and B.F.A. students are required to take at least one 3-unit course focusing specifically on gender, race, ethnicity or non-western civilization. This course can be part of the major, general education, or elective course work and must be approved by a departmental advisor.

The **MAJOR IN PERFORMANCE** includes the following five areas of specialization:

- **Keyboard Instrument** — major instrument, 31 units (minimum entrance level: 185. Graduation requirement: 7 units of 485); *ensemble:* one semester of conducted, four semesters of accompanying, two semesters of coached, one semester of elective; Mus. 370, 410a-410b, 420a-420b, 421, 433a-433b, and a senior recital. Additional general academic electives, 14-18 units. **Minimum total units:** 130.

- **String Instrument** — major instrument, 31 units (minimum entrance level: 185. Graduation requirement: 7 units of 485); *ensemble:* eight semesters of conducted, six semesters of coached; Mus. 370, 410a, 421, 4 units of music electives; a senior recital; additional general academic electives. **Minimum total units:** 130.

- **Guitar** — major instrument, 31 units (minimum entrance level: 185. Graduation requirement: 7 units of 485); *ensemble:* one semester of conducted, seven semesters of guitar ensemble, Mus. 410a-410b, 420a-420b, 434, 5 units of music electives; academic electives, 14-18 units. **Minimum total units:** 128.

- **Voice** — voice, 31 units (minimum entrance level: 185. Graduation requirement: 7 units of 485); *ensemble:* eight semesters of conducted; 4 units of piano beyond the general requirement listed above; Mus. 175, 211a-211b, 205/405 (2 units), 370, 9 units of music electives; a senior recital; additional general academic electives, 16 units of foreign language. **Minimum total units:** 130.

- **Wind Instrument or Percussion** — major instrument, 28-32 units (minimum entrance level: 185. Graduation requirement: 8 units of 485); *ensemble:* eight semesters of conducted (minimum: three orchestra, three band, two jazz — if appropriate instrument), six semesters of coached; Mus. 370, 410a, 421, 4 units of music electives; a senior recital; additional general academic electives. **Minimum total units:** 130.

The **MAJOR IN JAZZ STUDIES:** Major instrument, 16 units of 2 units/semester (minimum entrance level: 181. Graduation requirement: 4 units of 385); minor instrument or voice, 6 units of one unit/semester; *ensemble:* six semesters of 200r/400r, four semesters of 200/400 (excluding 200r/400r), two semesters of 201e/401e, two semesters of coached ensemble electives; Mus. 302, 321a-321b, 331, 422, 6 units of music electives; additional general academic electives, 14-18 units. **Minimum total units:** 127.

The **MAJOR IN MUSIC EDUCATION:** Voice: seven semesters of 2 units per semester (minimum entrance level: 181. Graduation requirement: 2 units of 285 and a half recital); keyboard: Mus. 310a-310b, 81; *ensemble:* seven semesters of conducted; Mus. 211a-211b, 250, 370, 372, 450, 451; Ed.P. 311; T.T.E. 338m, 435, 493b, 494b, two education courses to be determined. **Minimum total units:** 125.

The **MAJOR IN INSTRUMENTAL MUSIC EDUCATION:** Major instrument: seven semesters of 2 units per semester (minimum entrance level: 181. Graduation requirement: 2 units of 285 and a half recital); *ensemble:* seven semesters of conducted (including one unit of 200r, if appropriate instrument); one semester of coached; Mus. 111, 153, 250, 350a-350b, 351a-351b, 352, 370, 371, 421, 450. Jazz Pedagogy or History: Ed.P. 311; T.T.E. 338m, 435, 493b, 494b, two education courses to be determined. **Minimum total units:** 130.

**ALL MUSIC EDUCATION MAJORS:** After completion of Mus. 250, all music education majors must pass the Pre-Professional Skills Test (PPST), must complete the Music Education Advisory Review (MEAR) process, and should have a 2.8 GPA in all music courses other than ensembles and a 2.5 GPA in all courses before being admitted to the junior level Teacher Education Program.
The **MAJOR IN THEORY AND COMPOSITION**: Major instrument or voice, seven semesters of 2 units/semester (minimum entrance level: 181. Graduation requirement: 6 units of 185); ensemble: six semesters of conducted, two semesters of coached; Mus. 240a-240b, 340a-340b, 370, 420a-420b, 421, 425, 440 (6 units), 441a-b; additional general academic electives. **Minimum total units**: 132.

**BACHELOR OF ARTS IN MUSIC**

This degree program is designed for students interested in music history who may wish to pursue a graduate degree in musicology or for those whose interest in music is essentially avocational.

The major: In addition to the general education requirements, as described under the Bachelor of Arts in the College of Arts and Sciences section of this catalog, the following course work is required: 110a-110b, 120a-120b, 130a-130b, 210a-210b, 220a-220b, 320, 330a-330b, 420a-420b; 3 units of music electives. The student also must complete six semesters of work in a major instrument or voice (minimum entrance level: 181. Graduation requirement: 2 units of 185) and four semesters of ensemble (including two semesters of Collegium Musicum). A 20-unit minor is also required (see Faculty of Fine Arts section of this catalog). To meet the general education requirements in a foreign language, German or French is recommended. **Minimum total units**: 123.

*In all music degrees the term “semester” in the ensemble requirement indicates that the student is required to register for the number of successive semesters of ensemble listed.*

**Music Theory, Composition, and Technology**

100. **Basic Musicianship** (3) I II CDT Introduction to the rudiments of musical notation, harmony, rhythm, and melody.

107. **Survey of Music I** (3) I II Introductory course which concentrates on developing perceptual skills through a study of many types of music, with emphasis on Western art music of the 18th, 19th and 20th centuries, as well as popular and ethnic musics.

120a-120b. **Musical Skills and Structure I** (3-3) CDT Study of rhythm, melody, harmony, texture, timbre, and form in music. Students work in analysis, composition, music reading, ear training, conducting and class performance. P, 100.

220a-220b. **Musical Skills and Structure II** (3-3) CDT Continuation of 120a-120b, dealing with music from the late medieval period through early 20th-century art music in chronological order. 2R, 3L. P, 120b.

302. **Recording Studio Production** (3) I II Recording studio procedures including the recording chain and pre-post and actual recording production techniques. P, with permission of the School of Music. (Identical with M.Ar. 302)

320. **Form and Structure in 20th-Century Music** (3) I Intensive analysis of posttonal music, beginning with serial works of Schoenberg through very recent compositions by major composers. Open to mus. majors and minors only. P, 220b.

396H. **Honors Proseminar** (3) I II

420a-420b. **Counterpoint** (3-3) Practical study of the counterpoint of the 16th (in 420a) and 18th (in 420b) centuries. P, 220b.

421. **Orchestration** (3) I CDT Instruments of the orchestra together with practical study of the art of symphonic scoring; original work and transcriptions. P, 220b.

422. **Jazz Arranging** (2) GC II Class instruction and practice in writing arrangements for small jazz combos, rock groups, stage bands, and pop-vocal combinations; detailed study of jazz instrumental practices and problems. Open to majors only or consult department prior to enrolling. P, 200r, 201j, 220b.

423. **Band Arranging** (2) GC II 1987-88 CDT Detailed study of band instrumentation; major works transcribed for concert band. P, 421.

441a-441b. **Introduction to Electronic Music** (3-3) GC [Rpt./1] Survey of the historical, theoretical and technical aspects of electronic music as applied to the composition of music in the contemporary idiom, including actual lab applications.

521. **Introduction to Graduate Music Theory** (3) II Introduction to graduate analysis with emphasis on the survey of analytical systems as applied to a number of stylistic periods. Both cognitive and aural procedures will be investigated, Open to majors only.
DEPARTMENTS AND COURSES OF INSTRUCTION

620a-620b. History of Speculative Theory (3-3) 1987-88 Survey of speculative theory in music, classical Greeks to present.

621a-621b. Analysis of Music of the 18th and 19th Centuries (3-3) Intensive analysis of works written in the larger forms. 621a: 18th century. 621b: 19th century. Open to majors only. 621a is not prerequisite to 621b.

622. Theory Pedagogy (3) I 1988-89 Study of the philosophies, procedures, techniques, and materials used in teaching theory at the college level.


696. Seminar
   c. Music Theory (1 to 6) [Rpt./9 units] II

Music History and Literature

108. Survey of Music II (3) I II Continuation of 107, with emphasis on Western art music, particularly that of the Medieval through the Baroque era, and the music of other cultures. 107 is not prerequisite to 108.

130a-130b. Introduction to Music Literature (2-2) CDT Survey of music literature, with emphasis on structure, period, and style. Open to mus. majors and minors only. P, CR 120a-120b.

207. Western Civilization and the Arts: The Twentieth Century (3) I II (Identical with F.A. 207, which is home)

307. Western Civilization and the Arts: Paleolithic through Renaissance (3) I II (Identical with F.A. 307, which is home)

317. Western Civilization and the Arts: Baroque through Nineteenth Century (3) I II (Identical with F.A. 317, which is home)

330a-330b. History of Western Music (3-3) CDT Detailed study of the history of music in Western civilization from its origins to modern times; its relationship to general cultural development. P, 220b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

331. Jazz History (3) I CDT Development of jazz in the United States.

430a-430b. Art Song Repertory (2-2) GC 1988-89 Class performance of representative selections from the standard repertory of German, Italian, French, Russian and English language art songs; problems of accompaniment, interpretation, style and ensemble. Registration restricted to singers and pianists. Open to majors only.

431a-431b. History of the Opera (3-3) GC 1987-88 Detailed study of the course of opera from its inception by the Florentine Camerata through Berg, Menotti, Stravinsky, Ginastera, Penderecki, Britten and others. Open to majors only.

432. Music in World Cultures (3) GC II CDT Overview of nonwestern musics in selected world cultures.

433a-433b. Piano Literature (3-3) GC Historical and stylistic study of keyboard literature, instruments and performance practices. 433a: Baroque through the early Romantic periods. 433b: Mid-Romantic through the Contemporary periods. P, 285-P. 433a is not prerequisite to 433b.

434. History and Literature of Guitar (3) GC II 1987-88 In-depth study of the evolution of the guitar, lute, and vihuela, including repertoire, style periods, and composers. Open to majors only.

520. Aesthetics of Music (3) I Exploration of the problems of musical meanings, including a panoramic examination of what philosophers, philosophic musicians and artists, and others of critical intelligence have contributed to comprehensive theory.

530. Music in the Renaissance (3) II 1987-88 Vocal and instrumental genres from Dufay through Palestrina. Open to majors only.

531. Music in the Baroque (3) I 1987-88 CDT The age of the basso-continuo; instrumental and vocal genres from Monteverdi through J. S. Bach. Open to majors only.

532. Music in the Classical Period (3) I 1988-89 CDT The Viennese classical tradition from its origins to Beethoven. Open to majors only.

533. Music of the Twentieth Century (3) II 1988-89 CDT Contemporary idiom in music; study of genres, styles, and techniques from post-Romanticism to the present. Open to majors only.


537. **Survey of Early Music** (3) S Intensive survey of music history from Gregorian chant to the late Baroque. Open to majors only.

600. **Introduction to Graduate Study in Music** (3) II Bibliographical materials; research resources, techniques, and problems directed toward grad. study in music. Required of all doctoral candidates in music. (Identical with LLS. 600)

630. **The Music of Bach** (3) II 1988-89

631. **The Music of Mozart** (3) II 1987-88

635. **Choral Literature and Techniques** (3) [Rpt./5] I II A research-oriented study of choral literature from all stylistic periods and genre from the Renaissance to the present, together with appropriate conducting techniques. 2R, 3L. Open to majors only. P, graduate standing in choral conducting or choral music education. No more than 12 units of this course may be applied to a graduate degree program.

653. **The Music Cultures of Asia and Oceania** (3) I 1988-89 Study of the musical styles and practices of Oceania and selected cultures in Asia, with emphasis on materials, instruments and ideas appropriate for classroom use.

696. **Seminar**  
   b. Musicology (1 to 6) [Rpt./9 units] I II

**Music Education**

250. **Introduction to Music Education** (3) I Observation of and practical field experience in public schools; video-taped class presentations. Field trips. Open to majors only.

310a-310b. **Functional Piano for Music Education Majors** (1-1) 310a: Development of functional piano skills needed for public-school music teaching, with emphasis on improvising, harmonizing, transposing, and accompanying. 310b: Continuation of 310a with materials of increasing difficulty; open-score part-reading and rehearsal techniques. P, 210b.

338m. **The Teaching of Secondary School Music** (3) II Carries credit in ed. only. (Identical with T.T.E. 338m)

350a-350b. **Woodwind Techniques and Materials** (1-1) I Class instruction on flute, clarinet, oboe, saxophone, and bassoon, including materials and procedures for teaching these instruments in the public schools. Open to majors only.

351a-351b. **Brass Techniques and Materials** (1-1) II Class instruction on trumpet, trombone, horn and other low brass, including materials and procedures for teaching these instruments in the public schools. Open to majors only.

352. **String Instrument Techniques and Materials** (3) I Class instruction on violin, viola, cello and bass, including materials and procedures for teaching these instruments in the public schools. Open to majors only.

360. **Music Fundamentals Through Experience** (3) II CDT Music skills, concepts and information learned through playing, singing and focused listening. Emphasis on beginning experiences with autoharp, guitar, recorder and voice. No prior musical training is assumed.

361. **Music Learning and Perception in the Preadolescent Child** (2) I II A study of processes by which children achieve musical growth. Examination of means, settings and materials through which children acquire musical understanding and competence.

370. **Introduction to Conducting** (2) I Conducting choral as well as instrumental ensembles; includes basic beat patterns, transpositions and clefs, and introduction to score study. P, 220b.

371. **Intermediate Instrumental Conducting** (2) II Conducting techniques for instrumental ensembles of varying sizes; instrumental rehearsal techniques, score reading, and score study. P, 370.

372. **Intermediate Choral Conducting** (2) II Conducting techniques for choral ensembles; training the chorus, choral musicianship, continuing work in score reading, basic choral literature and program planning. P, 370.

450. **Teaching Music in the Elementary School** (3) GC I CDT Role of the music specialist in the elementary school; materials, activities, and observation of demonstration teaching as they relate to a comprehensive music curriculum and qualitative musical experiences for children in grades K-6.

451. **Production and Techniques for Special Ensembles and Musicals** (3) GC I CDT Objectives, materials and activities for swing choirs, musicals and small ensembles in the secondary schools. Lecture and laboratory experience.
550. **Advanced Studies in General Music Teaching** (3) I S Development of musical concepts through creative experiences; survey of research into music learning in children; alternative systems: Dalcroze, Orff, Kodaly, MCCP. P, 361 or 451.

570. **Advanced Conducting** (3) [Rpt.] II Styles of choral, band, and orchestral literature, as they pertain to the problems of the conductor; references to the styles of all periods, with emphasis on the contemporary and modern.

645a-645b. **Techniques for the Vocal and Instrumental Coach** (3-3) Techniques needed by accompanists to coach singers and chamber music ensembles. P, CR 685p or 785p.

550. **Foundations and Principles of Music Education** (3) I History and philosophy of music education in the public schools, with emphasis on the basic concepts needed for effective teaching in the field of music, curriculum development and evaluation of the music program.

651. **Curriculum Development in Music** (3) II 1988-89 Principles and techniques of curriculum construction applied to the field of music.

672. **Teaching Music in Higher Education** (3) II Contemporary practices in planning, organizing, and evaluating learning experiences in music for college and university students. Open to music majors only.

696. **Seminar**
   a. **Music Education** (1 to 6) [Rpt./9 units] I II

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**Music Performance**

101a-101b. **Exploring Music through Piano for General Students** (3-3) 101a: Introduces and develops basic concepts of music as a creative process in studying piano. Music fundamentals, beginning improvisation, playing by ear, chording to melodies, music reading, and repertory. 101b: A continuation of 101a at advanced level with the addition of ensemble playing and piano concert field trips. P, 101a or by audition/ interview.

102a-102b. **Class Guitar for General College Students** (1-1) 102a: Introduction to basic guitar playing techniques for the general college student, with emphasis on literature and styles of playing of current interest to students. 102b: Development of guitar skills including sightreading, accompanying, tone production and other classical techniques. 102a and 102b are offered both semesters.

103. **Class Voice for General College Students** (1) [Rpt.] Practical training in singing, with emphasis on basic skills of breathing, tone and diction; repertory to include folk, current, and classic songs in English.

110a-110b. **Piano Class I** (1-1) CDT Introductory development of basic keyboard musicianship and technique through activities including playing by ear, improvising, harmonizing, transposing. Open to mus. majors and minors only. P, CR 120a-120b.

111. **Voice Class** (1) [Rpt.] Beginning instruction; introduction and development of basic skills, breathing, diction, tone, rhythm, sight-singing, repertory songs in English; practical training in singing without specialization. Open to mus. majors and minors only.

153. **Percussion Instruments Class** (1) I II Class instruction in all percussion instruments, including materials and procedures for teaching these instruments in the schools.

175. **Theatre Dance** (1) I S (Identical with Dnc. 175 which is home)

209. **Percussion for Dance Students** (2) I 1988-89 Rhythmic principles of music for dance majors through study and performance of percussion instruments. Open to dance majors only. (Identical with Dnc. 209)

210a-210b. **Piano Class II** (1-1) CDT Continuation of 110b, with additional sight- reading, score- reading, and accompanying. Open to mus. majors and minors only. P, CR 120a-120b.

211a-211b. **Diction for Singers** (2-2) Training in diction for singers in English, French, German, Italian, Spanish and Ecclesiastical Latin.

321a-321b. **Jazz Improvisation** (2-2) CDT 321a: Background for the art of improvising jazz. Audition required. P, 201e. 321b: Continuation and refinement of the techniques studied in 321a.

410a-410b. **Pedagogy** (2-2) GC Study of methods and repertory suitable for studio teaching. Open to mus. majors in their major performance area only.

Ensembles

All courses listed below are offered both first and second semesters and may be repeated. Prerequisite for entrance to all ensembles is by audition or by permission of the School of Music.

Large Conducted Ensembles (200, 400, 500) (1) Offering chamber music experience, designed to develop musical independence.

a. Summer Band
b. Marching Band
c. Concert Band
d. Symphonic Band
e. Wind Ensemble
h. Summer Chorus
i. Symphonic Choir
j. University Singers
k. University-Community Chorus
l. Chamber Choir
m. Choraleers
o. Symphony Orchestra
p. Chamber Orchestra
q. Collegium Musicum
r. Jazz Ensemble
s. Honor Choir (not at 500 level)

Coached Ensembles (201, 401, 501) (1) Offering chamber music experience; designed to develop musical independence.

a. Accompanying
b. Brass Ensemble
c. Percussion Ensemble
d. Guitar Ensemble

e. Jazz Combo
f. Saxophone Ensemble
g. String Ensemble
h. Woodwind Ensemble

Small Conducted Ensembles (202, 402, 502) (1)

a. Brass Choir
b. Contemporary Ensemble
c. Clarinet Choir
d. Musical Theatre

Opera Theatre (205, 405, 605) (1 to 4)

Training in all aspects of operatic production, including major singing roles, minor roles, opera chorus, opera scenes and chamber operas; technical training in set construction, makeup, costumes and lighting. 605 may also include operatic staging techniques. P for 405, 2 units of 205; P for 605, 4 units of 405 or permission of the School of Music.

Composition Studies: Individual and Group Instruction

240. Introduction to Composition (3) I II [Rpt./1] Introduction to the basics of music composition, stressing fundamental forms, techniques and procedures. P, 120b or permission of the School of Music.

340. Composition (3) I II [Rpt./1] Pursuit of the more sophisticated aspects of music composition in regard to form; handling of original ideas and searching for a broader and more practical view of music composition as a profession. P, 6 units of 240 or permission of the School of Music.

440. Compositional Techniques (3) I II [Rpt./15 units] Creative techniques in the fields of modern harmony, counterpoint, orchestration, electronic music, or specific projects in commercial-type composition and arranging. P, 6 units of 340 or permission of the School of Music.

640. Advanced Composition (2 to 6) I II [Rpt.] Individual projects in composition. Open to theory and composition majors only.

Performance Studies: Individual and Group Instruction*

All of the courses listed below are offered both first and second semester. Please see "Entrance Requirements" at the beginning of this section for information regarding prerequisites for 181 and 185.

*See schedule of fees below.
### DEPARTMENTS AND COURSES OF INSTRUCTION

#### PIANO

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<th>Course</th>
<th>Duration</th>
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#### PIANO ACCOMPANYING

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#### VOICE

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#### ORGAN

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#### CONDUCTING

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<td>685-Q, 785-Q</td>
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#### STRING INSTRUMENTS

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<td>Violin</td>
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<td>Cello</td>
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#### WIND INSTRUMENTS

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Horn
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185-D, 285-D, 385-D, 485-D (1 to 4)
580-D (1 to 2); 685-D, 785-D (1 to 4)

Trumpet
180-T, 181-T, 182-T (1 to 2)
185-T, 285-T, 385-T, 485-T (1 to 4)
580-T (1 to 2); 685-T, 785-T (1 to 4)

Bassoon
180-B, 181-B, 182-B (1 to 2)
185-B, 285-B, 385-B, 485-B (1 to 4)
580-B (1 to 2); 685-B, 785-B (1 to 4)

Baritone
180-E, 181-E, 182-E (1 to 2)
185-E, 285-E, 385-E, 485-E (1 to 4)
580-E (1 to 2); 685-E (1 to 4)

Saxophone
180-S, 181-S, 182-S (1 to 2)
185-S, 285-S, 385-S, 485-S (1 to 4)
580-S (1 to 2); 685-S, 785-S (1 to 4)

Tuba
180-Y, 181-Y, 182-Y (1 to 2)
580-Y (1 to 2); 685-Y (1 to 4)

Percussion
180-Z, 181-Z, 182-Z (1 to 2)
185-Z, 285-Z, 385-Z, 485-Z (1 to 4)
580-Z (1 to 2), 685-Z, 785-Z (1 to 4)

PERCUSSION INSTRUMENTS

MUSIC FEES

All students registering for private or group instruction are charged special fees according to the following schedule. Regular and scholarship students will be assigned to private or group instruction each semester only after a Music Fee Statement has been secured. Rental instruments, practice rooms and lockers are issued upon presentation of this statement.

Group lesson or one-half hour private lesson: $40.
One-hour private lesson: $60.
A music major registering for more than one weekly lesson will pay a maximum fee of $60.

Rentals

Instruments are rented as available for use in regularly scheduled music activities according to the following fee schedule. Any damage beyond normal wear and tear will be paid for by the renter of the instrument. All rental instruments must be returned by the end of the semester or on demand.

Piano rental: Pianos will be rented only to those enrolled in group, private instruction or keyboard class. $4 for one hour practice per day. $8 for two hours practice per day. $12 for three hours practice per day.
Organs, Harpsichords, and Synthesizer: $10 for one hour practice per day. $15 for two hours practice per day. $20 for three hours practice per day.
Harp: $20 for one hour practice per day. $25 for two hours practice per day. $30 for three hours practice per day.
Band and Orchestra Instruments: Rented only to those enrolled in ensembles or techniques and literature classes. $8 per semester.

Refunds will be made according to the refund schedule. No refund will be made on rental charges of $4 or less.

NATURAL RESOURCE RECREATION
(See Renewable Natural Resources)

NUCLEAR AND ENERGY ENGINEERING

Professors Robert L. Seale, Head, Barry D. Ganapol, David L. Hetrick, Richard L. Morse, Roy G. Post, Morton E. Wacks
Associate Professors W. Morris Farr, Rocco A. Fazzolare, William Filippone, George W. Nelson
Assistant Professor Leland M. Montierth
The department offers the Bachelor of Science in Nuclear Engineering, Bachelor of Science in Energy Engineering, Master of Science, and Doctor of Philosophy degrees with a major in nuclear engineering.

For undergraduate degree requirements, please see the College of Engineering and Mines section of this catalog. For graduate degree requirements, please see the Graduate Catalog.

103a-103b. Introduction to Nuclear and Energy Engineering (1-1) Introduction to selected fundamentals of engineering science and to the role of nuclear and energy-related technology in the world.

120. Technology and Society: An Historical Perspective (3) Significant developments in human history emphasizing the role of technology as an agent for social change; particular attention to the use of energy resources.


221. Radiation Detection and Isotopes Laboratory (3) Introduction to the principles and practices of radiation measurement, experimental techniques and data reduction methods. P, 231.

231. Basic Nuclear Processes (3) Nuclear structure and stability, radioactive decay and interactions of radiation with matter, with emphasis on momentum and mass energy balance, and process rate definition. P, Chem. 103b, 104b, Math. 125b.

343. Elements of Nuclear Reactor Theory (4) Neutron diffusion and slowing down theory, as applied to bare and reflected reactors; the effects of core inhomogeneity on neutron behavior. P, 231.

348. Introduction to Nuclear Reactor Engineering (3) The analysis and design of nuclear power stations, with emphasis on central station systems. P, 343.


396. Proseminar s. Status of Nuclear Energy (1) I II

410. Energy System Design (3) Modern techniques in synthesis and analysis are reviewed and applied to contemporary energy problems; economic evaluation, system modeling, optimization, and decision analysis. P, 348, A.M.E. 340a or Ch.E. 306.

415. Environmental Analysis of Energy Conversion (3) Engineering analysis, assessment, and resolution of energy-environment interaction, with consideration of power plant siting, emissions, thermal effects, and waste management.

416. Radiation Health Physics and Safety (3) Study of health physics practices and safety responsibilities; analysis of radiation environments and applications of basic shielding methods to provide understanding of accepted working practices.

417. Nuclear Energy and Power (3) Fundamentals of nuclear energy and radiation; engineering applications; the basic concepts of nuclear reactors and power systems. Designed for nonmajors.

420. Nuclear Engineering Laboratory (3) Experimental techniques for determining various parameters in nuclear systems; experiments using the critical and subcritical reactors. P, 343. Writing-Emphasis Course for nuclear engineering students. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

425. Nuclear Reactor Operations (2) Application of principles of reactor theory to the operation of a nuclear reactor; reactor instrumentation, control systems, operating procedures, and radiological safety; review of federal regulation governing reactor operation and operator licensing. P, 540 or 343 and 420.


435. Radiation Effects (3) Radiation effects on solids and radiation chemistry of gases and liquids, with emphasis on effects encountered in nuclear reactor, detector, and dosimeter systems. P, 343, CR M.S.E. 331R.

437. Introduction to Radioactive Waste Management (3) Influence of public policy and waste physical form on the design criteria for waste management systems.
NUCLEAR AND ENERGY ENGINEERING

441. **Contemporary Nuclear Power Systems** (3) GC I Analysis of present nuclear power plants, with emphasis on design decisions as they affect performance of individual systems; comparison of different contemporary systems. P, 348 or 417.

445. **Direct Energy Conversion** (3) GC II Engineering requirements for achieving direct conversion of energy to electrical power; the engineering of thermoelectric and thermionic converters, fuel cells, magnetohydrodynamic, and photoelectric systems. P, Math. 254; A.M.E. 340a; or Phys. 121. (Identical with A.M.E. 445 and E.C.E. 445)

450. **Introductory Nuclear Physics** (3) GC II (Identical with Phys. 450)

453. **Air Conditioning Engineering** (3) GC I (Identical with A.M.E. 453)

454. **Dynamics of Nuclear Systems** (3) GC I Nuclear reactor kinetics, integral transform methods, internal feedback effects, stability; reactor instrumentation and control. P, 343.

456. **Engineering System Simulation** (3) GC II Dynamic modeling and simulation of engineering systems, including energy conversion systems, nuclear and chemical reactors, and control systems, using digital continuous-system simulation languages. P, A.M.E. 340a or Ch.E. 306a; Math. 254.

463. **Energy from Biomass** (3) GC II (Identical with A.En. 463)

465. **Current Problems in Energy and Power** (1 to 4) [Rpt./6 units] GC II A multidisciplinary course with guest lecturers who are practicing professionals from the energy and power industry; a number of week-long, self-contained minicourses, with topics varying from year to year. (Identical with Ch.E. 465, and E.C.E. 465)

466. **Power Plant Electrical Design** (3) GC II (Identical with E.C.E. 466)

467. **Solar Energy Engineering** (3) GC I Energy analyses of solar collectors; selective surfaces; solar cells; energy storage; systems for solar heating and cooling; mechanical and electrical power; perspective. P, A.M.E. 340 or Ch.E. 306. (Identical with A.M.E. 467 and E.C.E. 467)

469. **Energy Engineering Laboratory** (3) GC I II Basic measurements of energy quality, quantity, flow, and conversion. Includes active and passive solar as well as other alternative energy sources. 2R, 3L. P, 467 or CR. (Identical with A.M.E. 469) Writing-Emphasis Course for energy engineering students. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

477. **Environmental Impact of Energy-Related Systems** (3) GC III (Identical with C.E. 477)

496. **Proseminar** s. Developments in Nuclear Power (1) I II

530. **Radiochemistry and Radiation Detection** (3) I Radiation detection and measurement, health physics, isotope applications, activation analysis, and instrumentation. 2R, 3L. P, Chem. 480b or Phys. 330. (Identical with Chem. 530)


541. **Power Plant Engineering** (3) II The application of fluid dynamic heat transfer and mechanical interaction principles to the engineering design of a power plant. P, 441, 540.

554. **Nonlinear Reactor Dynamics** (3) II Nonlinear dynamics of nuclear reactors; shut-down mechanisms, inertial effects, nonlinear stability criteria, time-dependent neutron transport, neutron waves, and applications to pulsed reactors, start-up transients, reactor stability, and reactor safety. P, 454.

567. **Advanced Solar Engineering** (3) II Research and development studies related to solar applications: engineering design, analysis, and economics. Course includes invited lectures, literature research, and an original paper. P, A.M.E. 340a, 442. (Identical with A.M.E. 567, Ch.E. 567, and E.C.E. 567)

569. **Energy Use: Analysis and Management** (3) I Analysis of energy utilization; methods to evaluate and improve efficiency of energy. (Identical with Ch.E. 569 and E.C.E. 569)


583a-583b. **Plasma Physics and Thermonuclear Theory** (3-3) 583a: I Fundamentals of the theory of fully ionized plasmas, including wave phenomena and stability of plasma fluids; introduction to plasma kinetic theory. 583b: I Deposition of energy in thermonuclear plasmas; relaxation times and transport coefficients from Fokker-Planck theory; advanced subjects. P, 483b. (Identical with Phys. 583a-583b)
596. Seminar  
   s. Advanced Nuclear Power Activities (1) II


630. Fuel Cycles for Nuclear Reactors (3) II 1988-89 The design and analysis of fuel cycles for nuclear reactors; the processes and requirements for fuel element design and the limitations of fuel element performance to reactor design; economic factors in fuel cycles. P, 540.

642. Reactor Theory II (3) II Fundamental theory of heterogeneous reactors, integral transport, blackness theory, perturbation theory, and applications; temperature coefficient, changes in reactivity due to fission product accumulation, fuel consumption, and conversion. P, 540.

645. Nuclear Safety (3) II Possible incidents involving nuclear materials in critical reactors, chemical processing systems, fuel shipment operations or subcritical arrays, including assessments of the magnitudes and consequences of nuclear incidents; determination of criteria for evaluating nuclear system safety, including plant siting and operational procedures. P, 343.


681a-681b. Analytical Methods of Transport Theory (3-3) 1987-88 Application of the Boltzmann equation to neutron and photon transport problems; exact solutions, the method of singular eigenfunctions, spherical harmonic expansions, the moments methods, integral transport theory, invariant embedding, variational techniques, applications to slowing-down problems. P, 642, Math. 422a-422b.

685. Inertial Confinement Controlled Fusion (3) I Advanced topics in inertial confinement fusion, including energy absorption and transport phenomena, stability of spherical implosion systems, laser and charged particle drivers and reactor designs. P, 483b, 470b. (Identical with E.C.E. 685)

687. Magnetic Confinement Controlled Fusion (3) II Theory and design of magnetic fusion systems; instabilities; transport and reactor design considerations associated with linear magnetic fusion systems; Tokamaks and mirror machines. P, 483b; Phys. 415b, 470b. (Identical with E.C.E. 687)

NURSING

Professors L. Claire Parsons, Dean, Agnes M. Aamodt, Jan R. Atwood, Eleanor E. Bauwens, Pearl P. Coulter (Emerita), Ada Sue Hinshaw, Margarita A. Kay, Beverly A. McCord, Arlene M. Putt (Emerita), Gladys E. Sorensen

Associate Professors Evelyn M. DeWalt, Rose Gerber, Josephine R. Gibson, Katherine J. Graham, Mary E. Hazzard, Alice J. Longman, Lillian Lynch (Emerita), Betty J. McCracken (Emerita), Merle H. Mishel, Carolyn Murdaugh, Alice L. Noyes, Jessie V. Pergrin, Linda R. Phillips, Lois E. Prosser (Emerita), Gayle A. Traver, Suzanne Van Ort, Mary J. Welty, Mary O. Wolanin (Emerita)

Assistant Professors Mary Alexander, Terry Badger, Jacqueline Blank, Carrie Jo Braden, Jane Byleckie, J. Keenan Casteel, Leanna Crosby, Wanda Frank, Jennie Joe, Elaine B. Jones, Angela Leal, Kathleen May, Pamela Reed, Joyce Verran, Anne Woodti

Lecturers Jacqueline Barth, Lana Biocca, Phyllis L. Dow, Patricia King, Kaye Ronsman, Julie Schmidt, Evelyn Shaw, E. Jean Snider

Instructors Judith Ayoub, Ruth Becker-Schaller, Linda Evans, Gale Manke, James McGraw, Janet Neff

Director of Student Affairs Mary E. Henkel

Professional nursing is a service which helps people achieve and maintain health and which requires a body of knowledge in pace with scientific advances. Nursing is based upon the natural and behavioral sciences, and students are encouraged to use these principles, and to include psychological and social as well as physical care in their applied nursing courses.

The degrees offered are the Bachelor of Science in Nursing,* Master of Science, Nursing Specialist, and Doctor of Philosophy with a major in nursing. For undergraduate admission and degree requirements, please see the College of Nursing section of this catalog. For graduate admission and degree requirements, please see the Graduate Catalog.
Starting with the nursing major courses in the junior year, all nursing students are required to provide their own cars for transportation to the clinical areas where they are assigned for patient-care experience. Students wear an official College of Nursing uniform for clinical courses. During these semesters the student must be enrolled for all required courses.

Honors: The College participates in the Honors Program.

At the time of catalog editing, requirements for the Bachelor of Science in Nursing degree were under review. Consult with the College of Nursing for current information.

340. **Nursing Skills in Assessment** (3) [Rpt./2] I II Designed to develop skill in interviewing and physical assessment for development of a problem-oriented patient record; basic preparation in health assessment. 2R, 3L. Open only to employed RNs; not open to majors.

341. **Women and Health** (3) I II Exploration of body processes and body experiences of women throughout the life cycle, through examination of research, traditional and feminist writings; health care consumerism. Not open to majors. (Identical with W.S. 341)

342. **Emergency Care of the School Age Child** (2) S GRD Emergency care for school age children and explanation of the nurse’s role. P, R.N. (Offered alternate summers.)

340. **Utilization of the Nursing Process in Meeting Basic Human Needs** (6) I II Application of scientific knowledge for assessment of basic human needs in levels of wellness; utilization of nursing process in assisting individuals and groups to meet their health care needs. Open to majors only.

345. **Basic Nursing Practice** (3) I II Principles of biopsychosocial sciences and selected psychomotor skills practiced by nurses. 2R, 3L. Open to majors only. P, CR 353.

359. **Introduction to the Nursing Profession and Research** (3) I II Orientation to and socialization into professional nursing, including utilization of intellectual skills to define a problem and to evaluate existing research. Open to majors only. P, 353 or CR. Writing-Emphasis course*

363. **Nursing of Adults with Health Problems** (11) I II Caring for adults experiencing a deviation from their usual levels of wellness, with emphasis on medical-surgical settings. Open to majors only. P, 353, 354, 359; CR Pcol. 472.

373a-373b. **Maternal-Child Nursing** (6-5) 373a: Maternal Health Nursing: Supervised clinical practice and study of nursing concepts and theories applied to the health care of women and families during the childbearing years. Open to majors only. 373b: Child Health Nursing: Supervised clinical practice and study of nursing concepts and theories regarding health care needs of children and adolescents and the impact these needs have on the family. Open to majors only. Both 373a and 373b are offered each semester and must be taken concurrently. P, 363, Pcol. 472; CR 375, 379.

375. **Nursing of Patients with Chronic Health Problems** (3) I II Caring for the chronically ill persons, with emphasis on assisting them to remain independent and functional within the limitations imposed by the illness. Open to majors only. P, 353, 363, Pcol. 472.

378. **Nursing in Death and Dying** (3) I Designed to provide students the opportunity to explore feelings regarding death, to consider needs and perceptions of the patient and the patient’s family, and to improve ability to provide nursing care. Open to majors only. Writing-Emphasis Course*

379. **Analysis of Nursing Problems** (2) I II Development of analytical skills related to research and professional problems; introduction to research approaches; interrelationship of professionalism and research. Open to majors only. P, 373, 375 or CR.

381. **Community Health Nursing** (6) I II Principles of public health science and synthesis of nursing practice and community health practice in a variety of community settings. 2R, 12L. Open to majors only. P, 373, 375, 379; CR 382, 388, 389.


387a-387b. **The Professional Nurse in the Health Care System** (8-8) 387a: Supervised clinical practice with the adult patient with medical-surgical problems leading to multiple systems effects. Open to majors only. P, 381, 382, 388, 389, CR 387b. 387b: A clinical course to enable students to function on the health care system and to apply management and leadership theories in professional nursing practice. Open to majors only. P, 381, 382, 388, 389; CR 387a. Both 387a and 387b are offered each semester.

388. **Issues in Nursing and Health Care Delivery** (2) I II Nursing, health care and societal issues which impinge upon the practice of professional nursing; nursing role and responsibility in determining directions for change. Open to majors only.

389. **Research Methods in Nursing** (2) I II Implementation of the research process, evidenced through design of a research proposal. Open to majors only. P, 379.
DEPARTMENTS AND COURSES OF INSTRUCTION

396H. Honors Proseminar (3) I

482. Legal Implications in Nursing (3) GC I II Overview of the nurse's relationship with law, as a practicing nurse, and as an individual; exploration of roles from student to expanded practice, in the community, in the legislative process. Advanced degree credit available for non-Ph.D. majors only. Writing-Emphasis Course*

483. Perspectives of Cancer Care for Health Professionals (3) GC S Current methods of care for individuals with cancer and for their families. 6R, 9L. Not accepted in doctoral program of study in nursing. P, enrollment in baccalaureate or graduate programs in nursing, pharmacy, or health-related professions. (Identical with H.R.P. 483 and Ph.Pr. 483)

484. The Health Professions and the Social Sciences (3) GC I Implications of concepts and theories from anthropology, psychology, and sociology for health care. Advanced degree credit available for non-Ph.D. majors only. Writing-Emphasis Course*

487. Poverty and Health (3) GC II Study of the relationship between poverty and health. Concepts and theories from anthropology, psychology, and sociology will be used to analyze problems associated with poverty. Advanced degree credit available for non-Ph.D. majors only. P, six units of soc. sci. (Identical with Anth. 487 and F.C.M. 487) Writing-Emphasis Course*

488. School Nurse Practice (3) GC S Analysis and application of nursing in school systems. Communication skills, teaching-learning principles for family, physical, psychological assessment. P, R.N. (Offered alternate summers.)

495. Colloquium a. Bilingual Health Communication (3) GC II (Identical with Anth. 495a, which is home.)

588. Clinical Anthropology (3) II Application of principles from anthropological theory to the actual practice of patient care, with emphasis on culture content of groups living in the greater Southwest. P, nine units of behavioral sci. (Identical with Anth. 588 and F.C.M. 588)

589. Health of the Older Adult (3) I Current research of the aging process including physical and mental alterations; emphasis on physiological changes. Consult college before enrolling. (Identical with Gero. 589)

600a-600b-600c. Nursing Theory and Practice (3-3-3) II S Maintenance, therapeutic and preventive nursing care of persons in various settings. Student elects practice in one area of nursing: (1) child; (2) community health; (3) gerontology; (4) maternal-newborn; (5) medical-surgical; (6) psychiatric-mental health. Laboratory is required.

602. Evaluation Process in Nursing (3) II Development and use of models and tools for assessing nursing processes, programs and performances. Approaches to and psychological reactants of evaluation are explored.

620. Clinical Teaching in Collegiate Schools of Nursing (6) II Curriculum planning and implementation; principles of teaching and learning, formulation of objectives, the selection and organization of learning experiences in the clinical area. Directed practice teaching is included in the area of clinical interest. P, 600a or 600c, CR 600b.

624. The Administrative Process (6) II Theoretical and practical applications of administration as a decision-making process in formulating a course of action essential to solving patient care and personnel issues. P, 600a or 600c, CR 600b.

625a-625b. Physiologic/Pathophysiologic Concepts: Nursing (3-3) S 625a: Stressor activated and host defense responses. Includes fever, nutritional deficits, pain, sleep disorders. Offered S. 625b: Health response disorders such as hypoxia, perfusion deficits, fluid imbalance, immune response disorders and neurologic insults. Physiology of reproduction, menopause, infertility. Offered S. 625a is not prerequisite to 625b. (625a and 625b offered alternate summers.)

630. Methods in Nursing Research (3) I Critical examination of selected problems and methods in the nursing research process. P, 600a or CR.

631. Clinical Phenomena: Theories and Research (3) I Theory and research surrounding common clinical phenomena (e.g., pain, stress), with emphases on description of clinical phenomena and identification of strengths and weaknesses in available knowledge and research. Laboratory is required. P or CR, 630, 600a or 600b or 600c.

705. Testing Nursing Theory (3) I Examination of selected theories currently utilized in nursing; testing of theories in practice; provision for an exercise in theory construction. Laboratory is required. P, 600a-600b-600c, 602, 630, six units of advanced human physiology, six units of an advanced social science.

710. Clinical Nursing Research (3) II Investigation of selected strategies appropriate to researching problems in clinical nursing. P, 600a-600b-600c, 602, 705, 630.
771. Methods in Clinical Nursing Research (3) I Application of research methods from the physical and social sciences to clinical nursing; experimental and nonexperimental designs; collection, analysis and interpretation of data; computer use. P, 705, 710, 630.

775. Study of Social Influences (3) S 1988 In-depth examination of social forces affecting the health care system.

779. Quantitative Nursing Research (3) II Provides knowledge necessary to deal with clinical nursing research numerical data sets. Emphasis on confirmatory and exploratory data. Analysis issues. Residual analysis is stressed. P, 771, graduate statistics course.

781a-781b. Instrument Construction (3-3) S Deductive and inductive processes for constructing/testing instruments to measure nursing care interventions/patient outcomes. 781a: Instrumentation for behavior and objective phenomena. 781b: Instrumentation for subjective phenomena. Includes instrument strategies; experience developing a pilot measure. 2R, 3L. Open to majors and minors only. P, 705, 710, graduate level statistics. 781a is not prerequisite to 781b. (781a and 781b offered alternate summers.)

782a-782b-782c. Field Work in Nursing Research (3-3-3) S III Individualized course of study incorporating research and clinical knowledge in a selected area of nursing practice in the laboratory and field setting. P, 600a-600b-600c, 602, 630, 705, 710.

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

NUTRITION AND FOOD SCIENCE


Associate Professors Ronald E. Allen, Don P. Bourque, K. Y. Lei, Ralph L. Price, Edward T. Sheehan, Alice B. Stanfield (Emerita), Ann M. Tinsley

Assistant Professors Patsy M. Brannon, Roger A. Sunde

Lecturer Barbara J. Zeches (Emerita)

The Department of Nutrition and Food Science provides instructional programs in all areas of nutrition and food science. These programs prepare students for careers in various phases of the food industry, governmental regulatory and consumer agencies, health care delivery systems, and for graduate study or professional schools of medicine or nursing.

The department offers the degree of Bachelor of Science in Agriculture with majors in food science, food service management, and nutritional sciences.

The Master of Science is offered with majors in food science, dietsetics, or nutritional sciences. The department also participates with the Committee on Nutritional Sciences, the Department of Biochemistry, and the Department of Microbiology and Immunology in offering the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

Students in N.F.S. may take the undergraduate extension non-formal education option available in the College of Agriculture. Courses required for the option are: A.Ed./H.E.E. 220, H.E.E. 428, H.E.E./A.Ed. 448, Agri./F.C.R./R.N.R. 493, 496; plus two elective courses from an approved list.

Undergraduate students will select one curriculum from Section I and one specialization from the majors offered in Section II.

I. CURRICULAR REQUIREMENTS:

Agriculture: Micr. 110; N.F.S. 101, 201, 251 and courses specified under College of Agriculture requirements.

Agricultural Science: Micr. 110, N.F.S. 101, 201, 251; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b; and courses specified under College of Agriculture requirements.
DEPARTMENTS AND COURSES OF INSTRUCTION

Agricultural Business: Micr. 110, N.F.S. 101, 201, 251; Chem. 103a-103b, 104a-104b, 241a-241b, and courses specified under College of Agriculture requirements.

II. MAJORS:

A. The major in food science*: Students must take the following courses applicable to their area of specialization.

Consumer food science: 340, 459, 470, C.S. 446; Art (3 units); Jour. 205, 206, 208, 364; M.Ar. (3 units); Mktg. 361, 450, M.A.P. 320, 330. An internship is required in the junior or senior year. Specialization in consumer food science prepares the student for employment in food company research and consumer product test facilities, regulatory agencies and the media.

Food technology: 360, 468, 470, and at least two additional units at the 400 level; Chem. 322, 323; Math. 123 or 125a, 160 or 263. Specialization in food technology prepares the student for employment in the food industry in areas of analysis, product development, quality assurance, regulation, marketing or management or as preparation for a related advanced degree study.

B. The major in food service management*: Students must take 180, 258, 458, 470; Chem. 101a-101b, 102a-102b, or 103a-103b, 104a-104b and 241a-241b; M.A.P. 305, 320, 330; M.I.S. 111; and the following courses applicable to their major area of specialization:

Administrative dietetics: (Approved Plan IV ADA) 340, 159a-159b; Ed.P. 310; Acct. 472 and 200 or 272; A.Ec. 439 or Math. 160; Psyc. 101; Soc. 100; Econ. 201a-201b and Math. 117e; Specialization in administrative dietetics leads to application for internship and credentials from the American Dietetic Association.

Hospitality: C.T. 284R, 304; Psyc. 300 recommended; Mktg. 361 or 364 or 366; Acct. (3 units); and M.I.S. 111 recommended. Specialization in hospitality prepares the student for a food and beverage management position in the hotel and restaurant industry.

The majors in food science and food service management are currently under review. Consult the department for further information.

C. The major in nutritional sciences: Students must take 406a-406b, 408, 441; Ecol. 159a-159b, Ecol. 464a-464b; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Math. 117e, 263; and the following courses applicable to their areas of specialization:

Dietetics: (Approved Plan IV ADA) 258, 340, 442, 443, 449, 458; Engl. 308; Psyc. 101 or Soc. 100; Anth. 102 or 200; Ed.P. 310; M.A.P. 330; M.I.S. 111 (recommended); Phys. 102a, 180a. Specialization in dietetics leads to application for internship and credentials from the American Dietetic Association. The department maintains cooperative arrangements with the University Medical Center and other health care and educational facilities.

Nutrition: Chem. 322, 323; Phys. 102a-102b, 180a-180b; Math. 118, 125a; and 340 recommended. Specialization in nutrition provides an excellent background for graduate study in nutrition, biochemistry, or other health related fields. It is not intended as a terminal degree.

Nutrition/exercise physiology: same requirements as nutrition with the addition of 26-27 units in Group V to include ex.s.s. (4 activity units), Ex.S.S. 276, 279, 370, 373, 374, 377, 380, 393b, 394e. This specialization is valuable for students interested in health care fields. It requires 136-137 units for graduation.

The major in nutritional sciences is a viable preparation for professional schools of medicine, dentistry, nursing or veterinary medicine.

III. MINORS

The department offers students the opportunity to minor in two areas of emphasis: food science and nutritional science. The minor requires at least 20 units of credit to include 12 units of upper division courses. Students would be expected to have pre-requisites and/or supporting courses that may be required for the courses in the minor.

A. The minor in food science: 101, 201, 251; 12 units from the following: 360, 459, 463, 466, 468, 470, 471, 499 (1-3 units).
B. The minor in nutritional sciences: 101, 201, 251; 12 units from the following; 238, 310 or 340, 410, 443, 447, 448, 499 (1-3 units).

Other courses in the department available in consultation with an advisor.

Honors: The department participates in the Honors Program.

101. Nutrition, Food, and You (2) I II Current concepts and controversies in nutrition and food safety; practical applications. Designed for nonmajors and for majors with no previous work in nutrition. Price

102H. Nutrition, Food, and You (3) [Rpt/1] I II Current concepts and controversies in nutrition and food safety. Interpretation and critical analysis of hypotheses, experimentation and risk/benefit in nutrition and food science. This course is an honors section of 101 in which a student will earn one extra credit for additional seminar time and projects done with faculty outside of class. Price

180. Science of Meat and Meat Products (3) I II (Identical with An.S. 180)

201. Nutrition and the Life Cycle (3) II Nutrient uptake and requirements for pregnancy, lactation, and infancy, and for adolescents, adults, and the aged. P, 101, Chem. 101b or CR; Chem. 241a (required of majors and recommended for nonmajors). Lei

238. Theories of Biological Aging (2) I Introduction to aging in man and lower animals; nutritional, immunologic, neurologic and genetic effects on the aging process. P, beginning course in biology. (Identical with Gero. 238) McCaughey

251. Food Study (3) I II Application of scientific principles in handling food for enhancement or preservation of quality. 2R, 3L. P, Chem. 101b or CR; Chem. 241a (required of majors, recommended for nonmajors). Tinsley

258. Institution Food Management (1) I II Quantity food preparation and service, menu planning for institutions, management of time and labor and use of institution equipment. P, 251. 3L Tinsley


340. Introduction to Diet Therapy (3) I Food composition, principles of interviewing and counseling, cultural aspects of diets, energy requirements, major diseases requiring diet therapy. P, 201; Chem. 103b, 104b; Ecol. 159b.


396H. Honors Proseminar (3) I Sunde


408. Human Nutrition (3) GC I Concepts of the physiology and biochemistry of nutrients and nutrient homeostasis in humans. P, 406a-406b or Bioc. 460, Ecol. 159a-159b, CR 464a. Lei Writing-Emphasis Course for nutritional sciences major.*

410. General Human Nutrition (3) GC II Advanced principles of nutrition: digestion, absorption and utilization of nutrients. Open to non-majors only. P, Chem. 112 or Micr. 103 or consult department before enrolling.

411. Consumer Fraud in Nutrition (3) GC S Consumer issues in fraud and its effects on nutritional status, general health, and family economic means. Methods of combating nutrition misinformation. P, 101 or 201, Econ. 201a or 201b. (Identical with C.S. 411, H.E.E. 411)

430. Principles of Nutrition (3) GC I II (Identical with Ap.S. 430)

438. Problems in the Biochemistry of Aging (2) GC I 1987-88 Current topics in the biochemistry of mammalian aging; examination of the metabolic, hormonal, immunologic and neural aspects of aging in lower mammals and humans. P, 406a-406b or Chem. 460 or 462b. (Identical with Gero. 438) McCaughey

441. Therapeutic Nutrition (4) GC II Therapeutic principles of nutrient acquisition and utilization, including modification of the diet, for selected disease and/or deficiency states; factors of importance in client/patient care, rehabilitation and education. P, 408.

442. Clinical Biochemical Evaluations (2) I Review, analysis and critique of the literature covering current research methodology and information related to clinical biochemical evaluations as applied to nutritional status assessment; oral reports, group projects, and discussion. CR 408. Sheehan
DEPARTMENTS AND COURSES OF INSTRUCTION

443. Community Nutrition (2) II Nutritional status assessment in the community setting; review of ongoing community programs in government and private agencies; analysis of requirements and role of community nutritionist; nutrition projects and grant writing. Field trips. Sheehan

447. Perspectives in Geriatrics Laboratory (1) GC II (Identical with Ph.Pr. 447)

448. Perspectives in Geriatrics (2) GC II (Identical with Ph.Pr. 448)

449. Nutritional Care Management (2) I Management methods applied to the administration of nutritional care in health care delivery systems for individuals in various life situations. 1R, 3L. Field trips. CR 408, 442.

455. Food Product Development (3) GC II 1988-89 Flavor, color, texture, temperature and appearance, as related to acceptability of food products; analysis of change during storage, preservation and preparation, as related to food composition and quality. 1R, 6L. P, 251, 360. Tinsley

458. Food Service Organization and Management (3) GC I Organization and management of food service systems; responsibilities of management for leadership, sanitation, maintenance, and care of food service plant and its equipment. P, 258. Writing-Emphasis Course for food service management major.*

459. Sensory Evaluation of Food (3) GC II 1987-88 Fundamentals of taste, odor, color, and rheology perception as related to food; design and methodology of small-panel and consumer-panel testing. 2R, 3L.

460. General Biochemistry (5) GC I (Identical with Bioc. 460)


465. Food Engineering (3) GC II 1988-89 (Identical with A.En. 465)

466. Postharvest Physiology (3) GC I 1987-88 (Identical with Pt.S. 466)

468. Food Processing (3) GC I Refrigeration, freezing, dehydration, heating, fermentation and pickling, irradiation and addition of chemicals, as they apply to food preservation and processing, retention of nutritive value, flavor, appearance and safety. P, Chem. 241b, Micr. 110. Price Writing-Emphasis Course for food technology specialization within the food science major.*

470. Food Microbiology and Sanitation (3) GC II Microbiology in processing and handling of foods; relation of microorganisms, insects, and rodents to design and function of processing and handling equipment. P, Micr. 120 or 217. (Identical with Micr. 470) Gerba

471. Food Microbiology and Sanitation Laboratory (2) GC II 1988-89 Lab. procedures for assessment of sanitary quality of foods. P, 470 or CR. (Identical with Micr. 471) Gerba

548. Nutrition in Sport and Exercise (3) II S (Identical with Ex.S.S. 548)

560. Advanced Food Chemistry (3) I 1987-88 Chemical and physical structure and functions of food constituents, additives, and food properties. P, 360, CR 406a. Berry

568. Nucleic Acids (3) II (Identical with Bioc. 568)

580. Composition and Structure of Meat (2) I 1988-89 (Identical with An.S. 480)

596. Seminar

n. Community and International Nutrition (1 to 3) II (Identical with F.C.M. 596n., which is home)


602. Metabolic Integration (3) II Food intake, transport, protein and amino acid utilization in higher animals. P, 408. Sunde

609. Nutritional Biochemistry Techniques (3) II Biochemical methods for evaluating metabolic functions of nutrients. 1R, 6L. P, 408, Chem. 324 or 325, and 323 or 326. (Identical with An.S. 609) Reid


628. Steroid and Lipoprotein Chemistry and Metabolism (2) II 1988-89 Chemistry and metabolism of mammalian sterols and lipoproteins; biosynthesis and metabolism of sterols and lipoproteins in health and disease; the role of diet in treating abnormalities of sterol and lipoprotein metabolism; sterols and disease. P, 406a-406b, 408. McNamara
630. Developmental Nutrition (3) II Role of nutrients in development and growth; changes in maternal and child nutritional requirements due to development and growth; current research in developmental nutrition. P, 408. Brannon

640a-640b. Field Methods in Human Nutrition (3-3) Case-oriented approach to nutritional assessment, diagnosis, prescription, plan and prognosis; application of dietary, clinical and biochemical methods. 2R, 3L. Open to majors in N.F.S. and other health sciences areas only. Kight


663. Chemistry of Food Carbohydrates (2) II 1988-89 Chemical and physical properties of carbohydrates important to their presence in food. P, Bioc. 462a, 460 or N.F.S. 406a-406b Berry

665. Chemistry of Food Proteins (3) II 1987-88 The chemical and physical properties of proteins important to their use as food; analysis and purification of proteins; biochemical properties of proteins in muscle, milk, eggs, cereals, and other foods. P, Bioc. 462a preferred, Bioc. 460 or N.F.S. 406a-406b acceptable. (Identical with Bioc. 665) Golf

672. Food Safety (2) I 1987-88 Significance and control of foodborne hazards associated with pathogenic microorganisms, microbial toxins, industrial chemicals, and other environmental contaminants. P, 471, Chem. 241b. (Identical with Micr. 672) Gerba

693. Internship
a. Dietetic Internship, ADA Accredited (1 to 6) [Rpt./2] I II Field trips. Consult dept. before enrolling. Open to majors only. P, Course work equivalent to American Dietetic Association Plan IV.

696. Seminar
b. Nutrition (1) [Rpt./6 units] I II (Identical with Nu.Sc. 696b)
c. Food Science (1) [Rpt./6 units] I II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

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NUTRITIONAL SCIENCES

Committee on Nutritional Sciences (Graduate)

Professors Gail G. Harrison (Family and Community Medicine; Pediatrics; Nutrition and Food Science), Chairperson, David S. Alberts (Internal Medicine), James W. Berry (Nutrition and Food Science), William H. Brown (Animal Sciences), Herbert E. Carter (Emeritus, Biochemistry), Milos Chvapil (Surgery), David L. Earnest (Internal Medicine), Darrel E. Golf (Nutrition and Food Science; Biochemistry), Mark Haussler (Biochemistry), J. Tal Huber (Animal Sciences), Wayburn S. Jeter (Microbiology and Immunology), Mary Ann Kight (Nutrition and Food Science), Otakar Koldovsky (Pediatrics), Timothy Lohman (Exercise and Sport Science), John A. Marchello (Animal Sciences; Nutrition and Food Science), W. F. McCaughey (Nutrition and Food Science), Donald J. McNamara (Nutrition and Food Science), Frank L. Meyskens (Internal Medicine), Bobby L. Reid (Animal Sciences; Nutrition and Food Science), Richard W. Rice (Animal Sciences), Frank D. Rollins (Animal Sciences; Nutrition and Food Science), William A. Stini (Anthropology), Brent Theurer (Animal Sciences), Marc E. Tischler (Biochemistry), Hugo V. Villar (Surgery), Charles W. Weber (Nutrition and Food Science; Animal Sciences), Frank M. Whiting (Animal Sciences), Ronald R. Watson (Research, Family and Community Medicine)

Associate Professors Ronald E. Allen (Animal Sciences; Nutrition and Food Science), James Blanchard (Pharmaceutical Sciences), Sergio Bustamante (Pediatrics), Charles Gerba (Microbiology-Immunology), E. F. Ho (Internal Medicine), K. Y. Lei (Nutrition and Food Science), Ralph L. Price (Nutrition and Food Science), Ronald E. Pust (Family and Community Medicine), Edward T. Sheehan (Nutrition and Food Science), Spencer Swingle (Animal Sciences), Ann M. Tinsley (Nutrition and Food Science), John Udall (Pediatrics), Cheryl K. Ritenbaugh (Research, Family and Community Medicine)

Assistant Professors Alan D. Bedrick (Pediatrics/Neonatology), Patsy M. Brannon (Nutrition and Food Science), Murray Korc (Internal Medicine), W. A. Schurg (Animal Sciences), Roger A. Sunde (Nutrition and Food Science),
The interdepartmental Committee on Nutritional Sciences offers research direction in all areas of nutrition, including nutritional biochemistry, human nutrition, clinical and community nutrition, and animal nutrition.

The committee offers graduate work leading to the Doctor of Philosophy degree with a major in nutritional sciences. Options in nutritional biochemistry, human nutrition (clinical or community), or animal nutrition may be selected within this major. For admission and degree requirements, please see the Graduate Catalog.

696. Seminar
   b. Nutrition (1) I II (Identical with N.F.S. 696b, which is home)

OCCUPATIONAL SAFETY AND HEALTH
(See Health-Related Professions)

OPERATIONS MANAGEMENT
(See Management and Policy)

OPTICAL SCIENCES

Committee on Optical Sciences (Graduate)


Associate Professor Eustace L. Dereniak, Stephan W. Koch (Physics), George N. Lawrence, Hans Roehrig (Adjunct, Radiology), Robert R. Schowengerdt (Electrical and Computer Engineering/Arid Lands)

Assistant Professors Ursula J. Gibson, William M. Hetherington III (Chemistry), Chris L. Koliopoulos, Nasser Peyghambarian, George W. Seeley (Research, Radiology), Robin N. Strickland (Electrical and Computer Engineering)

Lecturers James M. Palmer, Robert E. Parks (Adjunct)

Qualified applicants holding undergraduate degrees in engineering, mathematics or physics are admitted to undertake graduate programs in optical sciences. Current active research areas include electro-optics, image formation, image processing, laser physics, materials, medical optics, non-linear optics, optical bistability, optical design, optical fabrication and testing, optical properties of materials, pattern recognition, quantum optics, remote sensing, spectroscopy, surface physics, and thin-film technology. Interdisciplinary programs in progress involve the departments of Astronomy, Chemistry, Civil Engineering and Engineering Mechanics, Electrical and Computer Engineering, Physics, and Radiology, as well as the Microelectronics Laboratory, Arizona Research Laboratory, the Optical Circuitry Cooperative and the Optical Data Storage Center.

The degrees of Master of Science and Doctor of Philosophy are offered with a major in optical sciences. For admission and degree requirements, please see the Graduate Catalog.
210. **Geometrical Optics** (3) I Basic principles of light, refraction, reflection, paraxial optics, pupils and stops, properties of optical glass, visual and other instruments, aberrations, measurement and testing. 2R, 3L. P, Math. 125a. (Identical with E.C.E. 210)

226. **Physical Optics** (3) II Fundamentals of electromagnetic waves; plane harmonic waves; light as a vector wave, reflection and refraction, interference, diffraction. 2R, 3L. P, 210, Phys. 116. (Identical with E.C.E. 226)

350. **Radiometry, Sources and Detectors** (3) I Symbols, units and nomenclature; geometrical radiation measurement, blackbody radiation, sources, noise, detectors, source-detector interfaces. P, 226, Phys. 121. (Identical with E.C.E. 350)


412. **Optical Instrumentation** (3) I Microscopes, telescopes, cameras, high-speed photography, diffraction gratings, fiber optics, ophthalmic instruments; medical optical instruments, adaptive optics, optical scanners. P, 370. (Identical with E.C.E. 412)

416. **Optical Design, Fabrication and Testing** (3) II Optical design, optical fabrication and testing, optical materials and coatings, lens mounting and centering. P. 412. (Identical with E.C.E. 416)

434. **Electrical and Optical Properties of Semiconducting Materials** (3) GC I (Identical with E.C.E. 434 or M.S.E. 434)

440a-440b. **Atomic and Molecular Spectroscopy for Experimentalists** (3-3) GC (Identical with Phys. 440a-440b)


501. **Electromagnetic Foundations of Optics** (3) I Gauss’ law; Coulomb’s law; dipole moment; polarizability; Faraday’s law; Maxwell’s equations; the wave equations; plane waves; spherical waves; Fresnel’s formulas; dipole radiation; magneto-optic effects; electro-optic effects. P, Phys. 116, Math. 422b.

502. **Introduction to Fourier Optics** (3) I Harmonic analysis; linear systems; impulse response; convolution; Fourier transform; transfer function; diffraction; image formation; holography; optical data processing. P, Math. 223.

503. **First-Order Optical Design** (3) I Rays and wavefronts; Fermat’s principle; Snell’s law; dispersion; systems of plane mirrors; Gaussian imagery; paraxial imagery; paraxial design methods; Delano diagram; introduction to aberrations.

503L. **First-Order Optical Design Laboratory** (1) I Lab. in support of 503. P, CR 503.

504. **Introduction to Quantum Optics** (3) II Quantum background; interaction of radiation with matter; dipole moments; line broadening; quantization of radiation fields; spontaneous emission; stimulated emission; lasers. P, 501, Phys. 230. (Identical with Phys. 504)

505. **Interference and Interferometry** (3) II Wave equations; energy flow; polarization; interference; coherence; interferometers; optical testing; heterodyne interferometry; holography; speckle interferometry. P, 501, 502.

505L. **Interference and Interferometry Laboratory** (1) II Lab. in support of 505. P, CR 505.

506. **Principles of Optical Systems Design** (3) II Sources of aberrations; aberration control; aberrations in simple systems; vision; color; mechanical design principles. P, 503, 503L.

507. **Introduction to Solid-State Optics** (3) I Solid-state background; lattice vibrations; energy bands; energy gaps; optical properties of metals, insulators and semiconductors; measurement techniques; modulators; light-emitting diodes. P, 504.

508. **Probability and Statistics in Optics** (3) II Probability; random variables; stochastic processes; autocorrelation; Wiener spectrum; noise; applications in photography; atmospheric turbulence; analysis of random data. P, 502.

509. **Radiometry, Sources, Materials and Detectors** (3) II Radiometry; sources; materials and components for optical systems; imaging and non-imaging detectors. P, 502, 503, 503L.

513. **Optical Testing** (3) I 1987-88 Metrology of components; aspheric surface testing; assembly and alignment of systems; system evaluation. P, 505.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>513L</td>
<td>Optical Testing Laboratory</td>
<td>1</td>
<td>Lab. in support of 513. P, CR 513.</td>
</tr>
<tr>
<td>514</td>
<td>Aberration Theory</td>
<td>3</td>
<td>1987-89 Aberration theory; geometrical image formation; diffraction; pupil,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>spread, and transfer functions; random wavefront perturbations; system effects; image evaluation; image processing. P, 503.</td>
</tr>
<tr>
<td>517</td>
<td>Lens Design</td>
<td>4</td>
<td>1 Fundamentals of optical system layout and design; exact and paraxial ray tracing; aberration theory; chromatic and monochromatic aberrations. 2R, 6L. P, 506.</td>
</tr>
<tr>
<td>524</td>
<td>Optical Data Processing</td>
<td>3</td>
<td>1987-88 Inverse filtering; matched filtering; frequency-domain synthesis; the Vander Lugt filter; shadow-casting correlators; OTF synthesis; coded-aperture imaging. P, 505.</td>
</tr>
<tr>
<td>527</td>
<td>Holography</td>
<td>3</td>
<td>1988-89 Historical background; the Gabor hologram; the hologram as a zone plate; Fresnel, image, Fourier-transform, and reflection holograms; practical holography; limitations. P, 505.</td>
</tr>
<tr>
<td>531</td>
<td>Image Processing Laboratory</td>
<td>3</td>
<td>(Identical with E.C.E. 531)</td>
</tr>
<tr>
<td>532</td>
<td>Pattern Recognition and Computer Vision</td>
<td>3</td>
<td>(Identical with E.C.E. 532)</td>
</tr>
<tr>
<td>533</td>
<td>Image Processing: Devices, Systems and Applications</td>
<td>3</td>
<td>1987-88 Image formation; resolution; noise; linear processing; display; discrete images; sampling; coding; maximum efficiency codes; nonlinear computer processing; coherent processing. P, 502 or background in theory of linear systems. (Identical with E.C.E. 533)</td>
</tr>
<tr>
<td>541</td>
<td>Introduction to Lasers</td>
<td>3</td>
<td>1987-88 Laser theory; properties of lasers; stimulated emission; dispersion theory; gain saturation and rate equation; optical resonators; survey of laser types and mechanisms. P, Phys. 103b.</td>
</tr>
<tr>
<td>541L</td>
<td>Introduction to Lasers Laboratory</td>
<td>1</td>
<td>Lab. in support of 541. P, CR 541.</td>
</tr>
<tr>
<td>543</td>
<td>Laser Physics</td>
<td>3</td>
<td>1987-88 Density matrix formulation of interaction of radiation with matter; semiclassical laser theory; single and multimode scalar fields; moving atoms; ring and Zeeman lasers; pressure effects. P, 504. (Identical with Phys. 543)</td>
</tr>
<tr>
<td>544</td>
<td>Advanced Electrodynamics</td>
<td>3</td>
<td>1987-88 Normal modes of matter; macroscopic electrodynamics; optical activity; crystal optics; electro-optics; magneto optics; bulk acousto-optics; scattering. P, 501.</td>
</tr>
<tr>
<td>545</td>
<td>Nonlinear Optics</td>
<td>3</td>
<td>1987-88 Scattering of light; parametric amplification; Brillouin, Raman, Rayleigh scattering; stimulated and spontaneous interactions; frequency multiplication; intense field effects; materials damage theory. P, 501.</td>
</tr>
<tr>
<td>550</td>
<td>Fundamentals of Remote Sensing</td>
<td>3</td>
<td>1987-88 Physics and methodology of remote sensing; radiometry; data collection systems; photointerpretation; photogrammetry; image enhancement and classification; applications in the earth sciences.</td>
</tr>
<tr>
<td>558</td>
<td>Radiometry</td>
<td>3</td>
<td>1987-88 Units and nomenclature; Planck’s law; black bodies; gray bodies; spectral emitters; Kirchoff’s law; flux concepts; axial and off-axis irradiance; radiative transfer; normalization; coherent illumination; radiometric instruments. P, 501.</td>
</tr>
<tr>
<td>559</td>
<td>Infrared Techniques</td>
<td>3</td>
<td>1988-89 The radiant environment; atmospheric properties; optical materials and systems; detector description and use; data processing; displays, systems design and analysis. P, 558.</td>
</tr>
<tr>
<td>560</td>
<td>Physics of the Solid State</td>
<td>3</td>
<td>(Identical with Phys. 560)</td>
</tr>
<tr>
<td>565</td>
<td>Radiation Detector Laboratory</td>
<td>2</td>
<td>1987-88 Operational amplifiers, noise, signal processing, photovoltaic and photoconductive detectors, photomultipliers, thermal detectors. 6L. P, 509, CR 566.</td>
</tr>
<tr>
<td>566</td>
<td>Optical Detectors</td>
<td>3</td>
<td>1988-89 Photoconductors; semiconductors; signal and noise mechanisms; figures of merit; limitations on the sensitivity of detectors; photoemitters; detectors of ionizing radiation. P, 507.</td>
</tr>
</tbody>
</table>
568. **Solid-State Imaging Devices** (2) I-1988-89 Charge transfer devices; monolithic and hybrid focal planes, figures of merit; time-delay integration; flat zero; transfer efficiency; double-correlated sampling; buried-channel and surface-channel devices. P, 507.

570. **Advanced Optics Laboratory** (2) II Hands-on experience in current optics research areas. Emphasis is device-oriented. Guided waves; acousto-optics; optical bistability; diode lasers; nonlinear optics; optical phase conjugation. 1R, 3L. P, Phys. 121.


577. **Optics of Thin Films** (3) II Dielectric interference films; semiconductor and metallic films; planar wave guide films; design methods for multilayer interference filter coatings; thin film components for integrated optical circuits. P, 505.

595. **Colloquium**
   a. Current Subjects in Optical Sciences (1) I II

596. **Seminar**
   a. Introduction to Thin-Film Techniques (2) I 1987-88 P, Phys. 330

597. **Workshop**
   a. Optical Shop Practices (3) I II 1R, 6L. P, 513, 513L.


643. **Quantum Optics** (3) II 1988-89 Quantum theory of electromagnetic radiation; spontaneous emission; Dicke superradiance; optical coherence and noise; quantum theory of the laser; superconductivity and Josephson radiation. P, 543. (Identical with Phys. 643)

656a-656b. **Atmospheric Optics and Radiation** (3-3) I 1988-89 (Identical with Atmo. 656a-656b)

680. **Microcomputer Interfacing in the Optics Laboratory** (3) I Design and construction of interfaces between microcomputer systems and a variety of devices in the optics laboratory, including switches, motors, optical sensors, displays and terminals. Hardware and assembly language software drivers. 1R, 6L. P, C.Sc. 122 or E.C.E. 171.

696. **Seminar**
   a. Advanced Optical Design (1 to 3) II P, 517

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**ORIENTAL STUDIES**


Associate Professors Michael E. Bonine, Constance Cronin (Anthropology), Richard M. Eaton, Leslie A. Flemming, Charles H. Hedtke, Chisato Kitagawa, Ronald C. Miao, Michael Schaller (History), Daniel Swetschinski, William J. Wilson, Norman Yoffee (Anthropology)

Assistant Professors Marie Chan, John Y. Hou

Lecturer Edward D. Putzar

The Department of Oriental Studies offers instruction in the languages, cultures and civilizations of Asia and North Africa. Programs of study may emphasize the language and literature, history, thought, or society, ancient or modern, of one or more cultural areas.

The department offers the Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees with a major in Oriental studies. The Master of Education with a teaching major in Oriental studies is also available. Undergraduate majors may specialize in China, Japan, India-Pakistan, the Middle East, Judaic studies, or general Oriental studies. For courses concerning Ancient Near East Studies, see sections on Judaic Studies and the Middle East below.

**The major**: A minimum of 35 units from one of the following areas of specialization (listed with their additional specific requirements): (1) China: 100a-100b, 375a-375b, 400a-400b. (2) Japan: 102a-102b, 402a-402b. (3) India-Pakistan: 101a-101b and 408a-408b, or 105a-105b and 405a-405b. (4) Middle East: 477a-477b, 478, and two yrs. or equivalent of Arabic, Persian, Hebrew,
DEPARTMENTS AND COURSES OF INSTRUCTION

Akkadian, or other language approved by the adviser. (5) Judaic Studies: 103a-103b, 403a-403b or 409a-409b, two courses selected from 370a-370b and 372a-372b. (6) General Oriental Studies: program of study to be planned with and approved by general Oriental studies adviser.

The supporting minor may be chosen, with the consent of the adviser, from outside the department or from another area of specialization within the department (except for the student with a specialization in general Oriental studies, who must seek a minor outside the department).

The teaching minor: 171, 172 and/or 170a-170b, and twelve additional units selected in consultation with departmental advisers (see the social studies teaching major in the College of Education section of this catalog).

For information regarding the East Asia Study Center and the Near Eastern Center, see the College of Arts and Sciences section of this catalog.

Honors: The department participates in the Honors Program.

The courses listed below are grouped by areas of specialization within the Oriental studies major.

General Oriental Studies

130. Asian Religions (3) II Religions of India and the Far East. (Identical with Reli. 130)

140a-140b. Oriental Humanities (3-3) Major trends and traditions in the arts, literatures and languages, religions and philosophies of Asia. 140a: The Middle East, India and Pakistan. 140b: China and Japan. (Identical with Reli. 140a-140b)

170a-170b. Introduction to Asian Civilizations (3-3) Survey of traditional and modern periods. Topics include societies, economics, cultures and institutions, and western influences. 170a: China and Japan. 170b: South Asia and the Middle East.

333. Buddhist Meditation Traditions (3) Major forms of Buddhist meditation from both the South Asian and East Asian traditions, with emphasis on the nature of meditation as a variety of religious experience. (Identical with Reli. 333)

396H. Honors Seminar (3)

421a-421b. East Asian Buddhism (3-3) GC Buddhism in China, Korea and Japan with emphasis on the relationship between East Asian Buddhist thought and practice and the various historical contexts in which they emerged. P, 330a or consult department before enrolling. (Identical with Reli. 421a-421b)

429. Pedagogical Linguistics: Applied Linguistics for Language Teachers (3) GC II Survey of applied linguistics, with emphasis on phonology, morphology, syntax, contrastive/error analysis, and implications for language teaching of current linguistic theories. (Identical with Ling. 429, R.Lg. 429 and T.T.E. 429)

432. Islamic Mysticism (3) GC II 1988-89 Origin and development of Sufism and its impact on the Muslim and non-Muslim worlds. (Identical with Reli. 432)

451. The United States and East Asia: 1840 to the Present (3) GC II 1988-89 (Identical with Hist. 451)

463. Marxism in East Asia (3) GC I Evolution of Marxist thought in China and Japan. (Identical with Hist. 463)

464. International Relations of East Asia (3) GC II (Identical with Pol. 464)

468a-468b. Asia and the West (3-3) GC 1987-88 Processes of interaction between Europeans and the peoples and cultures of the Middle East, South Asia, and East Asia, from the Portuguese explorations to the present. (Identical with Hist. 468a-468b) Writing-Emphasis Course* for general major.

489. Women in East Asia (3) GC I Women in traditional China and Japan; analysis of changes occurring in the modern period. (Identical with Hist. 489 and W.S. 489)

496. Proseminar

a. Special Topics in Asian Studies (3) [Rpt./4]GC

b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

503b. Introduction to Comparative Literature and Literary Theory (3) II (Identical with C.P.L.T. 503b)

*Writing-Emphasis Courses, P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
China

100a-100b. Elementary Chinese (5-5) CDT Introduction to modern spoken and written Chinese (Mandarin).


331. Taoist Traditions of China (3) 1987-88 Intellectual foundations of Taoism in its two scriptural sources, the Lao Tzu and the Chuang Tzu, and a sampling of some of the varieties of religious practice which developed upon these foundations. (Identical with Reli. 331)


375a-375b. History of China (3-3) Historical development of China. 375a: To 750 A.D. 375b: 750 to 1900 A.D. (Identical with Hist. 375a-375b)

400a-400b. Intermediate Modern Chinese (5-5) GC CDT Grammar, reading, and conversation in the modern (Mandarin) language. P, 100b.


419. Neo-Confucianism (3) GC II Major figures and themes in the Revival Confucianism from the 11th century through recent times; emphasis on the thought of Chu Hsi and Wang Yang-ming. P, 330b or consult department before enrolling. (Identical with Reli. 419)

420a-420b. Linguistic Structure of Modern Chinese (3-3) GC Linguistic study of the phonological, morphological, and syntactic systems of modern Chinese, with particular attention to linguistic analysis. (Identical with Ling. 420a-420b)

440. Chinese Calligraphy (2) GC [Rpt.] 1987-88 Theory, practice, and aesthetics of Chinese brush writing, with emphasis on individual training and development.

443. Chinese Aesthetics (2) GC II Survey of traditional Chinese aesthetic concepts in language, literature, painting, calligraphy, and design.

460. Modern Chinese Foreign Relations (3) GC II (Identical with Pol. 460)

475a-475b-475c-475d-475e. Periods in Chinese History (3-3-3-3-3) GC In-depth treatment of major premodern eras. 475a: Ancient and classical, to 200 B.C. 475b: Early Empire, 200 B.C.-200 A.D. 475c: Medieval, 200-750 A.D. 475d: New Empire, 750-1350 A.D. 475e: Late Empire, 1350-1800 A.D. May be taken in any order and CR. (Identical with Hist. 475a-475b-475c-475d-475e)

476. Modern Chinese History (3) GC Historical survey of the period since 1911 which examines the revolutionary developments shaping contemporary China. (Identical with Hist. 476) Writing-Emphasis Course for China specialization.*

482. Social History of China (3) GC Formation of ancient Chinese society; organization of families and clans; social stratification, mobility, conflict, and control in traditional China; and transformation from traditional to modern society. (Identical with Hist. 482)

495. Colloquium
   a. Revolution in Chinese History (3) GC II (Identical with Hist. 495a)
   d. Modern Chinese Frontier Areas (3) GC I 1987-88 (Identical with Hist. 495d)

496. Seminar
   g. The Archaeology of Pre-Han China (3) GC II (Identical with Anth. 496g, which is home)


510a-510b. Chinese Historical Linguistics (3-3) 1986-89 Historical survey of the development of the Chinese language, with particular attention to linguistic changes in phonology, morphology, and syntax. P, 400b and a course in general linguistics.

520. Resources and Methods in Sinology (3) II 1987-88 Introduction to and exercises in the use of standard Sinological reference and research resources. P, 500b.
DEPARTMENTS AND COURSES OF INSTRUCTION


595. Colloquium
   a. China [3] [Rpt.] II

596. Seminar
   f. Classical Chinese Literature [3] [Rpt.] II
   g. Modern Chinese Literature [3] [Rpt.] II
   h. Premodern Chinese History and Politics [3] [Rpt.] II
   i. Modern Chinese History and Politics [3] [Rpt.] II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

India-Pakistan


444a-444b. Literature of India (3-3) GC 444a: Ancient and classical literature; philosophical, epic, dramatic, and poetic literature until 1200 A.D. 444b: Modern literature; lyric poetry, short stories and novels by contemporary writers. In Engl. 444a is not prerequisite to 444b.


471. Introduction to Indic Civilization (3) GC I Social and political institutions, arts and philosophy of traditional society from prehistoric times to c. 1000 A.D., with emphasis on Hindu religion and its interrelations with the social order. (Identical with Anth. 471 and Hist. 471) Writing-Emphasis Course for India-Pakistan specialization*


473. History of Modern India and Pakistan: 1750-Present [3] GC II 1987-88 Survey of political, social and economic developments in South Asia from the mid-18th century to the present. (Identical with Hist. 473) Writing-Emphasis Course for India-Pakistan specialization*


495. Colloquium
   c. South Asia [3] [Rpt./4] GC

595. Colloquium
   c. South Asia [3] [Rpt.] II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Japan

Prior to registering in any Japanese language course other than 102a, the student must demonstrate the minimum knowledge of Japanese recommended by the instructor.

402a-402b. Intermediate Japanese (5-5) GC CDT Grammar, reading, and conversation in the modern language.

411a-411b. Modern Japanese Grammar (3-3) GC Introduction to Japanese linguistics: morphology, syntax, semantics, and pragmatics. (Identical with Ling. 411a-411b)

412a-412b. Advanced Japanese (5-5) GC [Rpt.] CDT Reading from modern scholarship, fiction, and essays, with attention to grammatical analysis.


437. Japanese Religion (3) GC I Japanese Buddhism, Shinto, new religions, with emphasis on the period since 1600. Reading is in English; basic knowledge of Japanese history required. (Identical with Reli. 437)


474a-474b-474c. History of Japan (3-3-3) GC Social, cultural and political history of Japan. 474a: From earliest times to 1500. 474b: 1500-1800. 474c: 1800-present. (Identical with Hist. 474a-474b-474c) 474a and 474c are Writing-Emphasis Courses for Japan specialization.*

495. Colloquium
   b. Japan (3) GC [Rpt./2] I II

502. Literary Japanese (3) Introduction to the varieties of writing styles used from the 8th century to modern times, including Sino-Japanese, documentary, epistolary and purely literary styles.

596. Seminar
   r. Japanese History (3) [Rpt.] I II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Judaic Studies

103a-103b. Elementary Modern Hebrew (5-5) CDT Intensive introduction to basic oral skills, reading and writing in class and language lab.; leads to an understanding of Biblical and modern Hebrew.

332a-332b. Judaic Thought and Culture (3-3) Survey of intellectual currents in post-Talmudic Jewish history. 332a: Medieval Jewish philosophy, mysticism, and popular culture. 332b: Modern Jewish thought. (Identical with Reli. 332a-332b)


372a-372b. History and Religion of Israel in Ancient Times (3-3) Survey of the history and religion of ancient Israel. 372a: Biblical period through the Babylonian Exile; introduction to the Hebrew Bible. 372b: Ezra-Nehemiah to the Roman Empire, with emphasis on the formation of rabbinic Judaism. (Identical with Hist. 372a-372b and Reli. 372a-372b)

374. The Holocaust (3) II 1988-89 Socio-economic and intellectual roots of modern antisemitism, evolution of Nazi policy, the world of death camps, responses of Axis and Allied governments, and responses of the Jews. (Identical with Hist. 374 and Reli. 374)

382. Archaeology and the Bible (3) II Discussion of areas of common interest to Biblical studies and archaeology, with a survey of the major discoveries which illuminate the Old and New Testaments. (Identical with Reli. 382)


403a-403b. Intermediate Modern Hebrew (5-5) GC CDT Intermediate grammar, reading, conversation, and extensive presentation of the syntax and vocabulary of modern Hebrew, leading to a firm foundation in the language. P, 103b.


427. Religion and Mythology of Mesopotamia (3) GC II 1987-88 (Identical with Anth. 427)
428. Anthropology of Law (3) GC II 1988-89 (Identical with Anth. 428)

430. Prophecy in Ancient Israel (3) GC II Nature and origins of Biblical prophecy and its ancient Near-Eastern analogues, including intensive study of several major Biblical prophets. (Identical with Reli. 430)


453. Advanced Hebrew (3) GC [Rpt.] Advanced topics in Biblical, Rabbinic, and/or modern Hebrew language and literature. P, 403b or 409b.

454. Spanish Inquisition (3) GC I 1988-89 (Identical with Hist. 454)

455. Introduction to Rabbinic Literature (3) GC II Reading in translation and interpretation of Hellenistic, Jewish, Rabbinic, and related literatures including legal, ethical, moral, and social interpretation of Scripture and oral traditions (Identical with Reli. 455)

495. Colloquium
   g. Judaic Studies (3) [Rpt./4] GC Consult department before enrolling.

595. Colloquium
   g. Judaic Studies (3) [Rpt./4] Consult department before enrolling.

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Middle East

104a-104b. Elementary Arabic (5-5) CDT Conversation and readings in modern standard Arabic.

105a-105b. Elementary Persian (5-5) CDT Conversation, reading, and composition in modern Persian.

171. Ancient Civilizations of the Near East (3) I Survey of pre-Islamic cultures of Persia, Mesopotamia, Syria-Palestine, Anatolia and Egypt, with emphasis on unifying themes and institutions. (Identical with Anth. 171 and Hist. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II Survey of the traditional and contemporary social, political, and economic institutions of Islamic civilizations in the Middle East. (Identical with Anth. 172 and Hist. 172)


405a-405b. Intermediate Persian (4-4) GC CDT Conversation in the dialect of contemporary Iran; extensive readings in classical and modern literature. P, 105b.

414a-414b. Advanced Arabic (3-3) GC Continuation of 404b, with emphasis on oral and written comprehension and expression. P, 404b. 414a is not prerequisite to 414b.

415a-415b. Advanced Persian (4-4) GC CDT Readings in Persian, with the objective of preparing the student for independent research. 415a: Contemporary prose. 415b: Poetry and prose. P, two yrs. of Persian. 415a is not prerequisite to 415b.

424a-424b. Conversational Levantine Arabic (3-3) GC 1987-88 Extensive oral drill, with emphasis on the acquisition of facility in normal conversation and comprehension. P, 104a.


426. Introduction to Arabic Linguistics (3) GC II History and structure of the Arabic language in its various forms. P, 104b, Ling. 101. (Identical with Ling. 426)

434. Islamic Thought (3) GC II Traditional ideological systems of Islamic countries and their evolutionary transformations. (Identical with Reli. 434)

439a-439b. Egyptian Arabic (3-3) GC Introduction to the Cairene dialect. Phonology, common greetings, basic vocabulary and grammar.

441. Arab-Israeli Conflict (3) GC I I S (Identical with Pol. 441)

442. Transformation of Agrarian Societies in the Middle East (3) GC II Dynamics, processes, and implications of rural change in the Middle East; focus on changes in peasant communities, nomadic pastoralists, rural-urban relations, and planned change. (Identical with A.Ec. 442, Pol. 442, Soc. 442)
448. Arabic Literature in English (3) GC 1987-88 Historical survey of Arabic literature of the Middle East and Mediterranean world, with readings in English translations.

449. Persian Literature in English (3) GC II 1988-89 Historical survey of Persian literary traditions, with readings in English translations.

457. Prehistoric Mesopotamia (3) GC I 1987-88 (Identical with Anth. 457)

458. Government and Politics of the Middle East (3) GC II Government and politics of the Middle East, combining study of Islamic institutions with a view to their applicability in the contemporary Middle East. (Identical with Pol. 458)

459. Topics in Economic Geography of the Middle East (3) GC II (Identical with Geog. 459)

467. Population and Development in the Middle East (3) GC I Review of theories and research in population, resources and socioeconomic development, with emphasis on determinants and consequence of population growth and migration in contemporary Middle East. (Identical with A.Ec. 467, Pol. 467)

469. Geography of the Middle East (3) GC I Physical environments and cultural areas of Southwest Asia, with emphasis on man-environment interrelationships, settlement systems and impact of Islam. (Identical with Geog. 469)

477a-477b. History of the Middle East (3-3) GC History of civilization in the Middle East from the rise of Islam to the 18th century. 477a: Period of Arab dominance. 477b: Period of Turkish dominance. 477a is not prerequisite to 477b. (Identical with Hist. 477a-477b) 477a is a Writing-Emphasis Course* for Middle East specialization.

478. Modern History of the Middle East (3) GC I Near and Middle Eastern history since the late 18th century, with special emphasis on Egypt and areas to the east. (Identical with Hist. 478) Writing-Emphasis Course* for Middle East specialization.

479. The Ottoman Empire to 1800 (3) GC II 1988-89 Great age of the Ottoman state, its origins and decline. (Identical with Hist. 479)

481a-481b. Archaeology of Syria-Palestine in the Bronze and Iron Ages (3-3) GC Survey of the Bronze and Iron Age cultures of Syria-Palestine, ca. 3500-500 B.C., with emphasis on the use of archaeological materials in historical reconstruction. (Identical with Anth. 481a-481b)

484a-484b. Akkadian Linguistics (3-3) GC 1988-89 (Identical with Anth. 484a-484b)

495. Colloquium
   h. Middle East (3) [Rpt./4] GC Consult department before enrolling.
   n. Modern Arabic Prose (3) [Rpt./1] GC P, Two years of Arabic.
   o. Classical Arabic Prose (3) [Rpt.] GC P, two years of Arabic.
   z. Readings in Classical Arabic Poetry (3) GC S P, 3 years of Arabic for non-native speakers of Arabic.

584a-584b. Readings in Akkadian (3-3) 1987-88 (Identical with Anth. 584a-584b)

596. Seminar
   m. Middle East: Topics in History and Civilization (3) [Rpt.] I II
   p. Middle Eastern Urbanism (3) [Rpt.] I II
   q. Near Eastern Archaeology (3) [Rpt.] I II (Identical with Anth. 596q)
   t. Tribe and State in the Middle East (3) I

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

PERSONNEL MANAGEMENT

(See Oriental Studies)
PHARMACEUTICAL SCIENCES

Professors Arnold R. Martin, Head, Willis R. Brewer (Emeritus), Jack R. Cole, Michael B. Mayersohn, William A. Remers, Samuel H. Yalkowsky, Joseph A. Zapotocky (Emeritus)
Associate Professors James Blanchard, Joseph J. Hoffmann (Arid Lands Resource Sciences), Karl H. Schram
Assistant Professors Michael D. Karol, Nair Rodriguez-Hornedo, Barbara Timmermann (Arid Lands Resource Sciences)

The Department of Pharmaceutical Sciences includes the academic disciplines of pharmaceutical chemistry, biopharmaceutics/pharmacokinetics, pharmaceutics, and pharmacognosy. Courses pertinent to the Bachelor of Science in Pharmacy are offered. Please consult the College of Pharmacy section of this catalog for undergraduate admission and degree requirements.

The Master of Science and Doctor of Philosophy degrees with a major in pharmaceutical sciences are available. Concentration within the major include pharmaceutical chemistry, biopharmaceutics/pharmacokinetics, pharmaceutics and pharmacognosy. For admission and degree requirements, please see the Graduate Catalog.

A student must be enrolled in the College of Pharmacy before taking any pharmaceutical science course required in the professional curriculum, except as approved by the department.

Honors: The department participates in the Honors Program.

300. Pharmaceutical Calculations (2) I Pharmaceutical calculations pertinent to the selection, formulation, preparation, dosage and administration of drugs and their dosage forms. (Identical with Ph.Pr. 300)

302a-302b. Pharmaceutics (4-4) Application of physical-chemical principles to pharmaceutical dosage forms, including a discussion of the biopharmaceutical considerations which influence the efficacy of pharmaceutical formulations. 3R, 3L. 302a: P, Phys. 102b, 180b, Chem. 103b, 104b. 302b: P, Ph.Pr. 300.


424. Antibiotics (2) GC I (Identical with Ph.Pr. 424)

427. Antineoplastic Drugs (2) GC II Discovery and development of natural and synthetic antineoplastic drugs; preclinical screening and toxicity evaluation; phase I, II, and III clinical studies in humans. P, 437b or CR.

430a-430b. Medical Radiopharmaceuticals (3-3) GC Medical applications, safe handling, measurement and preparation of radiopharmaceuticals. 2R, 3L. P, Math. 123, 263, Phys. 102b, 180b, Chem. 103b, 104b.

437a-437b. Medicinal Chemistry and Pharmacognosy (4-4) GC Relationships between the chemical structure and physiological activity, incompatibilities and stability of the organic and inorganic compounds obtained from natural and synthetic sources; essentials of pharmacognosy, including biologicals. P, 302b, Chem. 241b, 243b.

438. Pharmaceutical Analysis (2) GC II Modern methods and instrumentation used for qualitative and quantitative determination of drugs and metabolites. P, Chem. 323.

475a-475b-475c. Pharmacotherapeutics (2-3-6) GC (Identical with Ph.Pr. 475a-475b-475c)

512. Quantitative Structure-Activity Relationships (3) 1987-88 Approaches to the quantification of pharmacological actions of drugs on the basis of chemical structure.

575. Advanced Pharmacotherapeutics (6) II (Identical with Ph.Pr. 575)

596. Seminar
   a. Pharmaceutical Sciences (1) [Rpt./5] I II
   b. Pharmaceutical Chemistry Research (1) [Rpt./5] I II
   c. Pharmaceutics Research [1 to 2] [Rpt./5] I II Open to majors only.

601. Advanced Physical Pharmacy (3) II 1988-89 Applications of physical chemistry to pharmacy. P, physical pharmacy or physical chemistry course.


630a-630b. Advanced Organic Medicinals (3-3) 1988-89 Rational drug design, receptor site theories, mechanism of drug action, and metabolic pathways of medicinal agents; chemical and enzymatic synthesis of important pharmaceuticals. P, 437b, Pcol. 471b.


634. Biomedical Applications of Mass Spectrometry (3) I 1987-88 Principles of mass spectrometry including instrumental design, interpretation of spectra, and applications to biomedical and related problems. P, Chem. 241b

875. Advanced Pharmacotherapeutics (Pharmacy) (8) (Identical with Ph.Pr. 875)

PHARMACOLOGY

(Pharmacology, College of Medicine)

Professors Thomas F. Burks, Head, David S. Alberts (Internal Medicine), H. Vasken Aposhian (Molecular and Cellular Biology), Klaus Brendel, Rubin Bressler (Internal Medicine), Burnell R. Brown (Anesthesiology), Ryan J. Huxtable, David G. Johnson (Internal Medicine), Eugene Morkin (Internal Medicine), Charles W. Putnam (Surgery), William R. Roeske (Internal Medicine), Diane H. Russell, I. Glenn Sipes (Pharmacology and Toxicology), Henry I. Yamamura

Associate Professors Dean E. Carter (Pharmacology and Toxicology), Kenneth A. Conrad (Internal Medicine), Thomas P. Davis, A. Jay Gandolfi (Anesthesiology), David L. Kreulen, Thomas J. Lindell, John D. Palmer, Thomas L. Smith (Research)

Assistant Professors William Banner (Biology), John J. Duffy (Research), Timothy C. Fagan (Internal Medicine), Laurel A. Fisher, Ronald J. Lukas (Research), Frank Porreca

Instructors Alan D. Barreuther (Pharmacy), William L. Fritz (Pharmacy)

Pharmacology is a broad discipline involving the investigation of the actions of chemicals upon living material at all levels of organization. The discipline occupies an important interface between the basic medical sciences and the clinical sciences, drawing strongly upon the former for its contribution to the latter. In the health professions, pharmacologic knowledge is applied to the diagnosis, prevention, cure or relief of symptoms of disease, and to the promotion of optimal health.

In conjunction with the Department of Pharmacology and Toxicology in the College of Pharmacy, the department offers a joint program of instruction leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology. Students work under the administration of the Committee on Pharmacology and Toxicology (Graduate).

501. The Pharmacological Basis of Therapeutics (6) II Actions of chemical agents upon living material at all levels of organization, with emphasis on mechanisms of action of prototype drugs; foundation for a rational approach to human therapeutics and toxicology. P, Psio. 601, Bioc. 501. (Identical with Tox. 501)

520. Clinical Pharmacology (2) I Effects of drugs on natural history of disease; drug-drug interactions; drug testing designs; drug abuse; drug literature evaluation; aspects of clinical toxicology. P, 501.

550. Drug Disposition and Metabolism (2) II Principles of absorption, distribution and excretion of drugs, with emphasis on mechanisms of drug metabolism and pharmacokinetics. P, 462a-462b or 501; Bioc. 501, Tox. 602a. (Identical with Tox. 550)


561a-561b. Introduction to Pharmacological and Toxicological Literature (1-1) Designed to broaden the background of students in pharmacology and toxicology, and to improve scientific communication skills. P, 501. (Identical with Pcol. 561a-561b)

576. Environmental Toxicology (3) I (Identical with Tox. 576)

582. Immunotoxicology (2) I (Identical with Tox. 582)

586a-586b. Introduction to Pharmacology and Toxicology Research (1-1) Introduction to basic research techniques in pharmacology and toxicology through supervised laboratory rotations; student-initiated and faculty-structured lab. exercises in modern pharmacological and toxicological techniques. P, CR 501, Bioc. 565, Psio. 601.

596. Seminar
   a. Advanced Graduate Research (1 to 3) [Rpt./3] I II P, 561b. (Identical with Pcol. 596a)

601. Analytical Instrumentation and Techniques (4) I (Identical with Tox. 601)

602a-602b. Biotoxicology (3-1) (Identical with Tox. 602a-602b)

653. Neuropharmacology (3-4) II (Identical with Pcol. 653)

695. Colloquium
   a. Cellular/Molecular Pharmacology (1 to 3) [Rpt./4 units] I II P, Bioc. 462a-462b; 566a-566b and/or Phcl. 551.

800. Research (1 to 6)

801. The Pharmacological Basis of Therapeutics (6) II

815. Subspecialty

891. Preceptorship
   a. Pharmacology (3 to 12) [Rpt./12 units]

PHARMACOLOGY AND TOXICOLOGY

(Department, College of Pharmacy)


Assistant Professors Cliff Crutchfield (Family and Community Medicine), William S. Dalton (Internal Medicine), Robert T. Dorr (Internal Medicine), James R. Halpert, Andrea Hubbard (Microbiology and Immunology), Daniel C. Liebler, John Sullivan (Emergency Medicine and Pharmacology), Mark Van Ert (Family and Community Medicine)

Pharmacology is the science concerned with all aspects of the action of drugs on living systems. Its primary aim is the development and evaluation of drugs for the treatment of human disease. The broad scope of interests of pharmacology ranges from the study of intermolecular reactions of chemical constituents of cells with drugs to the effects of chemicals in our environment on entire populations. In conjunction with the Department of Pharmacology in the College of Medicine, the department offers a joint program of instruction leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology. For admission and degree requirements, please see the Graduate Catalog.

Toxicology is the science concerned with the harmful effects of chemicals (including drugs) on living systems. The toxicology program offers a curriculum leading to the Master of Science degree with a major in toxicology. The program prepares students for careers in hospital laboratories, police crime laboratories, medical examiners' offices, industrial hygiene laboratories, and toxicology laboratories in industry, government, and universities. For admission and degree requirements, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.
Pharmacology

401. Human Gross Anatomy (3) II (Identical with Anat. 401)

471a-471b. Fundamentals of Pharmacology (4-4) GC Comprehensive study of the biochemical, physiological, and therapeutic effects of drugs, including mechanisms of drug action and drug toxicity, and drug literature evaluation. 3R, 3L. P, Anat. 401, Bioc. 460, Psio. 480, 481; CR Ph.Pr. 475a-475b and Ph.Sc. 437a-437b. (Identical with Tox. 471a-471b)

472. Applied Pharmacology (3) GC I II Pharmacodynamics, pharmacology, and adverse effects of commonly used drugs, with emphasis on clinical applications. Not available for elective credit in the College of Pharmacy or graduate credit in pharmacology-toxicology doctoral programs. P, Ecol. 159b.

474. Clinical Toxicology (2) GC II Prevention, characteristics, diagnosis and rational management of diseases caused by drug overdose, toxic household products, poisonous plants, venomous animals, environmental and industrial toxicants. P, 472 or 471b, Ph.Sc. 407. (Identical with Tox. 474)

475a-475b-475c. Pharmacotherapeutics (2-3-6) GC (Identical with Ph.Pr. 475a-475b-475c)

561a-561b. Introduction to Pharmacological and Toxicological Literature (1-1) (Identical with Phcl. 561a-561b)

575. Advanced Pharmacotherapeutics (6) II (Identical with Ph.Pr. 575)

596. Seminar
   a. Advanced Graduate Research {1 to 3} [Rpt./3] III (Identical with Phcl. 596a, which is home)

653. Neuropharmacology (3-4) II Role of various neurochemicals in the peripheral and central nervous systems and the effects of drugs on the nervous system, including their actions at receptors and their influence on synthesis, storage, and release of neurotransmitters. P, Phcl. 501 or Pcol. 471b, 561a, 596. (Identical with Phcl. 653 and Tox. 653)

695. Colloquium
   a. Research Conference (1 to 4) [Rpt.] I II

875. Advanced Pharmacotherapeutics (Pharmacy) (8) (Identical with Ph.Pr. 875)

Toxicology

423R. General Pathology (3) GC II (Identical with V.Sc. 423R)

423L. General Pathology Laboratory (1) GC II (Identical with V.Sc. 423L)


462a-462b. Biochemistry (4-3) GC (Identical with Bioc. 462a-462b)

463a-463b. Human Physiology Laboratory (1-1) GC (Identical with Ecol. 463a-463b)

464a-464b. Human Physiology (3-3) GC (Identical with Ecol. 464a-464b)

465. Statistics for the Medical Sciences (4) GC I (Identical with Stat. 465)

471a-471b. Fundamentals of Pharmacology (4-4) GC (Identical with Pcol. 471a-471b)

474. Clinical Toxicology (2) GC II (Identical with Pcol. 474)

480. Human Physiology (4) GC II (Identical with Psio. 480)

481. Physiology Laboratory (1) GC II (Identical with Psio. 481)

486. Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487. Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

501. The Pharmacological Basis of Therapeutics (6) II (Identical with Phcl. 501)

508. Insecticide Toxicology (3) II 1987-88 (Identical with Ento. 508)

550. Drug Disposition and Metabolism (2) II (Identical with Phcl. 550)


554. Industrial Toxicology and Chemical Exposures (2 to 4) I Principles of toxicology related to industry; dose response; mechanisms of toxicity; hazard evaluation principles; toxicology of major classes of industrial compounds. P, 6 units each of biological science. and organic chem.
DEPARTMENTS AND COURSES OF INSTRUCTION

576. Environmental Toxicology (3) I Toxicity of natural toxins and of agricultural and industrial chemicals, with emphasis on air and water pollutants; decision-making in environmental issues. P, 6 units of biology and of organic chemistry; Chem. 325, 326. (Identical with Ento. 576 and Phcl. 576)

582. Immunotoxicology (2) I 1987-88 Broad overview of the immune system, with emphasis on how chemicals affect the immune system (immunomodulation) and the role of the immune system in chemical-induced tissue injury/allergic responses. P, 602, Micr. 419, 567. (Identical with Micr. 582, Phcl. 582)

596. Seminar
   a. Advanced Toxicology (1 to 2) [Rpt./3] I
   b. Current Concepts in Toxicology (1 to 2) [Rpt./3] II

601. Analytical Instrumentation and Techniques (4) I Lecture and laboratory in the qualitative and quantitative determination of toxic substances in the environment and body fluids. Modern instrumental techniques will be employed whenever appropriate. Lecture may be taken separately by non-majors. 2R, 6L. P. Chem. 400a. (Identical with Phcl. 601)

602a-602b. Biotoxicology (3-1) I 602a: Lecture. Mechanisms of organ directed toxicities in animals. Chemical carcinogenesis, teratogenesis and mutagenesis. Open to non-majors. P, two semesters of ecol. II 602b: Laboratory. Proper use of animals in toxicology and pharmacology research; focuses on organ specific toxicities. (Identical with Phcl. 602a-602b)

610. Topics in Advanced Toxicology (1 to 3) I II Current developments in toxicology including: chemical carcinogenesis, mutagenesis and teratogenesis; behavioral toxicology; inhalation toxicology; toxicokinetics; metabolism and environmental toxicology. P, 471b, 474.

653. Neuropharmacology (3-4) II (Identical with Pcol. 653)

PHARMACOLOGY AND TOXICOLOGY

Committee on Pharmacology and Toxicology (Graduate)

Professors I. Glenn Sipes, Chairperson, Klaus Brendel, Thomas F. Burks, Diane H. Russell
Associate Professors Dean E. Carter, David L. Kreulen, Hugh E. Laird, II, David L. Nelson

The Department of Pharmacology in the College of Medicine and the Department of Pharmacology and Toxicology in the College of Pharmacy cooperate, through the Committee on Pharmacology and Toxicology, in offering programs leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology.

For course descriptions, please see entries in this catalog for Pharmacology (Department, College of Medicine) and Pharmacology and Toxicology (Department, College of Pharmacy). For information on graduate programs and admission requirements, please see the Graduate Catalog.

PHARMACY PRACTICE

Professors Gary Smith, Theodore G. Tong
Associate Professors J. Lyle Bootman, Head, Alan D. Barreuther, William F. Fritz (Adjunct), James R. Guidry (Adjunct), William F. McGhan, Martin D. Higbee
Assistant Professors Edward P. Armstrong, Suzanne Campbell, Martha P. Fankhauser, Lee A. Gardner (Adjunct), Marie E. Gardner, G. Richard Hall (Adjunct), Richard Hammel (Adjunct), William N. Jones (Adjunct), Michael D. Katz, Richard Krueger (Adjunct), Lon N. Larson, Jennifer Linford, Joseph A. McElroy (Adjunct), Robert A. Mead, Michael Noel (Adjunct), Paul E. Nolan, James Paximos (Adjunct), Patricia M. Plezia, Joseph P. Rindone (Adjunct), Michael I. Smith (Adjunct), Carl Trinca (Adjunct)
Instructors Victor A. Elsberry, James Martin (Adjunct), J. C. Poe (Adjunct), Richard P. Stitt (Adjunct)
Lecturers Jack A. Arndt, James R. Morse
The Department of Pharmacy Practice offers courses leading to the Doctor of Pharmacy degree. A Master of Science with a major in pharmacy, with concentrations available in the areas of hospital pharmacy administration and pharmacy administration, is offered through the graduate college. Graduate study in pharmacy administration leading to a Doctor of Philosophy degree with a major in pharmacy is also available. For information regarding undergraduate admission and degree requirements, please consult the College of Pharmacy section of this catalog; for graduate admission and degree requirements, please see the Graduate Catalog.

A student must be enrolled in the College of Pharmacy before taking any pharmacy practice course, except as approved by the department.

Honors: The department participates in the Honors Program.

300. Pharmaceutical Calculations (2) I (Identical with Ph.Sc. 300)

301. Introduction to Medications and Their Use for the Consumer (3) II Therapeutic uses of medications, emphasizing non-prescription products and common prescription drugs. For non-pharmacy majors only.

303. Clinical Clerkship Pharmacy Practice and Communications Skills. Must be completed in sequence.
   a. Introductory Practice (1) I Field trips.
   b. Long-Term Care (1) II Field trips.
   c. Patient Counseling and Medical Devices (1) I Field trips.
   d. Interviewing and Counseling Skills (1) II Field trips.
   e. Dispensing Practice (1) I Field trips.

343. Pharmacy Laws (2) I Legal concepts covering professionalism, negligence, liability, legal processes and semantics; pertinent federal, state and local statutes and regulations.


403. Clinical Clerkship
   a. Institutional Clerkship (4 to 10) II S, 475.
   b. Ambulatory Clerkship (4 to 10) II S, 475.
   c. Externship (4 to 10) II S, 410, 475.

Note: 403a-c are six-week courses.


412. Nonprescription Drugs (2) II Presentation on nonprescription drugs, remedies sold over-the-counter (O.T.C.), designed to guide the pharmacist in providing better professional advice to the self-medicating public. P, 303c, Ph.Sc. 302b.

419. Parenteral Preparations (2) GC Principles and procedures in the preparation, stability, and administration of parenteral products. 1R, 3L. P, Ph.Sc. 302b.

424. Antibiotics (2) GC Principles of antibiotic chemotherapy and the properties of the antibiotics employed in therapeutics. P, 437b, Micr. 110, Pcol. 471b. (Identical with Ph.Sc. 424)

440. Perspectives in Health Care Services (3) GC I Consumers, providers, financing, and regulators of health care and medicines in the U.S. and exploration of controversies in relation to these components. (Identical with Rhab. 440)

442. Professional Practice Management (3) GC I Management of professional situations and the interaction among patients, colleagues, and other health-care providers, with application to institutional, community, and clinical pharmacy practice. P, 445.

445. Psychosocial Aspects of the Drug Use Process (3) GC I An overview of the drug-use process, including an examination of social, behavioral, and economic factors associated with the prescribing, dispensing, and use of drugs. (Identical with Coun. 445)

447. Perspectives in Geriatrics Laboratory (1) GC II Open to nonmajors. P, CR 448. (Identical with Gero. 447 and N.F.S. 447)

448. Perspectives in Geriatrics (2) GC II Multidisciplinary approach to the health-care needs of the elderly, including medication use and nutrition, through didactic training, a team project, and clerkship experiences. Open to nonmajors. P, CR 447 for nonmajors. (Identical with Gero. 448 and N.F.S. 448)

475a-475b-475c. Pharmacotherapeutics (2-3-6) GC Common diseases that afflict humans. Their management based on pharmacotherapeutic considerations of epidemiology, etiology, diagnosis, pathophysiology, and prognosis. P, Bioc. 460, Psio. 480 (Identical with Pcol. 475a-475b-475c and Ph.Sc. 475a-475b-475c)
DEPARTMENTS AND COURSES OF INSTRUCTION

483. Perspectives of Cancer Care for Health Professionals (3) GC S (Identical with Nurs. 483)

489. Clinical Pharmacotherapy of Mental Disorders (2) GC I II A multidisciplinary approach to clinical psychopharmacology, therapeutics, and diagnosis of mental disorders for health professionals.

496. Proseminar
   a. Clinical (1) II For pharmacy majors only. P, 403a or 403b, and 403c

503. Clinical Clerkship
   a. Externship (4) I II S P, grad. students consult department before enrolling.
   b. Adult Pharmacy Practice (4) I II S P, grad. students consult department before enrolling.
   c. Ambulatory Pharmacy Practice (4) I II S P, grad. students consult department before enrolling.
   d. Drug/Poison Information (4) I II S P, grad. students consult department before enrolling.  
      Note: 503a-d are six-week courses.

511. Pharmacy Management (3) I History, organization and administration of pharmaceutical services within the institutional environment.

512. Advanced Pharmacy Management (3) II Application of management principles to problem-solving and decision-making techniques in the provision of pharmaceutical services within the institutional environment. Field trips. Open to majors only. P, 511.

557. Physical Parameters for Monitoring Drug Therapy (1) II Introduction to physical assessment skills required of pharmacists for monitoring, assessing, and consulting on drug therapy. 3L, P, CR 575.

561. Research Methodology and Drug Literature Evaluation (3) II Skills and principles of clinical research design and biostatistics needed for evaluation of the medical literature and writing of research proposals. P, CR 575.

575. Advanced Pharmacotherapeutics (8) II Advanced concepts for the rational use of drugs in the management of diseases based on pathophysiological, pharmacokinetic, or pharmacologic and toxicologic considerations. 4R, 6L P, 303e, 410, 475, CR 557. (Identical with Ph.Sc. 575 and Pcol. 575)

585. Advanced Clinical Pharmacokinetics (3) II For description, see 885.

596. Seminar
   a. Pharmacy Administration (1) [Rpt./5] I II
   b. Pharmacy Administration Research (1) [Rpt./5] I II

611a-611b. Pharmacy and Its Environment (3-3) 1987-88 Cultural, social, behavioral, and organizational foundations of pharmacy, including the development of the present state of practice.

612a-612b. Issues in Pharmacy Practice Research (3-3) 1988-89 Survey of research methodology for studying social and behavioral aspects of health care and pharmacy practice; strategy for selecting and modifying existing research tools for particular purposes.

621. Pharmaceutical Marketing (3) I II Socioeconomic factors in the development, production, and distribution of drugs.

694. Practicum
   a. Clinical Clerkship (1 to 15) [Rpt.] I II
   b. Administrative Clerkship (1 to 15) [Rpt.] I II

695. Colloquium
   Research in Gerontology (1) I II (Identical with Gero. 695a)

800. Pharmacy Practice Project (1) II Individual pharmacy practice research not related to a thesis or dissertation. Open only to students enrolled in Doctor of Pharmacy program.

803. Pharmacy Clinical Clerkship
      Note: 803a-d are six-week courses.

810. Pharmacy Clerkship
   a. Internal Medicine (3 to 10) I II S P, 803b.
   b. Surgery (3 to 10) I II S P, 803b.
   c. Pediatrics (3 to 10) II S P, 803b.
   d. Geriatrics/Gerontology (3 to 10) I II S P, 803b.
   e. Outpatient Practice (3 to 10) II S P, 803b.
   f. Emergency Services (3 to 10) I II S P, 803b.
   g. Acute Care (3 to 10) I II S P, 803b.
   h. Clinical Pharmacokinetics (3 to 10) I II P, 803b.
   i. Psychopharmacy/Neurology (3 to 10) I II S P, 803b.  
      Note: 810a-i are three to six week courses.
815. Pharmacy Subspecialty
   a. Hematology/Oncology (3 to 10) I II S P, 10 units of 810 or CR.
   b. Cardiology (3 to 10) I II S P, 10 units of 810 or CR.
   c. Pulmonary (3 to 10) I II S P, 10 units of 810 or CR.
   d. Endocrine (3 to 10) I II S P, 10 units of 810 or CR.
   e. GI/Renal (3 to 10) I II S P, 10 units of 810 or CR.
   f. OB/GYN/Neonatal (3 to 10) I II S P, 10 units of 810 or CR.
   g. Infectious Disease (3 to 10) I II S P, 10 units of 810 or CR.
   h. Rheumatology/Immunology (3 to 10) I II S P, 10 units of 810 or CR.
   i. Dermatology (3 to 10) I II S P, 10 units of 810 or CR.
   j. Poison Information/Toxicology (3 to 10) I II S P, 10 units of 810 or CR.
   k. Administrative (3 to 10) I II S 15-30L P, 10 units of 810 or CR.
   l. Research (3 to 10) I II S 15-30L P, 10 units of 810 or CR.

   Note: 815a-i are three to six week courses.


861. Methodology in Pharmacy Research and Drug Literature Evaluation (3) P, CR 875

875. Advanced Pharmacotherapeutics (Pharmacy) (8) P, 303e, 410, 475. (Identical with Ph.Sc. 875 and Pcol. 875)

885. Advanced Clinical Pharmacokinetics (3) II Advanced pharmacokinetic principles emphasizing the application of mathematical relationships to patient care situations. P, Ph.Sc. 407, 409, or consult department before enrolling.

896. Seminar
   a. Pharmacy Practice (1) I
   b. Pharmacy Practice Research (1) II
   c. Infectious Disease (2) [Rpt./1] II Open to majors only. P, 875 or consult department before enrolling.

PHILOSOPHY


Associate Professor Holly M. Smith, Head
Assistant Professors Deborah Mathieu, Vann McGee

Philosophy attempts to answer analytic and speculative questions that perplex reflective people when they examine their basic concepts, goals, and ideals. Some of these questions arise naturally in the course of work in the various sciences and humanities. Hence philosophy has a natural border with all other academic disciplines, and lends itself to joint studies and collaborations.

The Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees are available with a major in philosophy. The department also encourages joint majors in such related fields as psychology, political science, economics, and linguistics, among others. Specialized minors in philosophy are available for students planning careers in law or the health professions. For details, students should consult the philosophy department's undergraduate advisor.

The major: 30 units, including 111, 112, 344, 260 or 470, and 262 or 471a or 471b. At least 15 units must be in upper-division work. Students who contemplate using an undergraduate major in philosophy as a background for graduate or professional work may want to plan a more specialized program in consultation with the department's undergraduate advisor.

The supporting minor should be chosen after consultation with the undergraduate adviser.

Honors: The department participates in the Honors Program, offering honors sections of its introductory courses, periodic honors seminars, and the opportunity to conduct independent honors research.

110. Critical Thinking (3) II Designed to improve ability to reason and think critically; emphasis on evaluating and presenting arguments.

111. Introduction to Philosophy (3) II Selected basic philosophical areas and problems: knowledge, belief and truth; the world and God; nature of persons; action and free will; the good life; the ideal community.

112. Introduction to Logic (3) II Basic introduction to symbolic logic; construction and critical analysis of arguments.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>Introduction to Moral and Social Philosophy (3)</td>
<td>I Introduction to moral and political theory, and problems of practical ethics. Readings from representative moral and social philosophers.</td>
</tr>
<tr>
<td>145</td>
<td>Science, Technology and Human Values (3)</td>
<td>I Nature of science, technology, pseudo-science, and their relation to philosophy and culture; impact of science and technology on society and its values and religion.</td>
</tr>
<tr>
<td>202</td>
<td>Symbolic Logic (3)</td>
<td>Truth-functional logic and quantification theory; semantic concepts; deductive techniques and translation into symbolic notation. (Identical with Math. 202)</td>
</tr>
<tr>
<td>233</td>
<td>Philosophy of Religion (3)</td>
<td>I Nature of religion; existence and nature of God; religion and meaning, values and knowledge. (Identical with Reli. 233)</td>
</tr>
<tr>
<td>238</td>
<td>Philosophy in Literature (3)</td>
<td>I Philosophical analysis of selected literary works.</td>
</tr>
<tr>
<td>245</td>
<td>Existential Problems (3) I 1987-88</td>
<td>Exploration of central problems of the human condition, such as meaning of life; death; self-deception; authenticity, integrity and responsibility; guilt and shame; love and sexuality.</td>
</tr>
<tr>
<td>260</td>
<td>Ancient Philosophy (3)</td>
<td>I Survey of Greek philosophy, from the pre-Socratic philosophers through Plato and Aristotle to post-Aristotelian philosophers. (Identical with Clas. 260)</td>
</tr>
<tr>
<td>262</td>
<td>Modern Philosophy (3)</td>
<td>II Principal European systems of thought from Descartes to Kant.</td>
</tr>
<tr>
<td>263</td>
<td>From Hegel to Nietzsche: Man and Society in 19th Century Philosophy (3)</td>
<td>Survey of influential 19th century philosophers, including Hegel, Marx, J.S. Mill, Kierkegaard, and Nietzsche. Their views on the individual and society, and human nature.</td>
</tr>
<tr>
<td>305</td>
<td>Introduction to the Philosophy of Science (3)</td>
<td>Basic issues in the logic of science: scientific concepts and their meaning, testing of hypotheses, explanation, measurement, role of mathematics, truth versus convention, limits of science.</td>
</tr>
<tr>
<td>310</td>
<td>History of Ethics (3)</td>
<td>II Reading and analysis of selected ethical theories from the Greeks to the present.</td>
</tr>
<tr>
<td>321</td>
<td>Medical Ethics (3)</td>
<td>Ethical issues that arise in relation to medicine and health care: abortion, euthanasia, the allocation of scarce medical resources, socialized medicine, doctor-patient confidentiality, paternalism, etc.</td>
</tr>
<tr>
<td>322</td>
<td>Business Ethics (3)</td>
<td>II Selected ethical issues in business, including corporate responsibility, preferential hiring and reverse discrimination, advertising practices, environmental responsibility.</td>
</tr>
<tr>
<td>344</td>
<td>Issues and Methods in Analytic Philosophy (3)</td>
<td>Designed to improve ability to think analytically, with emphasis on analytic methodology. Selected readings on the nature of mental states, the analytic/synthetic distinction, personal identity, the concept of knowledge and justified belief, the theory of reference, and the distinction between science and pseudo-science. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).</td>
</tr>
<tr>
<td>370</td>
<td>Issues in Greek Philosophy (3)</td>
<td>Philosophical issues in ancient thought. Topics may be selected from the pre-Socratics, Socrates, Plato, Aristotle, and post-Aristotelian philosophy. (Identical with Clas. 370)</td>
</tr>
<tr>
<td>376</td>
<td>Introduction to the Philosophy of Language (3)</td>
<td>A survey of basic issues in the philosophy of language. (Identical with Ling. 376)</td>
</tr>
<tr>
<td>396H</td>
<td>Honors Proseminar (3)</td>
<td>II</td>
</tr>
<tr>
<td>403</td>
<td>Foundations of Mathematics (3)</td>
<td>GC II 1988-89 (Identical with Math. 403)</td>
</tr>
<tr>
<td>414</td>
<td>Philosophical Logic (3)</td>
<td>GC 1987-88 Introduction to modal logic; problems of interpretation and application; extensions to such areas as tense logic, epistemic logic, deontic logic.</td>
</tr>
<tr>
<td>419</td>
<td>Induction and Probability (3)</td>
<td>GC 1988-89 Basic philosophical problems concerning justification of induction, confirmation of scientific hypotheses, and meaning of probability concepts.</td>
</tr>
<tr>
<td>421</td>
<td>Philosophy of the Biological Sciences (3)</td>
<td>GC 1987-88 Laws and models in biology, structure of evolutionary theory, teleological explanations, reductionism, sociobiology. (Identical with Ecol. 421)</td>
</tr>
<tr>
<td>422</td>
<td>Linguistic Semantics and Lexicology (3)</td>
<td>GC II 1988-89 (Identical with Ling. 422)</td>
</tr>
<tr>
<td>423</td>
<td>Philosophy of the Physical Sciences (3)</td>
<td>GC Philosophical problems regarding space, time, motion, relativity, causality, measurement, theoretical entities.</td>
</tr>
</tbody>
</table>
430a-430b. Ethical Theory (3-3) GC 1987-88 430a: Meta-ethics—meaning of moral terms, relativism, subjectivism, ethics and science, social contract theory. 430b: Normative ethics—Utilitarianism, egoism, rights, natural law, justice, deontological duties, blameworthiness and excuses.

433. Aesthetics (3) GC Classical and contemporary theories of art; the aesthetic experience, form and content, meaning, problems in interpretation and criticism of works of art.

434. Social and Political Philosophy (3) GC Fundamental concepts of politics; leading social and political theories, such as anarchism, social contract, Marxism.


438a-438b. Philosophy of Law [3-3] GC 438a: Nature and validity of law; law and morality, judicial reasoning, law and liberty. 438b: Problems about justice, compensation and contracts and/or responsibility and punishment. (Identical with Pol. 438a-438b)

440. Metaphysics (3) GC Topics include free will and determinism; causation; personal identity; necessity and essence; truth, realism and ontology.

441. Theory of Knowledge (3) GC Critical examination of some of the major problems concerning evidence, justification, knowledge, memory, perception and induction.


443. Knowledge and Society (3) GC I II Social and interpersonal processes affecting the acquisition and diffusion of knowledge. Emphasis on philosophical perspectives, with interdisciplinary borrowings.

450. Philosophy of Mind (3) GC Topics include the nature of mental states; the relation between mind and brain; and analysis of perception, emotion, memory and action.

451. Philosophy of Psychology (3) GC 1987-88 Investigation of philosophical issues arising from current work in psychology including perception, reasoning, memory, motivation and action.

452. Philosophy of Action (3) GC Topics include the explanation of human action; the nature of intentional action; practical reason and deliberation; and the mental antecedents to action, especially desire and belief.

453. Minds and Machines (3) GC 1987-88 Philosophical problems arising from current work in artificial intelligence and cognitive psychology.

456. Philosophy of Language (3) GC Survey of basic issues in the philosophy of language such as: speech acts, reference, meaning, logical form.

458. Pragmatics (3) GC 1987-88 (Identical with Ling. 458)

467. Frege and the Rise of Analytic Philosophy (3) GC The writings of Frege on logic, language, and mathematics and their influence on contemporary philosophical thought.

470. Greek Philosophy (3) GC [Rpt./1] Topics in Greek philosophy. May be selected from the pre-Socratics, Socrates, Plato, Aristotle and post-Aristotelian philosophy. (Identical with Clas. 470).


473. Natural Language Processing (3) GC II 1988-89 (Identical with Ling. 473)
DEPARTMENTS AND COURSES OF INSTRUCTION

PHYSICAL EDUCATION
(See Exercise and Sport Sciences)

PHYSICS


Associate Professors Adam S. Burrows, Ke-Chiang Hsieh, Stephan W. Koch, Jay E. Treat (Emeritus)

The department offers the degrees of Bachelor of Science, Master of Science and Doctor of Philosophy with a major in physics. A Bachelor of Science in Education and Master of Education are available with a teaching major in physics. The Bachelor of Science in Engineering Physics is offered through the College of Engineering and Mines. Students should consult the department concerning areas in which research is being conducted.

The major: 36 units, including 110, 116, 121, 330, 410, 415a, 420, 425, 435, and 480a-480b. Under special circumstances 102a-102b and 180a-180b, or 103a-103b and 180a-180b may be substituted for 110, 116, and 121. The following courses are strongly recommended: 415b, 470a-470b, 481a-481b; Chem. 103a-103b, 104a-104b, or 105a-105b. Math. 254 is recommended as a prerequisite for upper-division physics.

For the major in engineering physics, please see the College of Engineering and Mines section of this catalog. An engineering physics major who intends to do graduate work in physics should discuss his or her plans with the advisor.

The teaching major: 30 units, including 103a-103b and 180a-180b (or 110, 116, and 121), 330, 433, 480a-480b. Courses in related fields, such as astronomy, may be chosen in consultation with the departmental advisor.

The teaching minor: 18 units, including 102a-102b and 180a-180b (or 103a-103b and 180a-180b; or 110, 116, and 121), 433, 480a, and other courses chosen in consultation with the departmental advisor.

Honors: The department participates in the Honors Program.

102a-102b.* Introductory Physics (3-3) CDT Designed for liberal arts and life science majors with no calculus background. Survey of the basic fields of physics, with emphasis on applications to other fields and historical development. P, h.s. algebra, geometry, and trigonometry. Both 102a and 102b are offered each semester. Those wishing to take this course as a lecture-lab. course should register concurrently for 180a or 180b.

103a-103b.* Introductory Physics with Calculus (3-3) CDT Fundamental principles of mechanical, thermal, acoustical, electrical, optical, atomic and nuclear phenomena. P, CR Math. 125b. Both 103a and 103b are offered each semester. Those wishing to take this course as a lecture-lab. course should register concurrently for 180a or 180b.

105. Elements of Physics (3) I II CDT Designed for nursing majors. Physical measurement, kinematics, laws of motion, gravitation, work and energy, heat and thermometry, electromagnetism, light, sound, molecules, atoms, X-rays and nuclear radiations. 3R, 2L. Not to be used for Group VI requirements in the College of Arts and Sciences. P, Math. 117e.

106. Physics for Architects (3) II CDT Introduction to physics, with special emphasis on topics and concepts of interest to architects.
107. The Physics of Music (4) I CDT Sound production, musical instruments, frequency analysis, physics of hearing, psychological and physiological effects, harmony and scales, hall acoustics, electronic production and recording. 3R, 3L.

109. Physics in the Modern World (4) I II Basic concepts and the societal impact of physics, with emphasis on modern physics. Topics include mechanics, wave motion, energy, light, nuclear and atomic physics, and astrophysics. 3R, 3L. Open to nonmajors only. P, high school algebra.

110.* Introductory Mechanics (4) I II CDT Vector concepts; kinematics, statics, and dynamics for point masses, particle systems, and rigid bodies; conservation laws of energy, momentum, and angular momentum. 4R, 2L. P, Math. 125a, CR 125b.


*Credit will be allowed for only one of the following sequences of courses: 102a-102b and 180a-180b; 103a-103b and 180a-180b; 110, 116 and 121.

180a-180b. Introductory Laboratory (1-1) Quantitative experiments in physics, both illustrative and exploratory. Designed to accompany 102a-102b and 103a-103b; sections are established corresponding to each course. 3L. P, CR 102a-102b or 103a-103b. Both 180a and 180b are offered each semester.


402. Medical Physics (3) GC I CDT Basic physics of the human body: the principles of mechanics, electricity, sound, light, and radiation as they apply to physiology, with emphasis on instrumentation for diagnosis and treatment. P, 102b.


412. Theoretical Mechanics II (3) GC II CDT Continuation of 410; mechanics of the continuum; introduction to variational principles; Lagrange's equations. P, 410, Math. 254.

415a-415b. Electricity and Magnetism (3-3) GC CDT Electromagnetic phenomena; Maxwell's equations. P, 410 or Math. 422a.

420. Optics (3) GC I II CDT Electromagnetic waves; rays, interference, diffraction, scattering; applications to imaging systems, Fourier methods, holography, and crystal optics. P, 116, 121, Math. 223.

425. Thermodynamics (3) GC I II CDT Basic laws of thermal equilibrium; heat engines; ideal and non-ideal gases; phase transitions; introduction to irreversible processes, kinetic theory, and statistical mechanics. P, 110, 121, Math. 223.

430. Introduction to Biophysics (2) GC I CDT Concepts and experimental techniques of molecular biophysics; physical properties of biological macromolecules and cell organelles, optical interactions, macromolecular transitions, molecular mechanism or regulation. P, 102b, Chem. 103a-103b. (Identical with Micr. 430)

433. Physics Demonstrations (1 to 3) GC II Introduction to teaching materials and laboratory demonstrations illustrating principles of classical and modern physics, with emphasis on inexpensive techniques and direct experience. Advanced degree credit available for nonmajors only. P, two semesters of physics.

435. Introductory Quantum Theory and Atomic Spectra (3) GC I II CDT Introductory quantum mechanics; solutions of the Schroedinger equation for hydrogen-like atoms; perturbation theory; atomic structure; spectra of one and many electron systems; Zeeman-Paschen-Bach effects; hyperfine structure. P, 330, 410, Math. 254; CR 470a or Math. 413 recommended.

436. Applications of Introductory Quantum Theory (3) GC II CDT Applications of quantum theory to molecules, atomic nuclei, elementary particles and simple solids. P, 435.

440a-440b. Atomic and Molecular Spectroscopy for Experimentalists (3-3) GC CDT Experimental techniques to generate, analyze and detect photons from X-ray to IR; interpretation of spectra from gases, liquids, solids and biological macromolecules; light scattering, polarization. P, 330. (Identical with Opti. 440a-440b)

450. Introductory Nuclear Physics (3) GC II CDT Basic concepts of nuclear physics; structure and stability of the nucleus and its components, nuclear forces, nuclear reactions; energy loss of nuclear radiations. P, 330, Math. 254. (Identical with N.E.E. 450)
402 DEPARTMENTS AND COURSES OF INSTRUCTION

460. Introductory Solid-State Physics (3) GC I II CDT Properties of solids from molecular, atomic, and electronic theory; electric, magnetic, and thermal properties of metals, insulators, and semiconductors; free electron and band theories. P, 330.

470a-470b. Methods of Mathematical Physics (3-3) GC CDT Vector and tensor analysis; differential and integral equations; Green's functions; variational techniques; linear operator theory, with emphasis on physical applications. P, 410, Math. 254, CR 415a-415b.

480a-480b. Methods of Experimental Physics I (1 to 3-1 to 3) Designed to develop experimental skills and to demonstrate important concepts in classical and modern physics. 3L. P, two upper-division courses in phys. or CR. Both 480a and 480b are offered each semester, but students are encouraged not to enroll simultaneously. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

481a-481b. Methods of Experimental Physics II (1 to 3-1 to 3) Continuation of 480a-480b, with emphasis on individual work. 3 or 6L. P, 480b; ten units of upper-division phys. Both 481a and 481b are offered each semester, but students are encouraged not to enroll simultaneously.

482. Techniques in Particle Physics (3) GC II 1988-89 Classification of elementary particles and their interactions with matter, relativistic kinematics, detectors, data acquisition techniques, statistical techniques, analysis of experiments, cosmic radiation, and accelerators.

504. Introduction to Quantum Optics (3) II (Identical with Opti. 504)

511. Analytical Mechanics (3) I Laws of motion as developed by Newton, d’Alembert, Lagrange and Hamilton; dynamics of particles and rigid bodies. P, 410.


525. Advanced Thermodynamics and Kinetic Theory (3) II 1987-88 First and second laws of thermodynamics and their applications; Boltzmann transport equation; H-theorem; mean free path methods applied to viscosity, thermal conductivity, and diffusion. P, 425.

528. Statistical Mechanics (3) I Physical statistics; the connection between the thermodynamic properties of a macroscopic system and the statistics of the fundamental components; Maxwell-Boltzmann, Fermi-Dirac, Einstein-Bose statistics. P, 470b.

530. Biophysical Theory (2) II Physical concepts and theories describing biomolecular structure and function, molecular evolution, limits to structure, symmetry, oligomer and virus structure, organelle structure and function. (Identical with Micr. 530)

535. Advanced Atomic Physics (3) II 1988-89 Details of atomic structure; interactions of atoms with electromagnetic fields, electrons and ions; techniques for calculating unperturbed and perturbed energy levels, transition probabilities, and atomic interaction cross sections. P, 511, 515b, 570b.

543. Laser Physics (3) I (Identical with Opti. 543)


551. Satellite and Planetary Perturbation Theory (3) II (Identical with Pty.S. 551)


556a-556b. Electrodynamics of Conducting Fluids and Plasmas (3-3) 1988-89 (Identical with Pty.S. 556a-556b)

560. Physics of the Solid State (3) II Elementary excitations in solids, phonons, electrons and holes, excitons, biexcitons, interaction of light with semiconductors, polaritons, high excitation phenomena, dielectric formalism of optical response, many-body effects in a Coulomb system. P, 460, 570, or Opti. 507 recommended but not formally required. (Identical with Opti. 560)

570a-570b. Quantum Mechanics (3-3) Principles of quantum mechanics; wave mechanics and matrix mechanics; applications to atomic structure and spectroscopy. P, 470a-470b suggested but not required.

571. Symmetry Groups in Physics (3) I Algebraic results of the theory of groups which find repeated applications in atomic, molecular, nuclear and particle physics. Continuous groups, Lie algebras, discrete groups, irreducible tensors. P, 570a-570b.

577a-577b. Theory of Relativity (3-3) 1987-88 Special theory of relativity and its application to mechanics and electrodynamics; tensor calculus and general relativity; relativistic astrophysics and cosmology. P, 470b.
579a-579b. **Advanced Relativistic Quantum Mechanics** (3-3) 1988-89 Continuous groups; scattering theory; relativistic wave equations; quantum electrodynamics, Feynman diagrams, dispersion theory, renormalization; strong and weak interactions. P, 515b, 570b.


581. **Elementary Particle Physics** (3) II 1987-88 Production, interaction, and decay of mesons, baryons and leptons; high energy scattering of elementary particles; particle classification and symmetries; theoretical interpretation. P, 436.

583a-583b. **Plasma Physics and Thermonuclear Theory** (3-3) 583a: II. 583b: I. (Identical with N.E.E. 583a-583b)

585. **Stellar Pulsation** (1 to 3) [Rpt./5] I II Stellar pulsation, the solar atmosphere, solar seismology and long-term solar variability related to climate.

596. **Seminar**
   a. Current Problems in Molecular Biophysics (1) I II [Rpt.] (Identical with Micr. 596a)

643. **Quantum Optics** (3) II 1988-89 (Identical with Opti. 643)

685. **Graduate Physics Laboratory** (3) [Rpt./2] II Introduction to modern research methods and experiments. Problems in low-temperature physics; solid-state, atomic, and nuclear spectroscopy; computer-based data acquisition and analysis; solar-energy physics; and others.

695. **Colloquium**

**PHYSIOLOGY**

*(College of Medicine)*

Professors Paul C. Johnson, *Head*, James R. Bloedel (Research, Barrow Neurological Institute, Phoenix), Eldon J. Braun, William H. Dantzler, Robert W. Gore, Raphaël P. Gruener, Otakar Koldovsky (Pediatrics), Douglas G. Stuart

Associate Professors Alan R. Gibson (Research, Barrow Neurological Institute, Phoenix), Andrew M. Goldner, Ziaul Hasan, Marc E. Tischler (Biochemistry)

Assistant Professors Ann L. Baldwin (Research), Janis M. Burt, Roger M. Enoka (Exercise and Sport Sciences), Thomas M. Hamm (Research, Barrow Neurological Institute, Phoenix), Patricia B. Hoyer, Richard J. Lemen (Pediatrics), Timothy W. Secomb, Stephen H. Wright

The Department of Physiology offers a program of instruction leading to the degree of Doctor of Philosophy with a major in physiology. For admission and degree requirements, please see the Graduate Catalog. A Master of Science degree is offered only in rare instances when individuals qualified to study for the Ph.D. are forced to terminate their graduate education.

In addition to the courses listed below, the Department of Physiology offers temporary courses in the following areas, subject to faculty availability and student interest: neurophysiology, renal physiology, physiology of muscle, endocrinology, peripheral vascular physiology, respiratory physiology, gastrointestinal and developmental physiology, membrane transport processes in physiology, and cardiac physiology.

418. **Physiology for Engineers** (4) GC I Designed to bring to engineering students an awareness of the structure and function of whole organisms, their component organs, and organ systems. Open to nonmajors only. (Identical with A.M.E. 418, Ch.E. 418 and E.C.E. 418)

419. **Physiology Laboratory** (2) GC I Lab. experiments in physiology intended to provide experience with organ systems and measurement techniques. Designed for engineering students enrolled in the clinical engineering and biomedical engineering options. 6L. Open to nonmajors only. P, 418 or CR. (Identical with A.M.E. 419, Ch.E. 419 and E.C.E. 419)

480. **Human Physiology** (4) GC II Principles of physiology with emphasis on the human; designed primarily for students in pharmacy and health related sciences. Open to pharmacy majors; others consult dept. before enrolling. P, Chem. 243b, Math. 123, Phys. 102b, CR 481. (Identical with Tox. 480)
DEPARTMENTS AND COURSES OF INSTRUCTION

481. Physiology Laboratory (1) GC II Experiments intended to reinforce principles of physiological phenomena; designed primarily for students in pharmacy and health related sciences. Open to pharmacy majors; others should consult department before enrolling. P, Chem. 243b, Math. 123, Phys. 102b, CR 480. (Identical with Tox. 481)

495. Colloquium
   a. Introduction to the Neurosciences I (2) GC (Identical with Med. 495a, which is home)
   b. Introduction to the Neurosciences II (2) GC (Identical with Med. 495b, which is home)

503. Cellular Physiology (3) I Fundamental responses of living organisms to environmental changes. Mechanisms which operate at the cell level, including transmembrane homeostasis, energy metabolism maintenance, cell volume regulation and responses to environmental stimuli. P, Chem. 103b, 104b, 241b, 243b; Phys. 102b; Math. 125a-125b.

600. Mathematical Techniques in Physiology (3) I Application of quantitative and analytical mathematical techniques to selected areas of physiology; introduction to mathematical approaches commonly used in physiology. Open to majors and minors; others consult department before enrolling. P, Math. 125a-125b, 160.

601. Human Physiology (8) II Principles of physiology, with emphasis on that of the human. P, Chem. 103b, 104b, 241b, 243b; Phys. 102b. Consult department before enrolling.

602. Readings in Physiology (2) II Designed to provide students with more detailed consideration of various organ systems than can be provided in 601. Open to majors and minors only. P, Chem. 103b, 104b, 241b, 243b, Phys. 102b, CR Psio. 601.

605. Neurosciences (6) II (Identical with Anat. 605)

606. Readings in Neuroscience (4) II Essentials of mammalian neural structure and function. Open to majors and minors, others by permission of instructor. Not recommended for students whose major interests lie in the neurosciences.

610. Research Methods in Physiology (1 to 3) [Rpt.] III Lab. course stressing the principles of physiological research.

695. Colloquium
   a. Motor Control (2) [Rpt./8 units] II (Identical with Ex.S.S. 695a)

696. Seminar
   a. Advanced Mammalian Physiology (1 to 4) [Rpt./1] II Open to majors and minors, others by permission of instructor. P, 600, 601, 602; 606 or Anat. 605.
   b. Literature (1) [Rpt./5] I II Open to majors only. P, 600, 601, 602; 606 or Anat. 605.

801. Human Physiology (8) II

805. Neurosciences (6) II (Identical with Anat. 805)

891. Preceptorship
   a. Physiology (3 to 12) [Rpt./12 units].

PLANETARY SCIENCES


Associate Professors William V. Boynton, Robert B. Singer

Assistant Professors Jonathan I. Lunine, Timothy D. Swindle

Participating Scientists from the Lunar and Planetary Laboratory:
Senior Research Scientists Lyle A. Broadfoot, Richard J. Greenberg, Donald E. Shemansky
Associate Research Scientists Shailendra Kumar, Larry A. Lebofsky, Bill R. Sandel, Ewen A. Whitaker Assistant Research Scientists Jay B. Holberg, Lon L. Hood

The Department of Planetary Sciences offers a multidisciplinary program leading to the degrees of Master of Science and Doctor of Philosophy with a major in planetary sciences. For admission and degree requirements, please see the Graduate Catalog.
105. The Universe and Humanity: Origin and Destiny (3) I II Formation and evolution of the Universe, the solar system, and life; events which led to our existence; the future for life in the solar system; life elsewhere. Designed for nonscientists. (Identical with Astr. 105)

106. Survey of the Solar System (4) I II Interdisciplinary synthesis of planetary and space science; the sun, planets, satellites, interplanetary gas, comets, small bodies, space missions. Designed for nonscientists. 3R, 3L. P, Math. 117e. (Identical with Astr. 106 and Geos. 106)

403. Introduction to the Solar System (3) GC I Survey of planetology; origin of planets; asteroids; meteorites; interplanetary dust and gas; planetary interiors; geophysics; planetary atmospheres; origin of life. Advanced degree credit available only with departmental permission. P, Phys. 103a-103b. (Identical with Astr. 403 and Geos. 403)

404. Exploration of the Solar System (3) GC I S Primitive astronomy to modern space exploration; planetary science fundamentals, solar system physical properties; planetarium demonstrations, classroom projects. Field trip. Advanced degree credit available only with departmental permission. (Identical with Astr. 404)


419. Global Tectonic Processes (3) GC II (Identical with Geos. 419)


510. Principles of Cosmochemistry (3) I 1988-89 Chemical compositions of solar system objects; equilibrium and nonequilibrium chemical processes applied to planets; cosmochronology. P, 403, 480a-480b. (Identical with Geos. 510)

517. Planetary Atmospheres (3) I 1987-88 Survey of compositions, temperature and density profiles, chemistry, condensation products, spectroscopic evidence; circulations and heat budgets; evolution and origin of planetary atmospheres. P, 403.

518. Remote Sensing Techniques in Astronomy and Planetary Science (3) I 1987-88 Nature of radiant energy; optical and infrared detectors; error analysis; ultimate limits to system performance; photometry, polarimetry, and spectroscopy; high angular resolution. 2R, 3L. P, introductory physics and calculus. (Identical with Atmo. 518 and Astr. 518)

520. Meteorites (3) II 1988-89 Classification; chemical, mineralogical and isotopic composition; cosmic abundances; ages; interaction with solar and cosmic radiation; relation to comets and asteroids. P, 510. (Identical with Geos. 520)

527. Advanced Geochemistry (3) I (Identical with Geos. 527)

528. Nuclear Geology (3) II 1988-89 (Identical with Geos. 528)

544. Physics of the High Atmosphere (3) II 1987-88 Physical properties of the upper atmosphere, including gaseous composition, temperature and density, ozonosphere, and ionosphere, with emphasis on chemical transformations and eddy transport. (Identical with Atmo. 544)


554. Evolution of Planetary Surfaces (3) II 1988-89 The geologic processes and evolution of terrestrial planet and satellite surfaces including the Galilean and Saturnian and Uranian satellites. Course includes one or two field trips to Meteor Crater or other locales. P, 311, 403. (Identical with Geos. 554)


565. Jovian Planets and Satellites (3) I 1988-89 Observational data; atmospheric structure and composition; thermal balance; mass, radius, flattening; physics of light elements at high pressures; structure of rotating planets; origin of magnetic fields. P, 403.

567. Inverse Problems in Geophysics (3) I 1988-89 (Identical with Geos. 567)

571. Constitution and Evolution of the Terrestrial Planets (3) I 1987-88 Composition and evolution of terrestrial planets; includes the Moon, asteroids, meteorites, other evolved rocky satellites; geophysical/geochemical techniques used to deduce histories. (Identical with Geos. 571)
PLANNING

Committee on Planning (Graduate)

Professors Arthur L. Silvers (Management and Policy), Chairperson, Lay J. Gibson (Geography), Robert Giebner (Architecture), Frank Gregg (Renewable Natural Resources), David A. King (Renewable Natural Resources), James S. Lincoln (Management and Policy), Kirby W. Lockard (Architecture), Lawrence D. Mann (Geography), Fred S. Matter (Architecture), Richard L. Medlin (Architecture), Thomas F. Saarinen (Geography), Norman Williams, Jr. (Geography)

Associate Professors Stanley K. Brickler (Renewable Natural Resources), Harry der Boghosian (Architecture), Theodore H. Koff (Management and Policy), Gordon F. Mulligan (Geography), Ronald J. Vogel (Management and Policy)

Assistant Professors Robert Itami (Renewable Natural Resources), David Plane (Geography)

Lecturer Reid H. Ewing (Management and Policy)

Programs are offered in the fields of policy and planning (Management and Policy; College of Business and Public Administration), in regional planning (Geography; Faculty of Social and Behavioral Sciences), and in community design (College of Architecture). A program in natural resources planning (School of Renewable Natural Resources) is under development.

The program in policy and planning provides training for a variety of staff-level careers in state and local government. Areas of specialization are land use and the environment, health care, services for the elderly, and public facility planning. The program in regional planning provides a strong grounding in location and spatial analysis, environmental behavior, and in legal/political institutions for regional infrastructure and development planning. Areas of specialization are land use and the environment, regional development, techniques of regional analysis, and transportation and human interaction. The program in community design provides a background in the history and theory of urban design, as well as direct experience in designing the physical environment at community scale. Areas of specialty include the design process, qualitative analysis, generation of alternatives, responsive synthesis and design communication.

The Master of Science degree is available with a major in planning. Upper-division undergraduates and graduate students may take work in planning complementary to their major fields.

110. Regional Land Use (3) I (Identical with Geog. 110)

300.* Introduction to Policy and Planning (3) I (Identical with M.A.P. 300)

301. Introduction to Regional Planning (3) I (Identical with Geog. 301)

359. Land Use and Growth Regulation (3) I (Identical with Geog. 359)

444. Site Planning (2) GC II (Identical with Arch. 444)

453. Location Analysis (3) GC II (Identical with Geog. 453)

456. Urban Geography (3) GC I (Identical with Geog. 456)

457. Statistical Techniques in Geography and Planning (3) GC I (Identical with Geog. 457)

461. Population and Resources (3) GC I (Identical with Geog. 461)

463.* Community Agencies and Human Services (3) GC II (Identical with M.A.P. 463)

468. Urban Transportation Planning (3) GC II CDT. (Identical with C.E. 468)

471. Problems in Regional Development (3) GC I II (Identical with Geog. 471)

473. Geology and the Urban Environment (3) GC II (Identical with Geos. 473)

474. Planning the Built Environment (2) GC I (Identical with Arch. 474)

476. Metropolitan Land Development (3) [Rpt./1] GC I II S (Identical with Geog. 476)
Computer Cartography (3) GC II (Identical with Geog. 481)
Geographic Applications of Remote Sensing (3) GC II (Identical with Geog. 483)
Zoning Fundamentals (3) GC I (Identical with M.A.P. 485)
*Open only to students who meet requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

Workshop
- Community Design for Non-Designers (3) GC I (Identical with Arch. 497i which is home)

Fundamentals of Physical Planning (3) I (Identical with M.A.P. 506)
Social Service Planning (3) I (Identical with M.A.P. 507)
Development of Regional Planning (3) I (Identical with Geog. 510)
Metropolitan and Regional Planning (3) I (Identical with Geog. 511)
Urban Systems Analysis (3) II (Identical with Geog. 556)
Spatial Analysis (3) II (Identical with Geog. 557)
Resource Management (3) I (Identical with Geog. 561)
Perception of Environment (3) II (Identical with Geog. 563)
Quick Response Transportation Planning Methods (3) I 1987-88 (Identical with C.E. 565)
Urban Public Transportation Systems (3) I 1988-89 (Identical with C.E. 568)
Housing and Residential Areas (3) II (Identical with M.A.P. 575)
Interdisciplinary Environment-Behavior-Design (3) I (Identical with Idis. 596u, which is home)
Architecture (3 to 8) [Rpt.] I II (Identical with Arch. 597a which is home)
Methods and models for program planning and policy analysis; forecasting, service demand, facility location in capital investment programming, task sequencing, program analysis and evaluation. P, 457 or M.A.P. 552. (Identical with M.A.P. 602)
Planning Theories and Perspectives (3) I (Identical with Geog. 605)
Planning Law (3) II (Identical with Geog. 608)
Policy Problems in Structure and Change (3) II (Identical with M.A.P. 609)
Projects in Regional Planning (1 to 5) [Rpt./5 units] II (Identical with Geog. 611)
Projects in Policy and Planning (2-3) (Identical with M.A.P. 612a-612b)
Health and Public Policy (3) II (Identical with M.A.P. 651)
Efficiency Analysis in Health Administration (3) II (Identical with M.A.P. 655)
Growth Controls (3) II (Identical with Geog. 659)
Aging and Public Policy (3) I (Identical with M.A.P. 662)
Preservation of Historic Environments (3) II 1987-88 Current planning and legal methods to enhance the preservation of historic urban areas and structures; concentrated analysis of selected case studies. Field trips. (Identical with Law 669)
Policy and Planning (1 to 4) S (Identical with M.A.P. 693g, which is home)
Land-Use Regulation (3) I II (Identical with M.A.P. 696h, which is home)
Legal Inquiry in Policy and Planning (3) II (Identical with M.A.P. 696i, which is home)
Environmental Planning (3) I III (Identical with M.A.P. 696j, which is home)
Planning Administration (3) I II (Identical with M.A.P. 696k, which is home)
The General Plan (3) [Rpt./6 units] I II (Identical with Geog. 696o, which is home)
The Land Development Process (3) [Rpt./6 units] I II (Identical with Geog. 696p, which is home)
PLANT PATHOLOGY


Associate Professors H. Earl Bloss, Iraj J. Misaghi
Assistant Professors Martha C. Hawes, Alan J. Howarth

The department offers the degrees of Bachelor of Science in Agriculture, Master of Science and Doctor of Philosophy with a major in plant pathology. Courses are designed to acquaint students with causal agents of plant diseases, techniques used to manipulate pathogens, epidemiological and physiological aspects of plant-pathogen interactions, and procedures used to control or prevent diseases of plants.

The major: In addition to meeting the requirements of the agricultural science curriculum, as outlined in the College of Agriculture section of this catalog, students must take 205, 206, 402, 407, 451, 495a (writing-emphasis course), Micr. 110. The suggested program includes Pl.S. 100, M.C.B. 460; Chem. 241a-241b, 243a-243b; Math. 117e, 118 and 263 or Pl.S. 421; Phys. 102a or 102b. Calculus and computer science are also recommended.

120. Recognition and Control of Plant Diseases (2) I Diagnosis and control of plant diseases. Designed primarily for home gardeners and nurserymen. Not open to plant pathology or plant protection majors. Credit allowed for this course or 205, but not for both.

205. General Plant Pathology (3) I Detailed study of representative plant diseases, with emphasis on basic concepts of diagnosis, cause, epidemiology, and control. Credit allowed for this course or 120, but not for both. P, Ecol. 104 or Pl.S. 100.

206. General Plant Pathology Laboratory (1) I Lab. exercises in plant pathology. P, 205 or CR.

250. Forest Pathology (3) II Basic principles of plant pathology, with emphasis on diseases of forest trees and associated vegetation. Designed for majors in natural resources. 2R, 3L. P, Pl.S. 100. (Identical with Ws.M. 250)

402. Introduction to Pesticides and Their Use (2) GC I Overview of pesticide use, with emphasis on interaction of technical, societal, individual, and regulatory aspects of the choices; specific control recommendations not stressed. (Identical with Ento. 402, Pl.S. 402, and S.W. 402)


451. Diagnosis and Control of Plant Diseases (3) GC I Field and lab. course designed to give students familiarity with diagnosis of plant diseases and plant disease control concepts. 2R, 3L. All-day field trips. P, 206. (Identical with Micr. 451)

495. Colloquium
   a. Senior Report (1) I II Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


516. Plant Nematology (3) II 1988-89 Comprehensive course in plant nematology, including the nature, ecology, and classification of plant parasitic nematodes. Diagnosis and control of nematode diseases of plants. 2R, 3L. P, 205.

520. Analytical Techniques for Phytopathological Research (4) II Techniques, including chromatography, electrophoresis, spectroscopy, and immunology. 2R, 6L. P, 206.

575a-575b. General Mycology (3-3) 1988-89 Comprehensive study of fungi, including their structure, function, classification, genetics, and ecological importance. 575a: Basidiomycetes and Fungi Imperfecti. 575b: Myxomycetes, Phycomycetes, and Ascomycetes. 2R, 3L. P, Ecol. 104 or Pl.S. 100. 575a is not prerequisite to 575b.

596. Seminar
   a. Current Research (1 to 3) I II
PLANT SCIENCES


611. **Plant Virology (3)** I 1987-88 Comprehensive study of the physiology, epidemiology, pathology and classification of viruses attacking plants. 2R, 3L. P, 205, Bioc. 460.


694. **Practicum**

a. **Clinical Plant Pathology (1 to 3) [Rpt./2]** I II P, 407, 451.

b. **Teaching Techniques in Plant Pathology (1 to 3) [Rpt./2]** I II P, 407, 451.

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PLANT PROTECTION

**Committee on Plant Protection (Graduate)**

The Committee on Plant Protection, an interdepartmental committee in the College of Agriculture, offers a program leading to the Master of Science degree with a major in plant protection. For admission and degree requirements, please see the Graduate Catalog.

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PLANT SCIENCES


Associate Professors Koaru Matsuda, Hiroshi Muramoto


Assistant Research Scientists Jon P. Chernicky, Esmaeil Fallahi, John J. McGrady

Extension Specialists Donald J. Garrot, E. Stanley Heathman, Michael W. Kilby, David M. Kopec, Michael J. Ottman

The Department of Plant Sciences offers academic training to prepare a student for a wide range of opportunities in plant-related sciences and agriculture. The Bachelor of Science in Agriculture is available to undergraduate students in three curricula with majors in agronomy, horticulture, and plant sciences. A minor is also available in the above three areas.

Undergraduate students will select one of the three curricula specified in the College of Agriculture section of this catalog, depending on their career interests. Majors in agriculture or horticulture are available within the agriculture or agricultural business curricula. A major in plant sciences is available only in the agricultural science curriculum.

**The agriculture curriculum:** Students in this curriculum will be required to take the following courses which can be included in the minimum requirements specified in the College section: 100, 110, 220, 230, 312, 405, 495a; Ento. 151 or 201R; PI.P. 205; Chem. 103a-103b, 104a-104b, Ecol. 260 or M.C.B. 460; S.W. 200 and 201.

**The major in agronomy:** Students must take 12 additional units in P.I.S., and 3 units from S.W. to be chosen in consultation with a major advisor.

**The major in horticulture:** Students must take 12 additional units in P.I.S., and 3 units from S.W. or R.N.R. to be chosen in consultation with a major advisor.

Majors in horticulture or agronomy may specialize in seed industry management with the following additional required courses: 212, 315, 472, Acct. 200, M.A.P. 320, 330, and Mktg. 361.
An Extension/Non-Formal Education Option is available to students with majors in horticulture or agronomy. Students choosing this option will take A.Ed./H.E.E. 220; H.E.E. 428; H.E.E./A.Ed. 448; Agri. 493 and 496; plus two elective courses from an approved list available from the student’s advisor.

The agricultural business curriculum: Students selecting this curriculum must major in either agronomy or horticulture. In addition to the requirements specified in the college section, students following this curriculum must complete the agriculture curriculum with only one of the following required: 405; Ento. 151 or 201R, or P.I.P. 205. Ten additional P.L.S. units must be chosen in consultation with a major advisor. Students also will have an advisor in the Department of Agricultural Economics.

The agricultural science curriculum: Students following this curriculum must meet the requirements specified in the college, including in their programs 100, 220, 230, 312, 405, 421, 495a; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Ecol. 260 or M.C.B. 460; Ento. 151 or 201R; P.I.P. 205; S.W. 200, 201; and 4 units of physics.

The major in plant sciences: The major offers specialization in either plant breeding and genetics, or crop physiology. For the specialization in plant breeding and genetics the following courses are required: 315, 383; and Ecol. 470. For the specialization in crop physiology, 9 additional units must be chosen from P.L.S. 383, 408, 452, 466, 468, 472 or 482.

Majors in the Department of Plant Sciences may specialize in turfgrass management under any of the three agriculture curricula. Students in this specialization must meet the college and departmental requirements including the courses specified in the chosen curricula. Students are required to take P.L.S. 355 and 405, plus 6 additional P.L.S. units, and 3 S.W. units to be chosen in consultation with a major advisor.

The minor in agronomy, horticulture, or plant sciences: Students may obtain a minor in Agronomy, Horticulture or Plant Sciences. Foundation courses required are Chem. 101a, 102a, or Chem. 103a, 104a, Math. 117e, P.L.S. 100, and S.W. 200 and 201. Required courses for all three minors include P.L.S. 110, 230, and 312. The agronomy minor also requires P.L.S. 405; the horticulture minor requires one course from P.L.S. 339, 343, 361, or 364; the plant science minor requires P.L.S. 383. Nine additional units of plant science courses are required for all three minors, 6 units being upper-division units, to be selected in consultation with a minor advisor.

100. Plant Science (3) I II Germination, emergence, growth, and reproduction of important economic plant species; how these plant processes are influenced by the environment. Dobrenz

110. Agronomic and Horticultural Crop Science (3) I II Principles underlying the distribution, culture, improvement, and utilization of agronomic and horticultural crops useful to man. 2R, 3L: Field trips. P, 100. Mancino

130. Home Gardening (2) I II Care and maintenance of trees, shrubs, hedges, and flowers; principles of transplanting, pruning, and plant protection.

212. Principles of the Seed Industry (3) I 1988-89 Seed industry management principles, federal and state seed laws, seed certification, varietal release, and identification of crop and weed seeds. 2R, 3L. P, 100. Turner

220. Microcomputers in Agriculture (2) I II Introduction to the use of microcomputers for disciplines in the College of Agriculture. 1R, 3L. (Identical with Agri. 220) Hofmann

230. Plant Propagation (3) I Principles and practices of plant propagation by seed and asexual methods, including use of growth regulators, rooting media and misting systems. 2R, 3L. P, 110. Palzkill

234a-234b. Plant Materials (3-3) I II (Identical with L.A.R. 234a-234b)

312. Plant Genetics (3) I Critical examination of the various theories of heredity and their application to plant breeding, including demonstrations illustrating genetic factors in economic plants. P, 100. Ray

315. Principles of Plant Breeding (3) I Application of the principles of genetics, botany and statistics to the improvement of plants. P, 3 units of genetics. Smith


343. Florist and Foliage Plant Materials (2) I Environmental and nutritional requirements of foliage and floricultural plants; uses, identification, nomenclature. 1R, 3L. Field trip. Bailey

354. Landscape Management (3) I 1987-88 Installing, establishing and maintaining plants in the landscape; synthesis of cultural practices and environmental management techniques. 2R, 3L. Field trip. P, 100 or 110. Miller

361. **Vegetable Production** (3) I Vegetable industry, including climatic adaptation, culture, and special requirements for vegetable crops. P, 110, S.W. 200. *Kobriger*


368. **Forage Production** (3) II Adaptation, culture, and growth of legumes, grasses, and other forage plants. All-day field trip. P, 100 or 110, S.W. 200. *Smith*

369. **Fiber and Oilseed Crops** (3) I Principles and practices of growing and harvesting fiber and oilseed crops, with emphasis on cotton production, fiber technology, and utilization. All-day field trip. P, 110, S.W. 200. *Briggs*

372. **Grain Crop Production** (2) II Economic importance, production, utilization, and improvement of grain crops. P, 110, S.W. 200 *Volgt*

383. **Agricultural Biotechnology** (3) I Application of biotechnology principles to agricultural practices. Critical examination of the use of molecular genetics and tissue culture methods in agricultural production. P, 100, Chem. 103a, 104a. *Goldstein*

402. **Introduction to Pesticides and Their Use** (2) GC II (Identical with P.I.P. 402)

405. **Weed Control** (3) GC I Principles and effects of controlling agronomic and horticultural weeds, with emphasis on chemical control methods; weed identification. 2R, 3L. P, 6 units of plant sciences. *Hamilton*

408. **Crop Ecology** (3) GC II Physical and biotic environment of crops in relation to crop culture, production, and geographical distribution; relations among the human population, crop productivity, and man's environment. P, 110.

421. **Research Methods in Plant Sciences** (3) GC I Principles and techniques used in the design and evaluation of experiments including hypothesis development, plot design, and data collection and evaluation. 2R, 3L. P, Math. 117e. *Hofmann*

452. **Advanced Vegetable Crops** (3) GC II 1988-89 Environmental factors affecting germination, growth, development, maturation, and quality of vegetable crops; physiological problems unique to vegetables; presentation and interpretation of recent research progress. P, 361, Ecol. 260 or M.C.B. 460. *Kobriger*

466. **Postharvest Physiology** (1) GC II 1987-88 Biochemical and biophysical changes associated with the maturation, ripening and senescence of harvested horticultural plants. P, Chem. 241a, Ecol. 260 or M.C.B. 460. (Identical with N.F.S. 466)


472. **Seed Physiology** (1) GC II 1987-88 Physiology of seed development, germination and dormancy. P, Ecol. 260 or M.C.B. 460. *Lehle*

482. **Plant Cell and Tissue Culture** (3) GC II Principles and theory of callus induction, embryoid and plantlet regeneration, nutrient transport, protoplast culture and fusion and cell suspension. 2R, 3L. P, Ecol. 260. *Katterman*

495. **Colloquium**

509. **Information Sources for Agricultural Scientists** (1) I Information systems and retrieval techniques, with particular reference to concepts, uses and limitations; emphasis on abstracts, indexes, alerting services, journals and government documents. (Identical with L.I.S. 509) *McDaniel*

528. **Plant Microtechnique** (4) II 1987-88 Theory and practice of plant histological technique, including the use of light and electron microscopes and accessory equipment. P, twelve units of plant sciences or biology. *Bartels*


562. **Plant Intermediary Metabolism** (3) II 1988-89 (Identical with M.C.B. 562)

564. **Plant Growth and Development** (3) II 1987-88 (Identical with M.C.B. 564)
DEPARTMENTS AND COURSES OF INSTRUCTION

609. Scientific Communication and Research Funding Methods (1) II 1987-88 Techniques and limitations of written, oral, and visual scientific communication; procedures and policies for research funding sources. McDaniel

627. Advanced Genetics (3) I 1988-89 Strand and tetrad analysis; chromosome structure and organization; recombination at the molecular level and gene conversion; mutation classifications and origins; genetic complementation and its relation to a genetic unit and its function. P, 312 or Ecol. 320. (Identical with Gene. 627) Ray


635. Advanced Cytogenetics (4) II 1987-88 Fundamental principles that illustrate the correlation of genetic and cytological features involving intra- and interchromosomal structural changes, heterploidy and species hybrids. 3R, 3L. P, 6 units of gene. (Identical with Gene. 635) McCoy

696. Seminar
   a. Plant Science (1) [Rpt./4] I II

POLITICAL SCIENCE

Professors Jerrold G. Rusk, Head, James W. Clarke, Richard C. Cortner, Vine Deloria, Jr., Rosendo A. Gomez (Emeritus), R. Frank Gregg (Honorary Appointment), Helen M. Ingram, Conrad F. Joyner, Paul Kelso (Emeritus), Clifford M. Lyle, Edward N. Muller, John E. Schwarz, Michael P. Sullivan, Peter A. Toma, John C. Wahlke, Allen S. Whiting, Edward J. Williams, Clifton E. Wilson


Assistant Professors Paul G. Buchanan, Deborah R. Mathieu, Lyn Ragsdale

The Department of Political Science offers courses on the philosophies, processes, organizations, methods, and policies of government and related political institutions. These courses focus on government and politics in the United States and foreign countries and also on how governments of different nations relate to one another. Political science instruction is useful for pursuing careers in government, politics, law, business, education, journalism, and the media.

The department offers the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy with a major in political science. A Bachelor of Arts in Education and a Master of Education with a teaching major in political science are also available. For information on graduate degrees, please see the Graduate Catalog.

The major: Thirty units of course work in political science must be taken, including 102 and at least one of the following: 140, 150, 220. At least 18 units of this course work must be upper-division courses (300- and 400-level courses). Individual study cannot be used to satisfy this 18-unit requirement. Students must also take courses from five of the six fields of study listed below.

The teaching minor: Twenty units of course work in political science must be taken, including 102 and either 103 or 214 (110 is not applicable to the teaching minor), and three units in each of any three fields of study listed below.

Teacher certification: The U.S. and Arizona Constitutions requirement for a teacher’s certificate may be satisfied by three course options: 102, 103; 102, 214; or 110. An additional option is the constitutions examination, which carries no university credit.

Special programs: Majors interested in law, civil service, or foreign service should consult the department's career advisors regarding an appropriate course of study. Internships are offered in connection with the State Legislature, the Public Defender, the Juvenile Court, administrative agencies of the City of Tucson and Pima County, and the U.S. Congress. Prelaw students interested in legal problems of American Indians may combine prelaw and American Indian policy courses in the Department of Political Science with the minor in American Indian studies.

Honors: The department participates in the Honors Program.

101. Introduction to Politics (3) I II Issues in contemporary political analysis; human values and political goals; how governments differ and why they change; how nations influence one another. Not open to students with previous credit in 220, 140, or 150.

102. American National Government (3) I II General survey of the constitutional bases, organization, and functioning of the American national government; recent and current trends. Credit allowed for this course or 110, but not for both.

103. American State and Local Government (3) I II General survey of state and local government; recent and current trends.

110.* National and State Constitutions (3) I II Meets the state requirement for a teacher's certificate. Designed for seniors intending to teach. Credit allowed for this course or 102, but not for both.
*The state requirement for a teacher's certificate may be taken through correspondence.

140. Introduction to Comparative Politics (3) I II Survey of the major political systems and analysis of comparative political concepts, with a view to preparation for more advanced study.

150. Introduction to International Relations (3) I II Study of the international system, its actors and their capabilities; ends and means of foreign policy; international tension, conflict, and cooperation.

205. The American Presidency (3) I II Political dynamics of the executive office and its relationship to the competitive branches of government within the American political system.

206. Public Policy and Administration (3) I II Theory and practice of executive agencies, including policy making and other functions, processes, personnel and fiscal management, and administrative law.

214. Arizona Government (1) Arizona constitution. Offered through correspondence only.

220. Introduction to Political Ideas (3) I II Basic issues in political thought, with emphasis on contemporary problems of democracy, liberty, authority, obligation, and ideology.

227. Nuclear Age (3) II 1987-88 (Identical with Hist. 227)

231. Political Parties in an Age of Media and Money (3) I II American two-party system; party organization and activists; party roles in media, money, nominations, elections, and campaigns; party influence in the government; the future of parties.

240. Canadian Government and Politics (3) I Canada as a North American alternative: political culture, English-French relations, structures and processes, problems of federalism, environmental policies, Canadian-U.S. relations.

242a-242b. Western European Political Systems (3-3) Examination of the ideological framework, political culture, functions and processes of the Western European political systems. 242a: Britain, Ireland, Scandinavia, and the Low Countries. 242b: France, Italy, West Germany, and Spain. 242a is not prerequisite to 242b.

247. Introduction to Latin-American Politics (3) I Survey of the political forces and social groups important in shaping contemporary Latin America; examination of Indians, slaves, peasants, landlords, labor, the middle sectors, and the military; discussion of theories of instability.

250. Contemporary International Politics (3) I II Analysis of conflicts of national interests; decision making in the present international system; role-playing and simulation experience.

251. The United Nations (3) I The United Nations and its agencies, with emphasis on major issues confronting the organization.

260. Politics and the Vietnam War (3) I The American experience in Vietnam in terms of generational politics, foreign and military policy-making processes, the sociopolitical aspects of the war, and American political culture.

270. Politics and the Novel (3) I II Discussion and analysis of significant political questions as seen through the eyes of 19th and 20th century novelists, including Camus, Forster, Naipaul, Penn Warren, Didion, Dostoevsky, and Zola. (Identical with Engl. 290)

280. Workshop a. U.N. (1 to 3) I II Open to participants in Model U.N. programs only.

d. Election Law (3) I All-day field trips.
309. The Judicial Process (3) I II Structure, function, and processes of the “third branch” of the American government.

315. Political Sociology (3) II (Identical with Soc. 315)

328. Problems in Contemporary Political Theory (3) II Intensive examination of selected problems and concepts in political theory.

330. Minority Groups and American Politics (3) I II Political problems of the poor; analysis of systematic poverty in the U.S. and theories of causation; selected policy problems: education, housing, job training, enforcement of antidiscrimination statutes; future of “power” movements. (Identical with BIS. 330 and M.A.S. 330)

331. Politics and the Labor Movement (3) I The role of the labor movement in American politics, with emphasis on organizations, personalities, and issues that have initiated major changes in American society. A special concentration on legislation and litigation establishing contemporary labor rights.

332. Politics of the Mexican-American Community (3) II Political structure and processes of the Mexican-American community, with emphasis on history, schooling, political behavior, and class; future trends; bibliography. (Identical with M.A.S. 332)

333. Political Research and Methodology (3) I Introduction to research design and methods, with attention to philosophical foundations of modern political science.

334. Politics and American Indians (3) II Examination of public policy on American Indians and analysis of the political culture of American Indian communities. (Identical with A.In.S. 334)


393. Internship
   a. Administrative Internship (1 to 6) [Rpt./6 units] I II S
   b. Public Defender (1 to 6) I II
   c. County Attorney (1 to 6) I II
   d. Senatorial Internship (1 to 12) I II Open to majors only.
   e. Congressional Internship (1 to 12) I II Open to majors only.
   f. Legal Internship (1 to 6) [Rpt./6 units] I II S

396H. Honors Proseminar (3) I II

406. Bureaucracy (3) GC I Analyses of legal, political, cultural, and behavioral aspects of public organizations, bureaucratic typologies, and methods of public control.

407. Congress and American Politics (3) GC I II Examination of election politics, personalities, and career patterns of congressional members, the organization and structure of Congress, and the role of Congress in policy leadership and representation of the public.

408. Parliamentary Procedure (3) II (Identical with Comm. 408)

409. Struggle for the Presidency (3) GC I Examination of the campaign strategies and tactics of those seeking the nation’s most powerful office from 1960 to the present through films and readings.

412. Local Government and Administration (3) GC I II Examination and analysis of local decision-making structures and their policy outputs. P, 103.

421. Ancient and Medieval Political Theory (3) GC I Development of Western political theory from the Greeks to Machiavelli.

422. Early Modern Political Theory (3) GC II Western political theory from Machiavelli to Marx.

423. Recent Political Thought (3) GC I II Political theory from Marx to the present. Writing-Emphasis Course**

426. American Political Thought (3) GC II American political ideas from colonial times to the present.

431. Political Culture and the Dynamics of Change in American Society (3) GC I Examination of the manner in which attitudes about politics and political problems are acquired from exposure to music and television, and the manner in which such attitudes lead to political action.

432. Pressure Groups (3) GC I II Formation, structure, and place of pressure groups in the democratic society; the function of interest groups in the political process; problems of leadership, internal organization, and membership loyalties. Writing-Emphasis Course**

434. Quantitative Analysis of Political Problems (3) GC I Introduction to the use of statistics on political data, with emphasis on statistical manipulation; evaluation and interpretation of statistical explanations of political phenomena.
435. Public Opinion and Voting Behavior (3) GC II Attitude and opinion formation and socialization; public opinion in the political process; the relationship between attitudes, opinion, and voting behavior in American politics. (Identical with Soci. 435)

436. Personality and Politics (3) GC II Examination of the theories and concepts associated with the psychological basis of various types of political behavior. Writing-Emphasis Course**

437. Democracies, Emerging and Evolving (3) GC I Causal analysis of conditions of stability and breakdown of democratic regimes with particular emphasis on the developing democracies of the third world.

438a-438b. Philosophy of Law (3-3) GC (Identical with Phil. 438a-438b)

440. Politics and Mythology (3) GC I The role of the non-rational/irrational in politics: cults, utopias, crusades, conspiracies, cultural revitalization movements. Writing-Emphasis Course**

441. Arab-Israeli Conflict (3) GC I II Traces the birth and growth of the Arab-Israeli conflict since 1948 with particular attention to the internal impediments to conflict resolution on both the Arab and Israeli sides. Also surveys the role of the Great Powers in Middle East politics generally. (Identical with Or.S. 441)

442. Transformation of Agrarian Societies in the Middle East (3) GC II (Identical with Or.S. 442)

443. Soviet Politics (3) GC I Revolution and contemporary ideology; state, party, and mass organizations; economic and social planning; civil liberties; models of autocracy and pluralism. Writing-Emphasis Course**

444. East European Politics (3) GC II Divergent models of Communist development, from East Germany to Yugoslavia; political, economic, social, and cultural reform.

445. Comparative Political Revolution (3) GC I Examination of the causes and consequences of 20th-century revolutions and the revolutionary process, with emphasis on contemporary events. Writing-Emphasis Course**

446. Politics of Developing Areas (3) GC II Survey of politics and problems in Asia, Africa, and Latin America, including political violence, elections, bargaining, elites, parties, the military, and ideology.

447. Latin-American Political Development (3) GC II Presentation of strategies for development in Latin America; examination of case studies from Cuba, Brazil, Chile, Guatemala, and other countries.

448. Government and Politics of Mexico (3) GC I Description and analysis of Mexico's political economy, its political system, and its foreign policy, with emphasis on Mexican-U.S. relations. (Identical with M.A.S. 448)

449. The Politics of Cultural Conflict (3) GC II Comparative examination of the approaches of different types of political systems to domestic conflict of a racial, religious, lingual, and/or ethnic nature.

451. Soviet Foreign Policy (3) GC I Ends and means of Soviet foreign policy; the decision-making process; Soviet relations with the West and developing nations.

452. Communist Foreign Relations (3) GC II Interrelations of fourteen Communist-party states, with emphasis on cooperation and conflict in such organizations as the Comecon and the Warsaw Pact.

453. Theories of International Relations (3) GC I Introduction to theories of international relations on the levels of man, the nation-state, and the international system, with a logical and empirical evaluation of approaches and theories.

455. American Foreign Policy (3) GC II Analysis of the Cold War; Congressional-Executive clashes over foreign policy control; approaches to policy analysis.

456a-456b. International Law (3-3) GC 456a: The international state system; legal-political problems, including territory, environment, seas. 456b: The international system and the individual; the war system, including use of force, laws of war. 456a is not prerequisite to 456b. Writing-Emphasis Course (456a)**

457. Inter-American Politics (3) GC I Survey and analysis of the leading political and economic issues at controversy between the United States and Latin America.

458. Government and Politics of the Middle East (3) GC II (Identical with Or.S. 458)

459. Problems of World Order (3) GC II Analysis of complex, interrelated global problems, threats to survival, quality of life, and exploration of past and present policies and future worlds. Course is value-oriented and prescriptive.

460. Modern Chinese Foreign Relations (3) GC II Survey of the developments and trends in Chinese foreign relations in the modern period, focusing mainly on the relationship between the theoretical and actual objectives of China's foreign policies from 1949 to the present. (Identical with Or.S. 460)

464. International Relations of East Asia (3) GC II National interests, issues and conflicts, relations, and influence of domestic politics in interstate relations in East Asia. (Identical with Or.S. 464)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>467</td>
<td>Population and Development in the Middle East</td>
<td>(3) GC I (Identical with Or.S. 467)</td>
</tr>
<tr>
<td>468</td>
<td>Government and Politics of Africa</td>
<td>(3) II Government and politics of African nations south of the Sahara; emphasis on processes of political and economic development. (Identical with BLS 468)</td>
</tr>
<tr>
<td>470</td>
<td>Constitutional Law: Civil Liberties</td>
<td>(3) GC I II Analysis of the constitutional guarantees of civil liberties in the U.S.</td>
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<tr>
<td>474</td>
<td>Administrative Law</td>
<td>(3) GC I Law governing the organization, powers, and procedures of the executive and administrative establishment, with emphasis on the limitations imposed by the American constitutional system.</td>
</tr>
<tr>
<td>475</td>
<td>Concepts in Criminal Law</td>
<td>(3) GC II Focus on questions such as what constitutes a crime; when is killing murder; what makes punishment just; what distinctions exist between justifiable and excusable crimes.</td>
</tr>
<tr>
<td>476</td>
<td>Women and the Law</td>
<td>(3) GC I 1988-89 Legal status of women in America, including constitutional protections, marriage and family relationships, educational and vocational opportunities, political rights, criminal law. (Identical with W.S. 476)</td>
</tr>
<tr>
<td>477</td>
<td>Development of Federal Indian Policy</td>
<td>(3-3) GC 484a: European colonial precedents through the treaty-making period. 484b: End of treaty-making to the present. 484a is not prerequisite to 484b. (Identical with A.In.S. 484a-484b)</td>
</tr>
<tr>
<td>483</td>
<td>Urban Public Policy</td>
<td>(3) GC I II Analysis and discussion of social, economic, and political problems and proposed solutions in changing urban environments.</td>
</tr>
<tr>
<td>485</td>
<td>National Security Policy</td>
<td>(3) GC I Decision-making structures, processes, and outcomes relevant to American security policy; comparison with major foreign powers.</td>
</tr>
<tr>
<td>486</td>
<td>Political Systems of India and Pakistan</td>
<td>(3) GC II (Identical with Or.S. 486)</td>
</tr>
<tr>
<td>487</td>
<td>Race and Public Policy</td>
<td>(3) GC I Examination of the race issue in the context of American politics, from historical, behavioral, and comparative perspectives. (Identical with A.In.S. 487 and BLS 487) Writing-Emphasis Course**</td>
</tr>
<tr>
<td>489</td>
<td>The Politics of National Policymaking</td>
<td>(3) GC I II Analysis of institutional and political basis for cooperation and conflict between Congress, the President, and the Court in different policy areas.</td>
</tr>
<tr>
<td>579</td>
<td>Research Design</td>
<td>(3) I Introduction to experimental and quasi-experimental research design; survey research; the use of aggregate statistics; historical documents and life-history materials; participant observation; unobtrusive methods.</td>
</tr>
<tr>
<td>580</td>
<td>Methods of Political Inquiry</td>
<td>(3) II Systematic examination of problems of scope and methods of inquiry in the discipline of political science; intended to acquaint students with the discipline and to prepare them for scholarly research in the field.</td>
</tr>
<tr>
<td>582</td>
<td>Research and Methodology</td>
<td>(4) II Quantitative techniques and computer applications in political science.</td>
</tr>
<tr>
<td>585</td>
<td>Political Risk and Intelligence Analysis</td>
<td>(3) II Examination of political risk and intelligence analysis with emphasis on forecasting political developments in nations.</td>
</tr>
</tbody>
</table>
| 596        | Colloquium                                       | a. American Political Institutions (3) I II  
b. Political Behavior (3) I II  
c. Survey of Political Theory (3) I II  
d. Comparative Politics (3) I II  
e. International Relations (3) I II |
|            | Seminar                                          | a. American Political Institutions (3) [Rpt./2] I II  
b. Political Behavior (3) [Rpt./2] I II  
c. Political Theory (3) [Rpt./2] I II  
d. Comparative Politics (3) [Rpt./2] I II  
e. International Relations (3) [Rpt./2] I II  
f. Public Law and the Judicial Process (3) [Rpt./2] I II |
PSYCHOLOGY

610a-610b. Fiscal and Budgetary Administration of Public Agencies (3-3) (Identical with M.A.P. 610a-610b)

"Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of the catalog)."

PORTUGUESE

(See Spanish and Portuguese)

PSYCHOLOGY


Associate Professors Harold S. Arkowitz, Wayne R. Carroll, Lewis Hertz, Alfred W. Kaszniak, Ronald H. Pool, Rosemary A. Rosser, Linda Swisher (Speech and Hearing Sciences), William H. Thweatt, Elizabeth B. Yost

Assistant Professors Jeff L. Greenberg, Catherine M. Shisslak (Adjunct)

The Department of Psychology offers courses designed to provide an understanding of the scientific principles of behavior and functions of the brain.

Degrees awarded are the Bachelor of Arts, Bachelor of Science, Master of Arts and Doctor of Philosophy with a major in psychology. The master's degree is awarded during doctoral training; there is no Master of Arts program as such.

The major for the B.A.: 36 units of psychology, of which at least 18 units must be in upper-division course work. Majors must take 101, 245, 255, 302 and 370. The remaining 21 units may include 3 units from 211, 212, 214, 216, or 218, and 3 units of 99 series of Independent Study or 94 series of Practicum. A maximum of 48 units of psychology may be taken. Students planning on attending graduate school should complete 405 and 475, and should consult with an advisor no later than their sophomore year. Concentrations in biopsychology, learning, cognition and perception, developmental, social and individual adjustment and assessment should be planned with the assistance of an advisor.

The major for the B.S.: 36 units of psychology, of which at least 18 units must be in upper division course work. Majors must take 101, 245, 255, 302, and 370. In addition 8 units in a biological laboratory science (excluding Ecol. 107), 8 units in chemistry or 8 units in physics laboratory courses; Math. 117e and either Math. 119 or 123. Recommended minors are biological, physical or social sciences, and mathematics.

Honors: The department participates in the Honors Program.

101. Introduction to Psychology (3) I II S Survey of general psychology including history and systems, physiological, sensation and perception, learning, motivation, cognition, development, personality, social, and psychopathology.

210. Brain and Behavior (3) I Biological foundations of sensation, perception, motivation, emotion, cognition and action. Designed for students in the life sciences. P, 101. Credit is allowed for this course or 302, but not both.


216. **Psychological and Biological Perspectives on Gender Differences** (3) II Analysis of gender differences and their source in biology and culture. P, 101.


245. **Psychological Measurement and Statistics** (3) I II Measurement, quantitative description, and statistical inference as applied to psychological variables. P, Math. 116; Psyc. 101 or CR.

255. **Research Methods** (3) III Students will gain experience in a range of psychological research methods. 2R, 3L. P, 101, 245.

265. **Normal Personality** (3) I II An integrated model of developmental, intellectual, and moral/ethical stages; gender differentiation; plus the functions and structure of personality. Experimental learning of the social and interpersonal aspects of personality demonstrated in student-led labs. 2R, 3L. P, 101.

300. **Social Psychology** (3) I II Introduction to major theories and research findings of social psychology; to provide an understanding of the roles of cognitive and motivational processes in social behavior. P, 255.

302. **Introduction to Biopsychology** (3) I II Survey of the basic principles of nervous system function in relation to perception, learning, memory, emotion, and thinking. P, 255, or eight units of biology lab science.

312. **Primate Behavior** (3) I II Survey of psychological research on nonhuman primates; includes sensory processes, learning, development, social and abnormal behaviors. P, 255.

313. **Developmental Psychology** (3) I II The child, from conception to adolescence, with emphasis on experimental analyses of the development of behavior. P, 255.

316. **Personality** (3) I II Basic concepts and issues in personality theory; approaches to personality description and assessment. P, 255.

329. **Human Perception** (3) I II How people receive environmental information, and what they do with it. P, 255.

370. **Learning and Cognition** (3) I I Review of learning processes and related research methods and findings. P, 255.

371. **Environmental Psychology** (3) I Basic concepts in environmental psychology; the relationship between the individual and the large-scale environment. P, 101.

385. **Industrial-Organizational Psychology** (3) I II S The application of psychology to problems of industrial organizations, including personnel, job satisfaction, leadership, and advertising. P, 101.

400. **Methods of Neurological Psychology** (3) GC I II Group discussion, demonstrations and experiments on current problems in neuropsychology. Problems selected to permit students to integrate laboratory techniques, research literature, and anatomical and physiological knowledge with behavioral theory. P, 101, 255, 302. Writing-Emphasis Course*

401. **Body Chemistry and Behavior** (3) GC I Biochemical compounds related to life and the role of behavior in life; chemical processes occurring within organisms and how they interact with behavior. P, 101; and 302 or 8 units of biological lab science.

402. **Principles of Neuroanatomy** (4) II GC (Identical with Anat. 402)


410. **Advanced Social Psychology** (3) GC I II Social psychology, with emphasis on theory and method. P, 255, 300. Writing-Emphasis Course*


412. **Animal Learning** (3) GC II Animal learning with emphasis on interspecies comparisons. P, 255. Writing-Emphasis Course.*

414. **Personality and Social Development** (3) GC I II Research and theory in developmental psychology with an emphasis on social cognition, social and emotional growth. P, 255, 313.
415. Cognitive Development (3) GC II Introduction to major theories, methods, and research findings associated with the development of cognition and intelligence. P, 255, 313.

416. Advanced Personality (3) GC I II Advanced study of theories of personality; methods and results of personality study. P, 255, 316.

418. Abnormal Psychology (3) GC I II Nature and etiology of various forms of behavior disorder, mental deficiency, and other deviations; critical evaluation of current theories. P, 255.

421. Psychology of Death and Loss (3) GC I II Basic concepts in a psychology of death and loss, with emphasis on both the adjustment to death and loss, and the underlying phenomenal, humanistic and current social considerations: P, 255 or graduate standing.

428. Field Methods in Environmental Psychology (3) GC II Behavior in man-made or managed environments, with emphasis on objective methods; designed for students having a professional interest in environmental design or management. P, 371 or graduate standing. (Identical with Arch. 428 and L.Ar. 428)

430a-430b. Psychology, Law and Social Policy (3-3) GC Critical review of theory, methods and research in the psychology, law and social policy interface. P, 255, 300, 6 units of a social science, or graduate standing. 430a is not prerequisite to 430b.

435. Psychological Problems of the Aged (3) GC I Cognitive, intellectual, personality, and behavioral correlates of aging; relates general psychological theory to the problems of aging. P, 255; or 101 and two courses on gerontology; or graduate standing. (Identical with Gero. 435)

450. Psychological Assessment and Testing (3) GC I II Evaluation of assessment processes and of measurements of intelligence, aptitudes, personality, and interests; test theory; social implications. P, 255. Writing-Emphasis Course*

452. Psychology of Creativity (3) 1987-88 An analysis of the nature and nurture of creativity, with coverage of major theories and concepts, assessment techniques, and cognitive, social and personality aspects. P, 255 or consult department before enrolling.

454. Culture and Mental Health (3) GC I Mental health in cross-cultural perspective; universal and culture specific disorders, traditional and western psychotherapy, cultural values in treatment methods and in research. P, 101, 418.

455. Psychopathology (3) GC II In-depth study of current theoretical and research formulations in behavior deviancy; various approaches to behavior change. P, 255.

472. Human Memory and Cognition (3) GC II Human learning, memory, and cognition; emphasis on information-processing approach to results and theory. P, 255, 370; or grad. standing. Writing-Emphasis Course*

473. Natural Language Processing (3) GC II (Identical with Ling. 473)

474. Cognitive Neuroscience (3) GC II Neural mechanisms of higher mental function, including learning, memory, thought, and consciousness. P, 255, 302.

475. History of Psychology (3) GC I Growth of psychology as a science; major schools and theories; contributions of famous investigators and major advances; psychology as an art and a science today. P, 255 and 6 upper-division units in psychology.

481. Topics in the Biological Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule): physiological, neurological, sensory, and motor systems; comparative psych., others. P, 255 and 6 units upper-division psychology; or graduate standing. Writing-emphasis Course*

482. Topics in the Cognitive and Affective Bases of Behavior (3) [Rpt./1] GC III Variable content (consult schedule): learning, cognition, perception, psycholinguistics, emotion, others. P, 255 and 6 units of upper-division psychology; or grad. standing. Writing-Emphasis Course*

483. Topics in Social Bases of Behavior (3) [Rpt./1] GC I II Variable content, including developmental psychology, personality, psychopathology, and others. Consult schedule. P, 255 and 6 units of upper-division psychology; or grad. standing. Writing-Emphasis Course*

484. Topics in Individual Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule): developmental psychology, personality, psychopathology, others. P, 255 and 6 units of upper-division psychology; or grad. standing. Writing-Emphasis Course*

485. Contemporary Issues in Psychology (3) [Rpt./1] GC I II Variable content (consult schedule): major topical problems in psychological research, theory, and applications. P, 255 and 6 units of upper-division psychology; or graduate standing. Writing-Emphasis Course*

500a-500b. Current Issues in Psychological Theory and Research (3-3) Intensive examination of a range of content areas addressed in contemporary psychological theory and research. Open to psychology graduate students only.
507a-507b. Statistical Methods in Psychological Research (3-3) 507a: Research design, application of analysis of variance, multiple comparisons, and computer techniques in psychological research. 507b: Selected methodological issues and multivariate methods in psychology, with coverage of computer applications. Open to psychology majors only.

509. History of Psychological Theories and Research (3) II Development of psychology as a science; schools, systems, theories, major advances, famous investigators.

520. Neurobiology (3) [Rpt./1] II Recent advances in neurobiology, with a strong emphasis on cellular and molecular mechanisms of nervous system function.

522. Psychobiology (3) [Rpt./1] II Recent advances in psychobiology, with a strong emphasis on the neural bases of sensation, perception, motivation, emotion, and action.

524. Animal Behavior (3) [Rpt./1] II Recent advances in the study of behavior from an ethological/evolutionary perspective.

528. Cognitive Neuroscience (3) [Rpt./1] II Recent advances in analysis of the neural bases of cognitive functions, such as learning, memory, and thinking.

540. Perception and Attention (3) [Rpt./1] II Recent advances in the areas of perception and attention, with an emphasis on visual process.

542. Psycholinguistics (3) [Rpt./1] II Recent advances in the area of psycholinguistics, with an emphasis on sentence processing and the contribution of linguistic theory to an understanding of psychological mechanisms.

544. Cognitive Neuropsychology (3) [Rpt./1] II Recent advances in the area of cognitive neuropsychology, with an emphasis on the contribution of the brain to cognitive activities including memory, thinking, learning, and perceiving.

546. Environmental Cognition (3) [Rpt./1] II Recent advances in the area of environmental cognition, with an emphasis on cognitive aspects of environmental psychology.

560. Law and Social Science (3) [Rpt./1] II Major issues in the relationship between law and social (behavioral) science in general, and law and psychology in particular.

562. Mental Health Policy (3) [Rpt./3] II Major issues in law and mental health, including law and policies relating to the clients and providers of mental health services, and the organization/structure of the system for delivering these services.

564. Health Policy (3) [Rpt./3] II Major issues in law and health, including laws and policies relating to clients and providers of health services, and the organization/structure of the system for delivering these services.

566. Crime, Behavior, and Policy (3) [Rpt./3] II Major issues in law, crime and victimization, including laws and policies relating to criminals, victims, the criminal justice system, and legal personnel working in that system.

580. Clinical Neuropsychology (3) [Rpt./1] II Cognitive and affective sequelae of human central nervous system disease/damage, with emphasis on clinical evaluation, management and rehabilitation.

582. Psychopathology (3) [Rpt./1] II Advanced survey of current theory and research in symptoms, causes and treatment of the major psychological disorders.

584. Psychology and Health (3) [Rpt./1] II Current research and theory concerning psychological contributions to health maintenance, illness prevention and treatment, and the organization of health services.

586. Cross-Cultural Psychology (3) [Rpt./1] II Current research and theory in cross-cultural psychology, with a particular emphasis on the cultural context of symptoms, causes and treatments of psychopathology and behavior disorders.

596. Seminar
   a. Social Psychology (3) [Rpt./1] II
   b. Personality Psychology (3) [Rpt./1] II
   c. Developmental Psychology (3) [Rpt./1] II
   d. Environmental Psychology (3) [Rpt./1] II
   e. Biopsychology (3) [Rpt./1] II
   f. Cognitive Psychology (3) [Rpt./1] II
   g. Clinical Psychology (3) [Rpt./1] II
   h. Law, Psychology, and Policy (3) [Rpt./1] II
   i. Quantitative Methods (3) [Rpt./1] II
   u. Interdisciplinary Environment-Behavior-Design (3) [Rpt./1] II (Identical with IDIS/596u, which is home)
621. Clinical Assessment Methods (3) II Theory and practice in interview techniques and cognitive and personality assessment. Open to majors only.

625. Clinical Community Psychology (3) II Expanding role of psychology in innovative mental health functions, with emphasis on consultation, program development, primary prevention and social system modification. Open to majors only.

628. Psychotherapy (3) [Rpt/2] I II Current research and theory in psychotherapy. Alternate semesters will emphasize individual insight, behavioral, and treatment approaches.

694. Practicum
   a. Clinical Interviewing and Assessment (1 to 3) [Rpt/1] II Open to clinical psychology students only.
   b. Psychotherapy (1 to 3) [Rpt/1] II Open to clinical psychology students only.
   c. Community Mental Health (1 to 3) [Rpt/1] II Open to clinical psychology students only.

695. Colloquium
   a. Motor Control (2) II (Identical with Ex.S.S. 695a)

*Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
Religious studies is an interdisciplinary program offering a wide range of approaches to the study of various religions.

The major: 30 units requiring general survey courses in both Asian and Western religious traditions (120, 130 — 6 units). It also requires 6 units of courses involving the application of particular disciplinary approaches to the study of religion (233, 411, 439, 522). Finally, the major requires at least 9 units each in further study of Western and Eastern religions.

The minor: 20 units, including 120, 130 and 14 additional units in religious studies.

120. Western Religions (3) I II Religions of the Western World: Judaism, Christianity, Islam.

126. Mythology (3) I II (Identical with Clas. 126)

130. Asian Religions (3) I II (Identical with Or.S. 130)

140a-140b. Oriental Humanities (3-3) (Identical with Or.S. 140a-140b)

233. Philosophy of Religion (3) I (Identical with Phil. 233)


301. Catholic Thought in the 20th Century (3) I Development of Roman Catholic thought beginning with the neo-Thomistic revival under Pope Leo XIII and stressing the documents and theology of the Second Vatican Council.

302. Protestant Thought in the 20th Century (3) I Survey of the various strands of Protestant theology since the turn of the century, with special reference to authors such as Rauschenbusch, Barth, Brunner, Tillich, Bultmann and Bonhoeffer.

303. Epistles of St. Paul (3) I Examination of the religious and cultural background in the Greco-Roman world during the lifetime of St. Paul; analysis of Paul's thought in Acts and the Epistles.

320a-320b. Literature of the Bible (3-3) (Identical with Engl. 320a-320b)

322. Sociology of Religion (3) I II (Identical with Soc. 322)

323. Religious Organizations in America (3) II (Identical with Soc. 323)

330a-330b. Chinese Thought (3-3) (Identical with Or.S. 330a-330b)

331. Taoist Traditions of China (3) I 1987-88 (Identical with Or.S. 331)

332a-332b. Judaic Thought and Culture (3-3) (Identical with Or.S. 332a-332b)

333. Buddhist Meditation Traditions (3) I (Identical with Or.S. 333)

340. Jesus in Contemporary Thought (3) I 1987-88 Survey of present thinking about the meaning of Jesus, including humanistic, Jewish, and various Christian interpretations.

348. Myth and Archetype (3) I II (Identical with Clas. 348)

370a-370b. History of the Jews (3-3) (Identical with Or.S. 370a-370b)

372a-372b. History and Religion of Israel in Ancient Times (3-3) I (Identical with Or.S. 372a-372b)

374. The Holocaust (3) II 1988-89 (Identical with Or.S. 374)

382. Archaeology and the Bible (3) II (Identical with Or.S. 382)

405a-405b. Medieval Europe (3-3) GC (Identical with Hist. 405a-405b)

407. Intellectual History of Medieval Europe (3) GC II (Identical with Hist. 407)

408. The Renaissance (3) GC I (Identical with Hist. 408)

409. The Reformation (3) GC II (Identical with Hist. 409)

410. History of Hell in Early Europe (3) GC II (Identical with Hist. 410)

411. Anthropology of Religion (3) GC I (Identical with Anth. 411)

416. Tudor-Stuart England (3) GC I (Identical with Hist. 416)

418. Classical Confucianism (3) GC I (Identical with Or.S. 418)

419. Neo-Confucianism (3) GC II (Identical with Or.S. 419)

421a-421b. East Asian Buddhism (3-3) GC (Identical with Or.S. 421a-421b)

427. Religion and Mythology of Mesopotamia (3) GC II 1987-88 (Identical with Anth. 427)

430. Prophecy in Ancient Israel (3) GC II (Identical with Or.S. 430)
Remote sensing concerns the collection of information related in some way to the Earth's natural resources or environment. Data are primarily collected by satellite and aircraft systems in conjunction with localized ground-based surveys and measurements. The data are processed by digital computer or optical techniques to extract information of value to Earth scientists and resource and environment managers at the local, state, and federal levels.

The Committee on Remote Sensing offers no major at the present time but minor programs are available for doctoral students with majors in disciplines within the colleges of Agriculture, Arts and Sciences, Business and Public Administration, Engineering and Mines; and in the Office of Arid Lands Studies and the Optical Sciences Center. For further information concerning the minor, please see the Graduate Catalog.

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Programs of the School of Renewable Natural Resources concern the management of resources for water, wood, forage, recreation, wildlife, fisheries, soil and aesthetic values. The Bachelor of Science in Renewable Natural Resources degree is available with majors in natural resource recreation, range management, watershed management and wildlife and fisheries science. A Bachelor of Science in Agriculture under the agriculture business curriculum is available with a major in range management. Undergraduate minors are available in these general areas of study. A major in landscape architecture for the Bachelor of Landscape Architecture and Master of Landscape Architecture degrees is also offered. In addition, a student may obtain the degree of Master of Science or Doctor of Philosophy with a major in range management, watershed management, wildlife and fisheries science, or renewable natural resources studies.

Renewable Natural Resources

135. Conservation of Natural Resources (3) Conservation and multiple use of renewable natural resources, including forest, watershed, range, wildlife, and recreation; history of forest and range use and its present status. Zwolinski

202. Forest and Range Plants (2) Plant classification, identification and nomenclature, with emphasis on the grass, rose, legume, composite, pine, and other plant families containing important forest and range plants. 1R, 3L. P, M.C.B. 181, Ecol. 182. Ogden

295. Colloquium
   a. Natural Resource Management (1) II

321. Natural Resource Measurements (3) Study of basic land, climatic, hydrologic and vegetative measurements used in management of natural resources; presentation and interpretation of resulting data. 2R, 3L. P, Math. 118; 160 or 263. Lehman

417. Introduction to Geographic Information Systems (3) GC II Computer techniques for capture, processing, analysis and display of geographic information, with emphasis on applications in land resource management and planning. 2R, 3L. P, basic knowledge of computer operations. (Identical with S.W. 417, Geog. 417)


477. Economics of Water and Land Resources (3) GC I (Identical with A.Ec. 477)

481. Environmental Policy (3) GC II (Identical with Pol. 481)

546. Principles of Research (3) II Philosophy of science and research, the scientific method, problem selection, problem analysis, study plans, scientific communications. Klemmedson

595. Colloquium
   a. International Renewable Resource Issues (2) I 1988-89
   b. Public Natural Resource Management (2) II 1988-89
   c. Human Dimensions in Renewable Natural Resources (3) II 1987-88
   d. Topics in Forest and Range Ecology (2) II 1988-89

596. Seminar
   i. Water and Equity in the Southwest (3) I II (Identical with Pol. 596i)

597. Workshop

696. Seminar
   a. Renewable Natural Resources (1 to 2) [Rpt.] I II

*Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Landscape Resources

Ervin H. Zube, Chairperson of the Division
**Landscape Architecture**

The curriculum leading to the B.L.A. is a four-year program comprising two preprofessional years and two professional years designed to prepare the student to meet the demands of the profession and to qualify for professional registration in the state. While the principles of professional practice are universal, the program, which is accredited by the American Society of Landscape Architects, encourages strong linkages in renewable natural resources and recognition of the unique qualities of the arid Southwest.

In addition to complying with University admission requirements, all applicants to the program must file an Application for Admission to the Professional Major with the division chairman by July 1 preceding the intended fall admission. Students are admitted to the professional major in the fall semester only, after having completed the following courses: L.Ar. 101, 201, 202, 234a-234b, 250; Math. 117e and 118; Art 101; I.D. 115; Chem. 101a, 102a; Phys. 102a, 180a; P.I.S. 100; Ecol. 130; S.W. 200, 201; R.N.R. 135; C.E. 151; Engl. 101 and 102 or 102 and 103H; Psyc. 101.

Applicants will be evaluated by the Landscape Architecture Admissions Committee on the basis of the following criteria: grade-point average, course work, statement of intent, work experience, special interests, and creative endeavors. Admission will be restricted to those applicants with the highest evaluation. It is unlikely that a student with an overall grade-point average less than 2.5000 will be admitted. Applicants seeking advanced standing will be placed at the Year II level until they fulfill all requirements of the preprofessional phase.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Introduction to Landscape Architecture (2)</td>
<td>L</td>
<td>Introduction to the profession of landscape architecture.</td>
</tr>
<tr>
<td>201</td>
<td>Landscape Graphic Communication (3)</td>
<td>L</td>
<td>Introduction to materials and techniques of graphic communication.</td>
</tr>
<tr>
<td>202</td>
<td>Landscape Design Process (3)</td>
<td>L</td>
<td>Introduction to programming, analysis and problem solving in landscape architectural design.</td>
</tr>
<tr>
<td>234a-234b</td>
<td>Plant Materials (3-3)</td>
<td>L</td>
<td>Plant materials used in landscape design.</td>
</tr>
<tr>
<td>250</td>
<td>Landscape Analysis (3)</td>
<td>L</td>
<td>Introduction to basic analytical methods resulting in the solution of site problems; analysis procedures, data collection, data categorization, statistical techniques, computer applications.</td>
</tr>
<tr>
<td>301</td>
<td>Landscape Architecture/Site Planning and Design (4)</td>
<td>L</td>
<td>Application of the principles of design to site problems. Emphasis on design process, graphic and verbal communication, materials and methods.</td>
</tr>
<tr>
<td>302</td>
<td>Urban Landscape Planning and Design (4)</td>
<td>L</td>
<td>Planning and design problems in urban environments.</td>
</tr>
<tr>
<td>401</td>
<td>Urban/Rural Landscape Planning and Design (4)</td>
<td>GC</td>
<td>Planning and design problems at the urban/rural interface; issues of growth and change.</td>
</tr>
<tr>
<td>402</td>
<td>Regional Landscape Planning and Design (4)</td>
<td>GC</td>
<td>Planning and design problems of regional scope and emphasis.</td>
</tr>
<tr>
<td>407</td>
<td>The American Landscape (3)</td>
<td>GC</td>
<td>(Identical with Geog. 407)</td>
</tr>
<tr>
<td>428</td>
<td>Field Methods in Environmental Psychology (3)</td>
<td>GC</td>
<td>(Identical with Psyc. 428)</td>
</tr>
<tr>
<td>441</td>
<td>History and Theory of Landscape Architecture (3)</td>
<td>GC</td>
<td>Examination of the historical background and theoretical basis of landscape architecture.</td>
</tr>
<tr>
<td>451</td>
<td>Site Engineering (4)</td>
<td>L</td>
<td>Grading, road layout, utilities, and other site engineering considerations.</td>
</tr>
<tr>
<td>452</td>
<td>Landscape Construction (4)</td>
<td>GC</td>
<td>Construction materials and methods in landscape architecture; introduction to working drawings and specifications.</td>
</tr>
<tr>
<td>450</td>
<td>Professional Practice (2)</td>
<td>GC</td>
<td>Professional services, contract documents, contract administration, office organization, ethics, professional registration, roles of the landscape architect, the practice of landscape architecture.</td>
</tr>
<tr>
<td>495</td>
<td>Colloquium</td>
<td></td>
<td>Writing-Emphasis Course.</td>
</tr>
<tr>
<td>497</td>
<td>Workshop</td>
<td></td>
<td>Community Design for Non-Designers (3) (Identical with Arch. 497i, which is home)</td>
</tr>
</tbody>
</table>
DEPARTMENTS AND COURSES OF INSTRUCTION

522. Advanced Landscape Design (4) II Planning and design in the urban landscape; human needs, processes and responses; urban landscape systems. 2R, 6L.

523. Advanced Landscape Planning (4) I Advanced techniques in planning and designing of regional landscape resources; visual simulation, computer map overlay, video applications, application of research in perception and behavior. 2R, 6L. Field trip fee: $100.

533. Landscape Planning (2) I Theories and models in landscape planning; planning issues, methods, and case studies.

595. Colloquium
   a. Systems Ecology for Planners and Designers (3) II
   b. Urban Forestry (2) II 1988-89 (Identical with Ws.M. 595c, which is home)
   c. Landscape Architecture Research (3) I

596. Seminar (3) I
   a. Interdisciplinary Environment-Behavior-Design (Identical with Ids. 596u, which is home)

694. Practicum
   a. Landscape Architecture Teaching (1 to 2) I II

696. Seminar (1 to 3) I II

*Writing Emphasis Course. P, Satisfactory of the upper-division writing-proficiency requirement (see "Writing Emphasis Courses" in the Academic Guidelines section of this catalog).

Range Resources

E. Lamar Smith, Chairperson of the Division

Range Management

The major in range management provides students with the background necessary to begin professional careers in management of rangelands for livestock production, wildlife habitat, watershed protection, and other range resource values. Students majoring in range management may obtain a Bachelor of Science in Renewable Natural Resources or a Bachelor of Science in Agriculture. The B.S. in Renewable Natural Resources meets standards for federal employment as a range conservationist and is recommended for students desiring careers in public agencies or preparation for biologically oriented graduate studies. The B.S. in Agriculture emphasizes business aspects of range management and is recommended for students interested in ranch management, agricultural lending institutions, private consulting, international development, ranch appraising or similar careers, and for preparation for graduate studies in business/economics/policy-oriented fields. Students in this curriculum may qualify for government employment by additional course work. The range management curriculum is accredited by the Society for Range Management.

All students must take: Engl. 101 or 103H; 102; 307 or 308; Comm. 100, 102; Econ. 201a; M.C.B. 181; Ecol. 182; Chem. 103a-103b, 104a-104b; Math. 123; S.W. 200, 201; An.S. 430; 477 or 474; M.I.S. 111 or S.I.E. 170; R.N.R. 202; Ra.M. 305, 382, 416, 436, 446, 456, 487, 495a.

Students electing the B.S. in Renewable Natural Resources must meet the requirements for the curriculum in natural resources plus the following additional courses: M.C.B. 460; Econ. 201b; Geos. 101a, 102a; Math. 160 or 263; Phys. 102a; R.N.R. 321; S.W. 431; Ws.M. 422; Ra.M. 318; and at least 9 credits from the following courses: N.R.R. 381; Ws.M. 410, 460, 480, W.F.Sc. 325, Pl.S. 368.

Students electing the B.S. in Agriculture must meet the requirements for the curriculum in agriculture business, plus the following additional courses: 6 additional elective credits in agriculture; 3 additional credits in physics, atmospheric science, geosciences or chemistry; Math. 119, M.A.P. 275; 373 or 375 or A.Ec. 339; 33 credits in the business core (see agricultural business curriculum requirements).

A minor is available in range management. Twenty-one units of foundation courses must be completed before the minor is initiated. Foundation courses are Chem. 103a-103b; M.C.B. 181; Ecol. 182, S.W. 200, 201, and Math. 160 or 263. Required courses in the minor total 13 or 14 units and are R.N.R. 202 or Ra.M. 382, Ra.M. 305, 436, 446, and 456 or 486. To complete the minor, additional upper-division level courses totaling 6 or 7 units will be selected from the offerings in the College of Agriculture. Selection will be made after consulting an advisor in the faculty of range management.
305. **Range Management** (3) I Historical, political, physiological and ecological factors affecting range use; range plants and grazing regions; range treatments and improvements; range evaluation and planning; multiple use interrelationships.

318. **Range Field Studies** (2) S Field course covering the practical application of the principles of range management and ecology; grazing problems on forest, brush and grass ranges; noxious plant control; revegetation techniques; multiple use management. Fee $100.

322. **Range Plants and Communities** (3) II Identification, value and habitat relationships of important range plants, and description of major range plant communities. 2R, 3L. P, R.N.R. 202.


436. **Grazing Management** (2) GC II Effects of grazing animals on plants and soils; diet, nutrition and behavior of grazing animals; management of grazing to meet livestock production and multiple use objectives. P, 305, CR 416.

446. **Range Improvements** (3) GC I Range improvements through grazing systems, noxious plant control, cultural and mechanical elements of revegetation, runoff control, and specialized range and critical area treatments. 2R, 3L. Weekend field trips. P, 305; M.C.B. 181; Ecol. 182, S.W. 200.


480. **Forest Policy and Administration** (3) GC II (Identical with Ws.M. 480)

486. **Range Planning and Economics** (3) GC I Principles of management planning for rangelands and economic analysis of management alternatives; includes case studies, linear programming, computer simulation. P, R.Ma. 305; Econ. 201b. Writing-Emphasis Course.*

487. **Ranch Planning** (2) GC II Preparation of a range management plan for a ranch enterprise including field data collection, economic and environmental analysis of management alternatives. 6L. All-day field trips. P, 486, CR 456.

495. **Colloquium**
   - a. Range Management (1) II P, 305.

505. **Colloquium**
   - a. Rangeland Policy (2) II 1988-89
   - c. Range Herbivores (2) II 1987-88

696. **Seminar**
   - a. Range Management (1) [Rpt.] I II

*Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Forest-Watershed Resources

Gordon S. Lehman, Chairperson of the Division

Watershed Management

Watershed management courses, which consider the management needs of whole watersheds and their multiple uses, qualify the student for a professional career. Students may obtain a major in watershed management with an option in watershed hydrology or forest-watershed management. The forest-watershed option provides students with the education needed to manage forests for multiple uses and benefits, with some emphasis on water and dryland forests. The watershed management program is accredited by the Society of American Foresters.

In addition to the requirements for the curriculum in natural resources, the following courses are required for both options in watershed management: Chem. 103a-103b, 104a-104b; Econ. 201a-201b; Eng. 101 or 103H; 102; 307 or 308; M.C.B. 181; Ecol. 182; Geos..-101a, 102a; Math. 160; Phys. 102a or 103a; 180a; Ra.M. 305; R.N.R. 202, 295a, 321; S.W. 200, 201; Comm. 100, 102; Ws.M. 410, 460, 462. The watershed hydrology option also requires: Atmo. 171; M.C.B. 460; Chem. 241a; C.E. 471; Math. 125a-125b, 223; Phys. 102b or 103b; 180b; Hydr. 405 or S.W. 470; 406 or A.M.E. 331a; S.I.E. 272; Ws.M. 342 or Ra.M. 382; Ws.M. 440 or A.Ec. 477. The forest-watershed management option also requires: Chem. 241a and M.C.B. 460 or 9 units of m.a.p.
DEPARTMENTS AND COURSES OF INSTRUCTION

electives; C.Sc. 111 or S.I.E. 272; Math. 123 or 125a; N.R.R. 381; Ws.M. 250, 342, 408, 415, 422, 430, 440, 480, 481, 489; W.F.Sc. 325. Students in the forest-watershed management option selecting the m.a.p. electives may use up to 6 units of m.a.p. courses to fulfill their social science/humanities requirement.

Minors are available under both options in watershed management. Foundation courses consist of prerequisites to the courses selected for the minor. The minor consists of 20 units including S.W. 200, 201, Ws.M. 342, 410, and 460. Minors in forest-watershed management shall also select two courses from R.N.R. 321, Ws.M. 408, 415, and 440. Minors in watershed hydrology shall select Ws.M. 462 and either A.En. 406, Hydr. 405, or S.W. 470.

250. Forest Pathology (3) II (Identical with PLP. 250)

330. Introduction to Remote Sensing (3) I (Identical with Geog. 330)

342. Silvics and Dendrology (4) I Application of ecological principles to forests; silvical properties and identification of American forest trees and shrubs. 3R, 3L. P, S.W. 200, Ec. 182, R.N.R. 202. Lehman

408. Forest Fire Management (3) GC I Forest fire behavior, as influenced by fuels, weather, topography; ecological effects of fire; prevention, detection and control methods; fire danger rating and use of prescribed fire in forest management. Zwolinski

410. Silviculture (3) GC II Principles and technical procedures for reproducing, planting, and tending forest crops, with reference to watershed. P, 342 or Ra.M. 382; Ec. 182. Writing-Emphasis Course.*


420. Photogrammetry (1) GC II Aerial photographic planning for natural resource management; stereoscopic principles applied to planimetric and topographic mapping. 3L. P or CR 422.

422. Photointerpretation (2) GC II Reading and interpretation of aerial photographs; natural resource inventory from aerial photographs; remote sensing techniques. 1R, 3L. Lehman


427. Bioclimatology (3) GC II (Identical with Atmo. 427)

430. Forest Resource Management (3) GC I Decision making in the management of forest lands. 2R, 3L. P, 410, 415, 440.

440. Forest Resource Economics (3) GC II Economics of the production of goods and services from forest lands; decision making in microforest resource management situations; supply and demand relationships for products of forest resources. P, Econ. 201a, 201b, Math. 123. (Identical with A.Ec. 440) King

460. Watershed Hydrology (3) GC I Application of fundamental principles to quantifying the basic hydrologic processes occurring on watersheds. P, Geos. 100a; S.W. 200, 201, Math. 160. (Identical with Hydr. 460) Gay

462. Watershed Management (3) GC II Evaluating hydrologic impacts of management activities on watersheds to include silviculture, range, mining, and recreation use.

464a-464b. Introduction to Dendrochronology (3-3) GC (Identical with Geos. 464a-464b)

471. Water Quality Control (3) GC II (Identical with C.E. 471)

476. Natural Resource Economics (3) GC II (Identical with A.Ec. 476)


481. Simulation of Renewable Natural Resources (3) GC II Simulation of management impacts for multi-resource decision-making, including biologic, economic, and social factors. 2R, 3L. P, 430.

487. Forestry in Arid Environments (4) GC S Management and development of wood and other forest resources in developing nations. Designed for mid-level and upper-level resource professionals from developing nations. Field trip.

488. Development and Management of Water Resources (6) GC S Development and management of water resources on forest watersheds and rangelands in developing nations. Designed for mid-level and upper-level resource professionals from developing nations. Field trip.

489. Forest-Watershed Field Studies (4) II Field study of forest entomology and pathology, fire ecology (1 unit equiv.); forest resources measurement, inventory and analysis (2 unit equiv.); harvesting, processing of primary wood products (1 unit equiv.). P, 342, 410, 415. Fee $80.

505. **Modeling of Small Watershed Hydrology**  (3)  II  Techniques for synthesizing the hydrologic behavior of watershed catchments. P, 460, 462.

511. **Dryland Forest Management**  (2)  II  1988-89  Utilization and management of forest resources in dry environments; biophysical and socio-economic issues related to the development of forest commodities and amenities. P, 6 units of upper-division Ws.M.

532. **Agroforestry**  (2)  I  1987-88  Ecological and socioeconomic factors related to the planning and implementation of agroforestry systems. P, 6 units of upper-division Ws.M.

533. **Fuelwood Management in Dryland Ecosystems**  (2)  II  1987-88  Technical practices and social implications of fuelwood management in dryland ecosystems of the world. P, 6 units of upper-division Ws.M.

534. **Nursery and Plantation Management**  (2)  I  1988-89  Tree nursery and forest plantation establishment and management, with emphasis on dryland ecosystems. P, 6 units of upper-division Ws.M.

551. **Water Management in Dryland Ecosystems**  (3)  I  Hydrologic principles as applied to arid and semiarid ecosystems with water management applications in dryland resources management. P, A.Ec. 539, S.W. 201.


557. **Quantitative Dendrochronology**  (3)  I  1988-89  (Identical with Geos. 557)

563. **Plant-Water Relations**  (3)  II  (Identical with M.C.B. 563)

565. **Hydrochemistry**  (3)  II  1987-88  (Identical with S.W. 565)

566. **Botanical Basis of Dendrochronology**  (3)  II  1987-88  (Identical with Geos. 566)

576. **Advanced Natural Resource Economics**  (3)  I  (Identical with A.Ec. 576)

577. **Natural Resource Economics and Public Policy**  (3)  II  (Identical with A.Ec. 577)

595. **Colloquium**
   a. Non-Point Source Pollution from Watersheds  (3)  II  P, 460.
   c. Urban Forestry  (2)  II  1988-89  (Identical with L.Ar. 595c)
   d. Fire Ecology  (2)  II  1988-89

655. **Dendroclimatology**  (3)  II  1988-89  (Identical with Geos. 655)

696. **Seminar**
   a. Watershed Management  (1 to 2)  [Rpt.]  I  II

*"Writing-Emphasis Course, P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).*

**Wildlife, Fisheries and Recreation Resources**

William W. Shaw, Chairperson of the Division

**Wildlife and Fisheries Science**

A major in wildlife and fisheries science provides the student with a broad background for a professional career with state fish and game departments, with federal fish and wildlife or other natural resource management agencies, or for graduate study. In addition to the course requirements, it is recommended that students seek summer employment in related work with a state or federal agency. Students may obtain a major in wildlife and fisheries science with an option in wildlife ecology or in fisheries science.

In addition to the requirements for the curriculum in natural resources, the following courses are required for both options in wildlife and fisheries science: Chem. 103a-103b, 104a-104b, 241a, 243a; Econ. 201a; 201b or A.Ec. 217; Eng. 101 or 103H, 102; M.C.B. 181; Ecol. 182; 320 or An.S. 213; N.R.R. 381; Phys. 102a, 180a; S.W. 200, 201; Comm. 100, 102; W.F.Sc. 325. The wildlife ecology option also requires: Ecol. 436 or 472; Eng. 307 or 308; Math. 123 or 125a; 160 or 263; Ra.M. 382; 305 or 416 or W.F.Sc. 455R; R.N.R. 202, 295a, 321; V.Sc. 400a or 400b; Ws.M. 480, W.F.Sc. 444, 446, 448, 484, 485. The fisheries science option also requires: Chem. 241b, 243b or V.Sc. 250; C.E. 471; Ecol. 477; Math. 117e, 118; 160 or 263; W.F.Sc. 441, 455R, 455L, 482.
A minor is available in wildlife, fisheries, and recreational resources. Twenty-one units of courses must be completed before the minor is initiated. Foundation courses are Chem. 103a-103b, Math. 160 or 263, M.C.B. 181; Ecol. 182, and S.W. 200, 201. Required courses in the minor are W.F.Sc. 325, N.R.R. 381, and either W.F.Sc. 444 or 446, or 455R and 455L. To complete the minor, an additional 12 units must be selected from the following courses: W.F.Sc. 441, 446, 448, 484, 485, N.R.R. 388, 470, R.N.R. 321 and 424.

125. Introduction to Wildlife Conservation (3) I Survey of conservation history, ecological principles, wildlife management techniques, and contemporary wildlife conservation issues. Intended for non-majors. Shaw/Mannan

213. Animal Genetics (3) I (Identical with An.S. 213)

325. Introduction to Wildlife and Fisheries Ecology (3) I Study of the nature and importance of wildlife and fisheries resources, basic principles of fish and wildlife biology and management; and contemporary issues in the field. P, M.C.B. 181, Ecol. 182. Krausman/Matter

405. Aquatic Entomology (3) GC II 1988-89 (Identical with Ento. 405)

415. Principles of Nutrition (3) GC I II (Identical with An.S. 430)

441. Limnology (4) GC I Study of lakes and streams; biological characteristics, as related to physical, chemical, geological, and historical processes operating on fresh waters. 2R, 6L. Weekend field trips. P, six units of chem. or phys. with lab. (Identical with Ecol. 441) Matter

444. Wildlife Management/Mammalian Species (4) GC I Management of wildlife as a resource; characteristics of wildlife species; principles of population dynamics in wildlife populations; techniques used in studying wildlife. 3R, 3L and field work. Weekend field trips. P, 325. Krausman

446. Wildlife Management/Avian Species (4) GC II Field and lab. methods used in avian species management; evaluation of avian habits; census, productivity, diagnosis, and control of avian populations. 3R, 3L and field work. Weekend field trips. P, 325. Mannan

448. Current Problems in Wildlife Ecology (1) GC [Rpt.] I Discussions and assignments covering current problems, including the biological, economic, aesthetic, political, and sociological phases of wildlife management. P, 444 or 446.

455R. Fishery Management (3) GC II Methods and concepts pertaining to fishery investigations and management; application of principles for production of optimum fisheries to benefit man. P, 441 or 444. Matter Writing-Emphasis Course.*

455L. Fishery Management Laboratory (1) GC II Laboratory methods pertaining to fishery investigations and management. P, CR 455R, 482. Matter

482. Ichthyology (4) GC I (Identical with Ecol. 482)

484. Ornithology (4) GC II (Identical with Ecol. 484)

485. Mammalogy (4) GC I (Identical with Ecol. 485)

584. Selected Studies of Birds (2) I [Rpt.] (Identical with Ecol. 584)

   b. Wildlife Habitat Analysis (2) II 1987-88.

649. Fishery-Water Quality Relationships (2) I Pertinent water quality parameters essential for fish life, and the effects of various substances and their interrelationships to fish and aquatic organisms. P, 441 or 455R; Chem. 241a. Ziebell

695. Colloquium a. Advanced Issues in Fisheries and Wildlife Science (2) [Rpt./3] II

696. Seminar (1 to 3) I a. Fish and Wildlife Ecology (1) [Rpt.]

Natural Resource Recreation

Students in the natural resource recreation program are qualified to pursue professional careers with federal and state agencies as recreation specialists, or with private organizations. Sufficient flexibility has been created in the program to allow students to emphasize additional study in the professional areas of water-based recreation, resource planning, interpretation, park management administration and forest recreation management. In addition to the requirements for the curriculum in natural resources, the following courses are required for natural resource recreation: Chem. 103a-103b, 104a-104b; M.C.B. 181; Ecol. 182; Econ. 201a-201b; Engl. 101 or 103; 102; 307 or 308; W.F.Sc. 325; Geos. 101a, 102a; Math.
RUSSIAN AND SLAVIC LANGUAGES

Committee on Romance Languages (Graduate)

Professors Robert ter Horst (Spanish and Portuguese), Dana A. Nelson (Spanish and Portuguese)
Associate Professors Ingeborg Kohn (French and Italian), Henri Servin (French and Italian)

The Committee offers a Masters of Arts degree in Romance Languages. Administered by the Department of French and Italian and the Department of Spanish and Portuguese, it is primarily intended for future high-school or junior-college teachers and enables graduate students to acquire a sound foundation in fundamental aspects of Romance languages. For further information, including specific course suggestions for this program, please inquire in either department.

For admission and degree requirements, please see the Graduate Catalog.

422. Introduction to Romance Philology (3) GC I 1988-89 (Identical with Span. 422)
429. Pedagogical Linguistics: Applied Linguistics for Teachers (3) GC II (Identical with Or.S. 429)

RUSSIAN AND SLAVIC LANGUAGES

Professors John Garrard, Head, Alex de Jonge, Joe Malik, Jr.
Associate Professors Adele Barker, Alexander Dunkel, Margaret Gibson, Boriss Roberts
Lecturer Delbert Phillips

The department's emphasis is on building competence in the Russian language as preparation for government service, business careers, teaching, graduate study and research.

The department offers the degrees of Bachelor of Arts and Master of Arts with a major in Russian. A Bachelor of Arts in Education and a Master of Education are also available with a teaching major in Russian. For graduate admission and degree requirements, consult the Graduate Catalog.
The major: 40 units (in addition to 101a-101b), including 201a-201b or 205a-205b, 207a-207b, 301a-301b, 305a-305b, 307a-307b, 405a-405b, 407a-407b. No fewer than 28 units must be upper-division course work in the Russian language, no less than 18 of which must be taken in residence. In addition, the student must take 310 and 3 upper division units in either (a) the history of Russia or the Soviet Union, or (b) government or politics of the Soviet Union. No more than 3-6 units of independent study can apply to the major. It is recommended that students contemplating graduate study in Russian take 330, 340, 350, Russian Literature in Translation, and/or 250a-250b, Russian Humanities in Translation.

The supporting minor: 20 units selected from university-wide disciplines with the assistance and approval of the major advisor.

The teaching major: 34 units (in addition to 101a-101b) including 201a-201b, 207a-207b, 301a-301b, 305a-305b, 307a-307b, 407a-407b. 310 is highly recommended.

The teaching minor: 22 units (in addition to 101a-101b), including 201a-201b, 207a-207b, 301a-301b, 307a-307b.

Honors: The department participates in the Honors Program.

101a-101b. Elementary Russian (4-4) Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Phillips

201a-201b. Intermediate Russian (4-4) P, 101b.

205a-205b. Reading Contemporary Russian (4-4) Alternate course for 201a-201b, for students interested in reading and translating. 205a: Humanities and social sciences literature. 205b: Scientific literature. P, 101b.

207a-207b. First Level Russian Conversation (2-2) P, 101b.

250a-250b. Russian Humanities in Translation (3-3) 250a: I II The Quest for Identity: Russia's cultural heritage — literature, art, music, architecture, religious tradition — from the earliest beginnings through the 19th century. 250b: I II The Search for Utopia: 20th century literature, art, music, architecture, film, and theater in pre-and post-revolutionary Russia and the emigration. 250a is not prerequisite to 250b.

301a-301b. Advanced Composition and Grammar (3-3) P, 201b or 205b.

305a-305b. Readings in Russian Texts (3-3) Reading of original texts, with emphasis on the acquisition of passive vocabulary through analysis of word roots, prefixes and suffixes. P, 201b or 205b.


310. Russian Civilization and Culture: Pre-Christian Era to the Present (3) I Selected topics in Russian culture and civilization: architecture, film, fine art, literature, music and theater within their artistic, historical, ideological and sociological contexts. Taught in English. Open to non-majors. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

330. Russian Literature from Beginnings to 1800 in English (3) Readings and discussion of representative Russian literary works from earliest times to 1800.

340. Nineteenth Century Russian Literature in English (3) Readings and discussion of representative Russian literary works of the 19th century.

350. Twentieth Century Russian Literature in English (3) Readings and discussion of representative Russian literary works from the 20th century.

396H. Honors Proseminar (3) I

405a-405b. Survey of Russian Literature (3-3) GC Historical survey of Russian literature from the earliest times to the Soviet period; designed to acquaint students with literary terminology and facilitate comprehension of lectures in Russ. Advanced degree credit available only with departmental permission. P, 301b or 305b.


450a. Soviet Technology and Science (3) GC I (Identical with M.I.S. 450)

496. Proseminar
   b. Russian and Soviet Studies II (3) P, 496a.

497. Workshop
   b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

501a-501b. Russian Stylistics (3-3) Designed to improve the student's practical mastery and understanding of Russian at a higher and more sophisticated level. P, 301b.

579a-579b. Problems of Teaching Russian (1-1) Survey of modern methods of language teaching, with emphasis on the particular problems presented by Russian. All teaching assistants must be enrolled in this course while teaching Russian. Maximum of two units will be counted toward Master’s degree requirements.

581. Russian Phonology and Morphology (3) II P, 301b or 305b.

583. History of the Russian Language (3) I P, 301b or 305b.


685. Old Church Slavic (3) A study of Old Church Slavic language and its relationship to Old Russian and Modern Russian. P, 301b or 305b.


696. Seminar
   b. Russian Literature: 18th Century (3)
   c. Russian Literature: 19th Century (3)
   d. Russian Literature: 20th Century (3)

SECONDARY EDUCATION
(See Teaching and Teacher Education)

SOCIOLOGY

Professors Harrison C. White, Head, Albert J. Bergesen, Raymond V. Bowers (Emeritus), Richard F. Curtis, Andrew M. Greeley, Robert L. Hamblin, Michael N. Hechter, Travis W. Hirschi, Gary F. Jensen, Robert C. Leonard, James R. Lincoln, Bruce D. Sales, I. Roger Yoshino

Associate Professors James T. Borhek, Courtney B. Cleland, Robert R. Evans, Celestino Fernandez, Neil D. Fligstein, Patricia L. MacCorquodale, Douglas J. McAdam, Jerry L. L. Miller

Assistant Professors Roberto M. Fernandez, Debra Friedman, Joseph R. Hambenne (Emeritus), Trudy L. Mills, Richard B. Polley, Kathleen C. Schwartzman, James Shockey

Sociology is the scientific study of social relations in all kinds of human populations, ranging in size from two individuals to nations. Sociologists study changing and stable patterns of social interaction, values and attitudes.

The Department of Sociology offers the following degrees: Bachelor of Arts, Master of Arts, and Doctor of Philosophy with a major in sociology.

The major: 30 units, including 301, 375a-375b, and 401. A minimum of 24 units must be in upper-division courses.

The supporting minor is usually chosen from the social sciences, mathematics, or computer science, but another field may be selected with the approval of the student’s departmental advisor.

The teaching minor: 21 units, including 251, 301, 375a-375b, and 401.

100. Introduction to Sociology (3) I II Sociological concepts and principles, with special reference to contemporary society.

150. Sociology of Women (3) I II Sociological approach to women’s roles in American society, with emphasis on trends and problems relating to sex-role identification and socialization. P, 100 or 301. (Identical with W.S. 150)

160. Minority Relations and Urban Society (3) I II Analysis of minority relations and mass movements in urban society; trends in the modern world, with special reference to present-day race problems and social conflict. (Identical with B.S. 160 and M.A.S. 160)

161. The Chicano in American Society (3) II Study of Mexican Americans (Chicanos) as an ethnic-cultural group in American society; analysis of their present problems as a minority group; focus on Chicano-Anglo relations in southwestern U.S. (Identical with M.A.S. 161)
189. World Population (3) I II Basic concepts of population studies; analysis of social trends, problems and solutions in relation to environmental factors, with reference to both advanced and developing nations. P, 100 or 301.


202. Medical Sociology (3) I II Organization of health care in U.S.; its impact on patients and society; health care practitioners; medical industries; policy debates. P, Completion of the freshman English requirement.

240. Sociology of Childhood and Youth (3) II Children, adolescents, and young adults in American society; their social roles, relationships, and problems. P, 6 units of sociology.*

251. Sociology of Education (3) I II Educational system as a basic social institution; its structure, impact on society, and effects on students; consideration of alternative structures. P, 3 units of social sciences.

301. Sociological Analysis (3) I II A survey of sociological concepts and principles for sociology majors. P, for majors, completion of the freshman English requirement.

302. Sociosomatics (3) II Social control of bodily process and structure, including social determinants of health. Both macro and sociopsychological theory and statistical research literature. P, Upper division standing and 3 units of social science or consult department before enrolling.

310. Culture and the Individual (3) I II (Identical with Anth. 310)

311. Social Change (3) I II Innovation and inertia in society; case studies of the impact of new technology, behavior and ideas; the problems of social progress. P, 100 or 301.

313. Collective Behavior and Social Movements (3) I II Study of riots, panics, crazes, reform and revolutionary movements; their origins, social bases, careers and consequences. P, 6 units of sociology.

315. Political Sociology (3) II Current competing theories of socio-political institutions. P, 6 units of social sciences. (Identical with Pol. 315)

317. The Sociology of Popular Culture (3) II The place of popular culture in mass society; literature, film, popular music, and the life of the mind in general. P, 6 units of social sciences.

321. Sociology of the Family (3) II Analysis of the modern family and its characteristics in a social and historical setting. P, 9 units of social science.

322. Sociology of Religion (3) II Religion as a social institution with special reference to industrial societies. (Identical with Reli. 322)

323. Religious Organizations in America (3) II Analysis of religious organizations with primary reference to the U.S., including the nature and variety of belief systems, organizations and relations to each other and the larger society. (Identical with Reli. 323)

324. Sociology of Sexuality (3) I II Impact of individual and community sexual attitudes and behaviors on other sociological and psychological functioning. P, 3 units of sociology and 3 units of another social science.

326. Industrial Sociology (3) I Survey of the sociology of work and its organization, with emphasis on social supports of work motivation and effectiveness. P, 6 units of sociology.

333. Group Dynamics (3) I II Study of small groups; their objectives, leadership, interpersonal relations, and effectiveness. P, 100 or 301; 3 additional units of sociology or psyc.

341. Juvenile Delinquency (3) II Nature and causes of, and reactions to, juvenile delinquency. P, 201; 3 additional units of sociology.

342. Criminology (3) I II Study of the social origins of criminal law, criminal behavior, and reactions to crime. P, 6 units of sociology.

375a-375b. Social Research Methods (3-3) 375a: Problems of conceptualization and design; elementary techniques of data collection and analysis. P, 6 units of social sciences. 375b: Techniques of statistical description and elementary statistical inference, as applied to social data. P, Completion of the college mathematics requirement. 2R, 3L.

384. Sociology of Latin American Societies (3) II Analysis of their social structures and institutions, including government, religion, family, education, stratification, urban and rural development, economics, migration. P, 100 or 301; 3 additional units in sociology or anth. (Identical with Anth. 384)

396H. Honors Proseminar (3) I II
401. **Sources of Sociological Theory** (3) I II Critical review of the works of leading sociologists. P, for all students, 9 units of social science. P, for majors, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

402. **Kinship and Social Organization** (3) GC II (Identical with Anth. 402)

404. **Sociology of the Southwest** (3) GC I Populations, cultures, and social problems in their regional setting, with emphasis on the Southwest. P, 100 or 301; 6 additional units of sociology or anth. (Identical with Anth. 404, A.In.S. 404 and M.A.S. 404)

406. **Social Gerontology** (3) GC II Social aspects of aging and retirement, with special reference to the United States. P, 9 units of sociology.* (Identical with Gero. 406)

407. **Peasant Communities** (3) GC I (Identical with Anth. 407)

422. **Complex Organizations** (3) GC II Theories and research regarding large-scale organizations and their relations to the individual and society. P, 9 units of sociology.*

435. **Public Opinion and Voting Behavior** (3) GC I II (Identical with Pol. 435)

436. **Social Structure and Personality** (3) GC II Relation between the person and the group; social factors in character formation. P, 9 units of sociology.

442. **Transformation of Agrarian Societies in the Middle East** (3) GC II (Identical with Or.S. 442)

444. **Group-Process Methods in Management** (3) GC II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of the catalog. (Identical with M.A.P. 444)

450. **Social Stratification** (3) GC I II Theories of social class, caste, and rank; social mobility in contemporary society. P, 9 units of sociology.* (Identical with Anth. 450)

457. **Bio-Social Determinants of Socialization** (3) GC II (Identical with C.D.F.R. 457)

459. **Sociology of Gender** (3) GC II Social construction, variation and consequences of gender categories across time and space. Topical (decision-making, deviance) and institutional (family, religion, politics) approaches. P, 100 or consult department before enrolling. (Identical with W.S. 459)

461. **Race and Ethnic Relations** (3) GC I II Social processes involved in minority groups in terms of race, caste, class, ethnicity, politics, and religion. P, 100 or 301; 6 additional units of sociology or anth. (Identical with Anth. 461, A.In.S. 461, Bl.S. 461 and M.A.S. 461)

486. **Comparative Community Development** (3) GC I Principles of social change applied to problems of community development, including analysis of specific programs. P, 6 units of social sciences. (Identical with Anth. 486)


505. **World-System Theory and Research** (3) I II Theory and research on the modern world-system.

510. **Political Sociology** (3) Basic approaches in political sociology, with emphasis on the relationship of economic and political processes.

525. **Intermediate Complex Organizations** (3) Basic review of classic and contemporary approaches to the study of complex organizations; formation, development, and internal processes. (Identical with M.A.P. 525)

530. **Graduate Social Psychology** (3) Basic study of classic and contemporary approaches with particular reference to socialization and the relationship between the individual and social structure.

541. **Deviance and Social Control** (3) Basic critical review of traditional and contemporary concepts and formulations of deviance and social control; evaluation of contemporary research bearing upon deviance theory and informal and formal mechanisms of social control. P, 201, 341 or 342.

550. **Stratification and Class** (3) Basic examination of concepts and research in the area of stratification, with emphasis on the classic statements and contemporary research.

560. **Intergroup Relations** (3) Analysis of recent research on the relations among racial and ethnic groups in society, with special attention to current empirical and theoretical issues. P, 461.

570a-570b. **Social Statistics** (3-3) 570a: Probability, distributions, estimation and hypothesis testing. 570b: Ordinary least squares regression, generalized least squares regression, structural equation models (path analysis and non-recursive systems).

DEPARTMENTS AND COURSES OF INSTRUCTION

580. **Population Studies** (3) I Theory and research in the fields of fertility, mortality, and migration, with emphasis on their relationships to social structure. An original research project is required.

585. **Advanced Sociological Theory** (3) I Sociological theories as alternative explanations. Classic and modern examples of working through the implications of alternative theories to formulate competing hypotheses for empirical tests. P, two courses in Social Science theory, preferably 500a-500b.

595. **Colloquium**
   - Introduction to Graduate Study (1) I

596. **Seminar**
   - Advanced Problems in Research (1 to 3) [Rpt.] I II
   - Graduate Teaching (3) II 1988-89 2R 3L
   - Advanced Problems in Deviant Behavior (1 to 3) I II
   - Advanced Social Change (1 to 3) [Rpt.] I II
   - Advanced Juvenile Delinquency (1 to 3) I II
   - Macrosociology (1 to 3) I II.

SOIL AND WATER SCIENCE


Associate Professors David M. Hendricks, Ian L. Pepper

Assistant Professors Alfredo Huete, Allan D. Matthias, Marti M. Minnich, James R. Simpson

Extension Specialists Paul D. Brown, Thomas A. Doerge, John E. Watson

The degree of Bachelor of Science in Agriculture with a major in soil and water science is available through the College of Agriculture. The department offers opportunities for study toward the Master of Science and the Doctor of Philosophy degrees with a major in soil and water science.

**The major in soil and water science** includes the minimum requirements as outlined under agriculture or agricultural science in the College of Agriculture section of this catalog. In addition to these requirements, the following courses are required: S.W. 200, 201, 296a, 314 or 316 and 317, 431, 461 and two of the following: 411, 435 or 470. Also Chem. 241a or 322 and 323, Math. 125a or 123, Geos. 101a and 102a, Phys. 102a and 180a. University writing-emphasis courses requirement must be met by completion of either S.W. 435 or S.W. 461. Majors are encouraged to take additional classes in chemistry, physics, and mathematics beyond the minimum, as well as classes in computer science and statistics.

The College of Agriculture curriculum in agricultural business and options in turfgrass management and international agriculture are also available to students majoring in soil and water science. Courses to be included with each option will be selected in consultation with the student's adviser.

**A minor in soil and water science** is available to students from other disciplines. Requirements include S.W. 200, 201 and three of the following: S.W. 316 and 317, 411, 431, 435, 461, 470; also 7 additional units (at least 3 units upper division) of geosciences, irrigation, or additional soil and water science.

200. **Soils** (3) I II GRD Fundamental principles of soil science—origin, nature, and constitution of soils; their chemical, physical, and biological properties in relation to plant growth and the nonplant uses of soils. P, Chem. 101a and 102a or 103a and 104a. Post


250. **Water In Agriculture** (3) II GRD (Identical with A.En. 250)

314. **Soil Management** (3) I CDT Evaluation of soil factors affecting water-plant relationships; farm planning for soil conservation; soil and water management on irrigated soils. 2R, 3L. Field trips. P, 200. Stroehlein

316. **Soil Fertility** (2) II CDT Fertility status of semiarid and arid soils; factors affecting availability of the essential elements; influence of physical, chemical, and biological conditions on soil fertility; practices for assessing and improving soil fertility. P, 200. Stroehlein/Tucker

317. **Soil Fertility Laboratory** (1) II Practical application of the basic concepts of soil fertility presented in 316, through demonstration and experimentation under lab., greenhouse and field conditions. Field trip. P, CR 316.
330. Introduction to Remote Sensing (3) (Identical with Geog. 330)

402. Introduction to Pesticides and Their Use (2) GC II (Identical with Pl.P.402)

405. Hydrology of Unsaturated Media (3) GC I (Identical with Hydr. 405)

411. Soil Chemistry (3) GC I CDT Soil chemical interactions with water, air, plants and pollutants. P, 200, Chem. 103b, 104b. Bohn

417. Introduction to Geographic Information Systems (3) GC II (Identical with R.N.R. 417)

431. Soil Morphology, Classification and Survey (3) GC I Theory and practice of describing characteristics of soils; principles of soil classification and the classification systems; methods and applications of soil surveys. 2R, 3L. Field trips. P, 200, 201, Geos. 101a. Post


453. Remote Sensing in Agriculture (3) GC II Remote sensing techniques and applications for improved natural resource utilization of soils, water, grasslands, and forest. Fundamental energy-matter interactions that influence the spectral characteristics of vegetation, soil, and water. 2R, 3L. Field trips. P, 330 or Phys. 102b.


470. Soil Physics (3) GC II CDT Soil structure and physical constitution of soils; the physical properties of soil-water systems, movement and exchange of gases in the soil, and physical laws governing the movement and availability of soil water. 2R, 3L. P, 200, Phys. 102b, CR Math. 125a. Warrick

501. Management of Arid Lands and Salt-Affected Soils (3) II Principles and practices of soil, water and crop management under arid and semiarid conditions, the use of diagnostic procedures for evaluating soils and waters, reclamation, and economics of irrigation project development. 2R, 3L. Field Trip. Dutt

505. Chemical Analysis of Soils and Plants (4) II Principles and methods of chemical analysis of soils, water, and biological materials with emphasis on instrumental techniques. 2R, 6L. P, Chem. 322, 323; Phys. 102b, 180b. Hendricks

520. Evapotranspiration (3) I Theories and concepts of potential and actual evapotranspiration in arid regions; measurement and estimation methods, and plant growth-evapotranspiration relations. P, Math. 125b, Phys. 102b.

541. Soil Genesis (3) II Physical and chemical processes and mineralogy of weathering and soil formation; quantitative pedology; the soil as part of the ecosystem. Field trips. P, Math. 101a and Chem. 103b. (Identical with Geos. 541) Hendricks

565. Hydrochemistry (3) II 1987-88 Solute composition of naturally-occurring waters, chemical reactions affecting the solute content of water, relations and effects of above on water quality criteria and pollution, analytical procedures used by water testing laboratories. 2R, 3L. P, Chem. 322 or C.E. or 471. (Identical with Hydr. 565 and Ws.M. 565) Dutt


696. Seminar
   a. Soils, Water and Agricultural Engineering (1) [Rpt/1] I II (Identical with A.En. 696a)
DEPARTMENTS AND COURSES OF INSTRUCTION

SOUTHWEST STUDIES

Southwest studies are designed to bring new perspectives to regional subjects through an interdisciplinary approach. Courses on the Southwest are taught through many university departments and programs, including American Indian studies, anthropology, English, geography, history, Latin American studies, linguistics, Mexican American studies, political science, sociology, Spanish and Portuguese, and women's studies. For information, contact the Department of History or the Southwest Center.

SPANISH AND PORTUGUESE

Professors Charles M. Tatum, Head, Leo L. Barrow, A. Dolores Brown, Jack Emory Davis (Emeritus), John J. Gilabert, Lanin A. Gyurko, Ruth Lee Kennedy (Emerita), Richard P. Kinkade, John W. Martin, Miguel Méndez, Dana A. Nelson, José Promis, Eliana S. Rivero, Renato I. Rosaldo (Emeritus), Robert ter Horst
Associate Professors Gilbert E. Evans, Karl C. Gregg, H. Reynolds Stone
Assistant Professors Frances R. Aparicio, Karen L. Smith
Lecturers Adalberto Guerrero, M. Nivea Pereira Parsons

The Department of Spanish and Portuguese offers courses in language skills, linguistics, pedagogy, composition, literature, and culture. It offers creative writing in Spanish. There is an alternate track designed especially for Mexican-American bilinguals with courses in language and culture, culminating in creative writing and a variety of classes in Chicano literature. The department provides academic direction in summer programs in Spanish at the Guadalajara Summer School and in a semester program in Portuguese at Pontificia Universidade Católica in Rio de Janeiro.

The department offers programs leading to the following degrees: Bachelor of Arts with majors in Spanish or Portuguese; Bachelor of Arts in Education with a teaching major in Spanish; Master of Arts with a major in Spanish (emphasizing either literature or language and linguistics); Master of Arts in Education with a teaching major in Spanish; and Doctor of Philosophy with a major in Spanish. The department also participates in offering the M.A. with a major in Romance Languages through the Committee on Romance Languages. For further information regarding the graduate programs, please see the Graduate Catalog.

The major in Spanish for the B.A.: 36 upper-division units, 18 in language (including 405) and 18 in literature (including 320 and 6 units of one survey, either 400a-400b or 401a-401b).
The major in Portuguese for the B.A.: 24 units, including 405a-405b and at least 6 units of literature courses in the 400 series. At least 16 units must be upper division.
The supporting minor for majors in Spanish or Portuguese: recommended subjects are classics, drama, English, philosophy, modern languages, humanities, history and theory of art or of music, journalism, speech, anthropology, political science, business, economics, history, linguistics, psychology, sociology; other subjects as may be individually justified.
The teaching major for the B.A. in Education: 24 units in upper-division Spanish, including 310, 320, 329, 330, 414, 470.
The teaching minor for the B.A. in Education: 20 units in Spanish, including 310, 320, 329.

Students will be placed in the proper class level according to one or more of the following factors: previous experience or study, departmental placement examinations, individual counseling. Placement examinations are given during the summer to incoming freshmen and during the week of registration preceding the fall and the spring semesters to all students needing
advice on placement. Non-credit proficiency examinations are available during registration and
the first week of classes for students interested in challenging 300-level language courses; no
credit or grade is given for this type of intra-departmental examination. Consult an undergraduate
advisor. For information about proficiency examinations with credit, consult the Academic
Guidelines section of this catalog.

The four-semester language proficiency group requirement may be satisfied by completing
with a passing grade Span. 201b, 202b, 213, Port. 201b or 202b. It may also be satisfied by placing
in the fifth semester on the departmental placement examination or through Advanced Placement
examinations. Once a course in a grammar or language-skill sequence is successfully completed,
no lower numbered course taken subsequently in that sequence will count toward the major.

**Writing-Emphasis Course:** Since writing in all upper-division courses is in either Spanish
or Portuguese, the requirement will be satisfied through completion of at least one 3-unit course
designated as a Writing-Emphasis Course within the minor department. (See pertinent section
in the Academic Guidelines section of this catalog.)

**Honors:** The department participates in the Honors Program.

For further information, contact your advisor and those of the Department of Spanish and
Portuguese.

### Spanish

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>101a/101m-101b.</td>
<td>First Year Spanish</td>
<td>CDT Oral approach. 101a: First-semester Span. for the student with no previous experience in Span. 101m: First-semester Span. for the student with some previous experience in Span. Credit allowed for 101a or 101m, but not for both; either prepares students for 101b. 101b: Second-semester Span. P, 101a or 101m or one year of h.s. Span.</td>
</tr>
<tr>
<td>201a-201b.</td>
<td>Second Year Spanish</td>
<td>CDT Credit allowed for 201a or 213, but not for both; credit allowed for 201b or 333, but not for both. P, 101b or two years of h.s. Span.</td>
</tr>
<tr>
<td>202a-202b.</td>
<td>Intensive Spanish</td>
<td>CDT 202a is the equivalent of 101a and 101b; 202b is the equivalent of 201a and 201b. P, knowledge of another Romance language.</td>
</tr>
<tr>
<td>202c-202d-202e.</td>
<td>Intensive Spanish</td>
<td>202c is the equivalent of 101a-101b. 202d is the equivalent of 101b-201a. 202e is the equivalent of 201a-201b. P, knowledge of another Romance language.</td>
</tr>
<tr>
<td>213.</td>
<td>Oral Communication in Spanish</td>
<td>Designed for native speakers of Span. only; considered to be at the third-semester level. Credit allowed for this course or 201a-201b, but not for both. (Identical with M.A.S. 213)</td>
</tr>
<tr>
<td>301a-301b.</td>
<td>Intermediate Spanish</td>
<td>CDT Combines all forms of language skills (speaking, reading, writing, and comprehension) with intermediate grammar. Credit is allowed for this course or 303a-303b, but not both. P, 201b.</td>
</tr>
<tr>
<td>303a-303b.</td>
<td>Comprehensive Spanish for the Bilingual</td>
<td>Speaking, reading and writing skills; designed for the native speaker of Span. with some formal study of the language. Students receiving credit for this course will not receive credit for 301a-301b, 329, or 330. (Identical with M.A.S. 303a-303b)</td>
</tr>
<tr>
<td>310.</td>
<td>Phonetics</td>
<td>Offered for students who need to perfect pronunciation. P, 201b.</td>
</tr>
<tr>
<td>320.</td>
<td>Readings in the Literary Genres</td>
<td>P, 301b.</td>
</tr>
<tr>
<td>323.</td>
<td>Mexican-American Spanish and Bilingualism</td>
<td>CDT Mexican-American Spanish and bilingualism as a point of departure for developing standard vocabulary and grammar at the intermediate level. Credit is allowed for this course or 329, but not both. P, 303b.</td>
</tr>
<tr>
<td>333.</td>
<td>Writing and Oral Skills for the Bilingual</td>
<td>Credit is allowed for this course or 330, but not both.</td>
</tr>
<tr>
<td>350.</td>
<td>Selected Spanish Prose</td>
<td>1987-88 Major Spanish prose works from the Middle Ages to the present. P, 320.</td>
</tr>
</tbody>
</table>
DEPARTMENTS AND COURSES OF INSTRUCTION


400a-400b. Survey of Spanish Literature (3-3) GC 400a: From the beginning through the 17th century. 400b: 18th-20th centuries. P, 320. 400a is not prerequisite to 400b.

401a-401b. Survey of Spanish-American Literature (3-3) GC 401a: From the beginning through the 18th century. 401b: 19th and 20th centuries. P, 320. 401a is not prerequisite to 401b.

402. Survey of Mexican Literature (3) GC S Major works by Mexican writers. Offered in Guadalajara only. P, five semesters of Spanish.

405. Advanced Composition and Conversation (3) GC I II Study and practice in formal discussion and expository writing. P, 330.

414. Teaching of Modern Languages (3) GC II (Identical with T.T.E. 414)


422. Introduction to Romance Philology (3) GC I 1988-89 Survey of the development of the modern Romance tongues from the Latin language. P, knowledge of two Romance languages. (Identical with Fren. 422, Ital. 422, Port. 422, and R.Lg. 422)

423a-423b. Theory of Spanish Syntax (3-3) GC 423a: Introduction to grammar as a theoretical construct; principles of transformational generative grammar exemplified in Span.; examination of traditional grammatical concepts in the new framework. 423b: More detailed and further-ranging analysis of Span. grammar within the general theory. P, 329. (Identical with Ling. 423a-423b)

427. Applied Spanish Linguistics (3) GC I Pedagogical applications of syntactic theory; introduction to phonological theory of Span. for pedagogical purposes; applied phonetics. (Identical with Ling. 427)


432. Pre-Columbian Culture and Myths (3) GC II 1988-89 Cultural development of Aztec, Mayan and Incan civilizations and their artistic and mythic expression. P, 320. (Identical with M.A.S. 432)


447. Contemporary Mexican Literature (3) GC II S Major novelists of modern Mexico; their works, narrative perspective, characterization, language, time, space, and themes. P, 320. (Identical with M.A.S. 447)


450. Spanish-American Short Story (3) GC S Development of the modern short story in Latin America, with examples from various countries and authors. Offered in Guadalajara only. P, five semesters of college Span.

473. Spanish for the Bilingual Classroom Teacher (3) GC II Practical Span. for the elementary and secondary school subject-matter teacher who uses Span. as the medium of instruction. P, 329 or 330. (Identical with M.A.S. 473)

495. Colloquium
   g. Hispanic Literature (3) GC [Rpt./1] S Offered in Guadalajara only. P, 330.

497. Workshop
   b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

501. Literary Theory and Criticism (3) II 1988-89 Historical survey of theoretical writings on literature, with their implications for practical criticism.


503. Introduction to Medieval Studies (3) I 1989-90 Historical, social, and cultural currents as background for the analysis of medieval Hispanic letters. P, 420.

504. Thirteenth Century Spanish Literature (3) II 1987-88 Epic, clerical verse, and origins of prose. P, 420 or 503.


506. Fifteenth Century Spanish Literature (3) II 1988-89 Traditional courtly and satiric literature; the Celestina. P, 420 or 503.

515. Golden Age Theater I: Drama Before Lope de Vega (3) I 1987-88 Drama from the late fifteenth century to the latter part of the sixteenth, including Enzina, Vicente, Torres Naharro, Rueda, plus the early auto sacramental. P, 400a.


523. Hispanic Prose of the Enlightenment (3) II 1990-91 Prose writers of the Neoclassical Period in Spain and the New World. P, 400b or 401b.

524. Hispanic Poetry of the Enlightenment (3) II 1987-88 Poets of the Neoclassic period in Spain and the New World.


531. Realism and Naturalism (3) II 1988-89 Major prose writers of the 19th century from Galdós to Blasco Ibáñez.

532. The Generation of '98 (3) I 1987-88 Major literary expressions concerning the problems of Spain and the Spaniard from the late 19th century to 1936.


534. Contemporary Spanish Novel (3) I 1988-89 The novel since the Civil War.

535. Contemporary Spanish Poetry (3) II 1987-88

536. Contemporary Spanish Drama (3) II 1988-89 Major Spanish theatrical trends from the Civil War (1936-39) to the present. P, graduate standing, 400b.


DEPARTMENTS AND COURSES OF INSTRUCTION


548. Hispanic Romanticism (3) II 1987-88 Romantic discourse in the different genres as they appeared both in Spain and in Spanish-America, from the pre-Romantics through 1888. P, 400b or 401b.


552. Hispanic-American Short Story (3) II 1987-88 Masterworks of the short story in Hispanic-America during the twentieth century. P, 401b.


554. Spanish-American Contemporary Poetry (3) II 1987-88 Contemporary authors and trends in Spanish-American poetry, mostly from the 1940's to the present. P, 401b.


555a-555c. Spanish-American Novel of the Twentieth Century (3-3-3) 555a: The 1920's. 555b: From 1930 to 1960. 555c: From 1960 to the present. Neither semester in this sequence is prerequisite to any other. P, 401b.


557. Seminar
   b. Methods of Literary Research (3) I 1987-88

620. History of the Spanish Language (3) I 1987-88

621. Spanish in the Americas (3) I 1988-89

679a-679b. Techniques of Teaching College Spanish (1 to 3-1 to 3) Problems encountered in teaching basic language courses. Units cannot be used to satisfy departmental graduate degree requirements.

696. Seminar
   a. Philology and Linguistics (3) I II
   b. Spanish Literature (3) I II
   c. Spanish American Literature (3) I II

Portuguese

101a-101b. Elementary Portuguese (4-4) CDT Both 101a and 101b are offered each semester.

201a-201b. Intermediate Portuguese (4-4) CDT Both 201a and 201b are offered each semester. P, 101b or two years of h.s. Port.

202a-202b. Intensive Portuguese (4-4) P, knowledge of another Romance language or permission of instructor. 202a is the equivalent of 101a-101b; 202b is the equivalent of 201a-201b.

305. Composition and Conversation (3) [Rpt/1] I II S Fifth semester Portuguese; development of writing and speaking skills. P, 201b or 202b.

370. Intermediate Grammar (3) II S Basic Portuguese grammatical concepts. P, 201b or 202b.

383. Literature of Brazil in Translation (3) II 1988-89 Will not count toward fulfillment of the language requirement of the major or minor in Port.

397. Workshop
   r. Portuguese Language Skills and Culture (4) S Offered only in Rio de Janeiro. P, four semesters of Portuguese.
400a-400b. Survey of Brazilian and Portuguese Literature (3-3) GC 1988-89 400a: Brazilian literature. 400b: Portuguese literature. P, 201b or 202b.

402a-402b. Brazilian Civilization (3-3) GC P, 201b or 202b.

405a-405b. Advanced Composition and Conversation (3-3) [Rpt./1] GC Two hours conversation, one hour composition. P, 201b or 202b.

422. Introduction to Romance Philology (3) GC I 1988-89 (Identical with Span. 422)

463. Studies in Brazilian Literature (3) GC I 1987-88 Major works, authors and tendencies in modern Brazilian literature. P, 201b or 202b.

464. Studies in Portuguese Literature (3) GC II 1987-88 Major works, authors and tendencies in the literature of Portugal. P, 201b or 202b.

497. Workshop 
b. Techniques of Foreign Language Teaching (1) I (Identical with Ger. 497b)

696. Seminar 
a. Portuguese Literature (3) [Rpt. I II 
g. Brazilian Literature: 16th-18th Centuries (3) I II 
h. Brazilian Literature: 19th Century (3) I II 
i. Brazilian Literature: 20th Century (3) I II

SPECIAL EDUCATION AND REHABILITATION

Associate Professors Shirin D. Antia, Candace S. Bos, C. June Maker, S. Mae Smith, Inez Tucker, John Umbreit
Assistant Professors Nancy Eldredge, James Organist, Anthony K. Van Reusen
Lecturers Thomas J. Fisher, Aldine S. von Isser

The division offers programs leading to the Bachelor of Science in Education and Master of Science degrees with a major in rehabilitation. The division also offers programs leading to the Master of Arts, Master of Education, and Educational Specialist with a major in special education. The Doctor of Education and Doctor of Philosophy degrees are offered with majors in rehabilitation and special education. Nonteaching minors in special education and rehabilitation are offered at the baccalaureate level. For information on concentrations, admission, and degree requirements at the graduate level, please consult the Graduate Catalog.

At the time the catalog was being edited, many programs in the College of Education were being redesigned. All current and prospective students should check with the Office of Student Services in the College of Education or the Division of Special Education and Rehabilitation for current admission and degree requirements in each major.

270. Introduction to Sign Language (3) I II Study of history and culture of deaf people, history of sign language, the evolution of various sign systems, fingerspelling and non-verbal communication aspects of sign language.

300. Introduction to Special Education and Rehabilitation (3) I II General characteristics of exceptional/disabled persons in interrelated human service delivery systems.


380a-380b. Survey of Human Disabilities (3-3) I II Critical study of rehabilitation processes and services for handicapped individuals and groups. P, 300.

381. Vocational Development and Placement (3) I II Intensive study of vocations, vocational skill development and vocational placement. Open to majors only. P, 300, 380b.

400. Introduction to Learning Disabilities (3) GC I II Theories and history of programs for the learning-disabled — definition, characteristics, etiology. Degree candidates must complete 300 prior to taking 400.
401. Diagnosis and Remediation of Learning Problems (3) GC I II Procedures, methods, strategies for informal diagnosis and remediation of children with learning problems in the academic areas of reading, spelling, handwriting, written expression, and mathematics. Strategies and adaptations appropriate for use in the regular elementary or the special classroom. P, 300 or CR. Not open to students in the learning disabilities concentration.

402. Behavior Principles for the Handicapped (3) GC I II Use of behavior principles to modify the behavior of handicapped persons, especially moderately and severely handicapped. 3R, 1L. P, 300.

403. The Special Services in the Schools (3) GC I II S Information to aid teachers in dealing with responsibilities and concerns in school settings with regard to P.L. 94-142, Education for All Handicapped Children Act Section 504 of the Rehabilitation Act, Family Education Rights and Privacy Act, and other legal issues.

410. Mental Retardation (3) GC I II History and philosophy of educational programs for the mentally retarded and other developmentally disabled; etiology, classification, and characteristics, with consideration of educational, social, and psychological problems. P, 300 or CR.

420. Vision and Visual Functioning (3) GC I Anatomy and physiology of the eye; visual development, assessment and training; relationship of visual defects to learning and school experiences.

430. The Sensory Impaired (3) GC I Current and historical perspectives; educational and rehabilitation services; etiology, psychosocial, cognitive, and motor development and functioning of hearing impaired and visually impaired individuals.

431a-431b. Advanced Sign Language (3) GC I II Advanced principles, methods and techniques of American Sign Language and Manually Coded English; idioms, receptive skills, regional variations. P, 370b.

432. Interpreting for Deaf People (6) GC I II Introduction to theories, principles, and special settings of interpreting. Covers ethics, definitions and related topics of interpreting. Role playing and simulated interpreting experiences will be included in the course. Principles, methods, and techniques of interpreting for deaf people in rehabilitation and other settings. P, 431a or 370b with division permission.

433. Interpreting in Special Settings (1-12) GC I II Classes will be offered on a rotating basis in areas such as educational, legal, medical, oral and MLC interpreting. P, 432.

440. Education of Gifted Children (3) GC I Issues in education of the gifted; discussion of definitions, characteristics, development, screening, identification, curriculum, teaching strategies, and program development. P, 300.


460. Introduction to Early Childhood Education for the Handicapped (3) GC I This course will focus on the handicapping conditions impacting on preschool children, programs available to serve them and critical issues in this rapidly evolving field. P, 300.

480. Principles of Rehabilitation (3) GC I Principles underlying rehabilitation programs and interdisciplinary relationships of agencies engaged in rehabilitation services.

481. Interviewing and Client Services (3) GC I II The development of essential interviewing skills for case management of rehabilitation clients. P, 300, 380a, 380b; 381. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

482. Rehabilitation of the Aged (3) GC II Emphasis on aging from the viewpoint of the aging person and those working with the aged.

483. Supervised Casework in Rehabilitation (3) GC I II Application of fundamental professional rehabilitation theories and skills in field settings. P, 300, 380b; 481 or CR.

484. Problems of Drug Abuse (3) [Rpt./1] GC I II Survey course for teachers, counselors, and agency workers concerned with drug abuse; examination of community, cultural, and educational approaches to drug use and abuse.

485. Rehabilitating the Public Offender (3) GC I Components in service delivery to the public offender, how the offender enters the criminal justice system, and treatment and rehabilitation services available.

494. Practicum
   a. Teaching Exceptional Children (1 to 10) I II P, 300, methods courses in area of emphasis.


501. Methods for Diagnosing Specific Learning Disabilities (3) GC I Educational and psychological assessment of academic areas and learning processes involving perception, integration, and expression, with emphasis on informal and formal assessment and diagnostic teaching. P, 400 or CR and permission of division; CR 593.
502. Methods of Teaching the Learning-Disabled (3) II Remediation of academic areas and cognitive processes involving perception, integration, and expression, with emphasis on strategies for planning and implementing instructional programs at the elementary level. P, 400, 501, and permission of division; CR 593 and 594.


511. Teaching the Mentally Retarded (3) II Methods of teaching and program development for the retarded and other developmentally disabled learners. P, 410.


521. Methods of Teaching the Visually Handicapped (3) II Curriculum development and adaptation in various educational programs; adaptation of classroom materials and procedures for use with blind and partially-sighted children and youth; emphasis on methods of teaching academic and nonacademic skills and on educating students with nonhandicapped peers. CR 593, P, 420.

522. Orientation and Mobility of the Visually Handicapped (3) II Methods of teaching orientation and mobility skills to visually impaired and blind students. Emphasis on the school-aged child, with particular attention to concept development, orientation skills, pre-cane skills, personal safety, and independent ambulation, including an introduction to long-cane techniques.

530. Language Development for the Exceptional Child (3) I Pragmatic, semantic and syntactic aspects of language development in exceptional children and youth; cognitive and social bases for intervention.

531. Language Intervention for Hearing Impaired (3) II Receptive and expressive language assessment; techniques of teaching language intervention and remediation for hearing impaired children and youth. P, 530.

532. Speech for the Hearing Impaired (3) II Oral/aural communication development; methods for assessing and teaching speech and auditory skills. P, 430.


540. Teaching the Gifted: Hierarchical Models (3) I 1988-89 Introduction to general principles involved in providing a curriculum for the gifted. Overview of ten teaching-learning models commonly used with the gifted. Mastery of skills involved in using the hierarchical models with gifted students. P, 440.

541. Teaching the Gifted: Questioning Strategies (3) I 1988-89 Mastery of skills involved in developing abstract thinking abilities in gifted children by using the Hilda Taba Teaching Strategies. Emphasis on using these sequential questioning methods in all content areas and at all grade levels. P, 440.

542. Teaching the Gifted: Productive Thinking Models (3) I 1987-88 Mastery of skills involved in developing productive thinking abilities in gifted children by using teaching-learning models developed by Parnes, Williams, Taylor, Guilford, Renzulli and Treffinger at all grade levels and in all content areas. P, 440.

550. Teaching Children with Behavioral Disorders (3) II Assessment techniques, academic and behavioral intervention strategies, and classroom management with behavior disordered children and youth. P, 450.

560. Methods of Assessment for Preschool Handicapped Children (3) I Norm-referenced and criterion-referenced instruments for screening, diagnosis and assessment of preschool children will be reviewed. Emphasis will be placed on teacher involvement in the assessment process. P, 300.

561. Methods of Teaching Preschool Handicapped (3) II Deals with competencies required to teach all categories of handicapped preschool children except deaf/blind. Field trips. P, 460, 560, 575.

570. Administration of Special Education Programs (3) II Practical aspects of organization and development of special education programs, problems of public relations, personnel, case finding, evaluation, placement, and records. P, consult division before enrolling.

571. Supervision of Special Education (3) I Practical aspects of supervising special education programs and services; curriculum development, service delivery models, staff development, program development, and legal issues and requirements.

572. Policy Analysis in Special Education (3) I Practical aspects of policy analysis and development in schools and other social agencies which serve the handicapped and the gifted.
575. Observation and Participation in Special Education Programs (1 to 3) I II Specific types of exceptional individual, psychological and educational implications and practices. Field trips, class observations and seminars. P, 300. Special sections in each category of the exceptionality to be arranged in the division office.

580. Medical Aspects of Disability (3) I Etiology, therapy, and prognosis of the major disabilities, including drug and alcohol; assessment of physical capacities and limitations; typical restorative techniques.

581. Psychosocial Aspects of Disability (3) I II Exploration of the psychological and sociological aspects of disability; analysis of somatopsychology, psychosomatics, and social psychology.

582. Principles and Practices of Vocational Evaluation (3) I II Understanding work skills and labor market conditions; process of vocational evaluation of rehabilitation clientele; collecting and synthesizing evaluation data and writing meaningful reports.

583. Counseling Practices in Rehabilitation Setting (3) I II Facilitation training of rehabilitation professionals in their implementation of counseling practices with varied ethnic, age, disability, and dependency populations. 3R, 1L. Open to majors only.

584. Client Assessment in Rehabilitation (3) I II Exploration of the world of work; critical review of vocational choice theories; experiences in the use and interpretation of individual assessment techniques. P, 480 or CR; Ed.P. 458.

585. Vocational Planning and Placement (3) I II Problems of physical, mental, social, and emotional disability, as they relate to the formulation of a rehabilitation plan; exploration of the various sources of occupational and career choice information, job placement and development. P, 480, 580, 584 or Cr.


587. Construction and Development of Assessment Samples (3) I II Use of occupational information, career exploration and job analysis techniques; development, construction, standardization, and use of work samples and related vocational assessment techniques. P, 480, 582, 584.

588. Professional Problems in Rehabilitation Psychology (3) I II Course will discuss professional problems such as research, publishing, membership in professional organizations, including participation and presentation, legislation, monitoring the profession and defining new professional issues. P, 480.


590. Applied Research with Exceptional Learners (3) I II Review of principles and practices underlying applied research with exceptional learners; practice in preparation of research proposals; conduct of research emphasized.

593. Internship (1 to 10) I II Note: Special sections in each concentration to be arranged in the division office.

594. Practicum
   a. Sign Language (1) [Rpt./4 units] I II 2L. Open to majors only.
   b. Communication Development for Hearing Impaired Children (1 to 6) I II P, 532, CR 593.

595. Colloquium
   a. Behavioral Disorders (3) I Open to majors only.
   b. Language Learning and Reading Disabilities (3) I II (Identical with L.R.C. 595b).
   c. Mental Retardation (3) I II P, 403.
   d. Recent Advances in Special Education (3) I II

597. Workshop
   a. Creativity and Giftedness (3) [Rpt./9 units]

600. Research in Rehabilitation Psychology (3) I II Identification and analysis of current problems in rehabilitation. P, 480; Ed.P. 640; Ed.A. 603.
SPEECH AND HEARING SCIENCES

Associate Professor Kathryn Bayles, Linda Swisher
Instructors Diann Grimm (Clinical), Anne Oyler (Clinical), Rebecca Vance (Clinical)
Director, Speech-Language Clinic Anthony DeFeo

The Department of Speech and Hearing Sciences prepares students for careers in basic and clinical sciences (speech-language pathology, audiology, speech science, and hearing science) in university, laboratory, medical or other clinical settings, or as public school clinicians. Professional certification in the state of Arizona and with the American Speech-Language-Hearing Association requires graduate study with the acquisition of at least 30 semester credits or a Master of Science degree.

The department offers the following degrees: Bachelor of Science in Speech and Hearing Sciences, Master of Science and Doctor of Philosophy with a major in speech and hearing sciences. For graduate admission and degree requirements, consult the Graduate Catalog. The major: In addition to the group units required for the B.S., as described in the College of Arts and Sciences section of this catalog, the major requires 30 units, including 260, 280, 367, 370a-370b and 483.

In addition to the group unit requirements for the B.S. degree as described in the College of Arts and Sciences section of this catalog, the department requires one course in mathematics or statistics beyond college algebra and 8 hours in a laboratory science course beyond the minimum requirement. Students enrolled in the American Indian Professional Training program should consult with their advisors regarding the mathematics and science requirements.

A 20-unit minor is also required. At least 24 units in the major must be taken in residence. Minimum total units for the degree with this major — 125.

106. Voice and Articulation (2) I II Designed to improve voice, articulation, and fluency patterns in speech. Class members' presentations are videotaped and analyzed. Individual lab. practice.

107. Survey of Hearing, Language, and Speech: Normal and Disordered (3) I II Role of speech, hearing, and language in human communication; normal processes and disorders in speech, language, and hearing; directed observations in labs. and clinics.

260. Speech Science (4) I Anatomy, neuroanatomy, physiology of the speech mechanism; acoustical characteristics of voice and speech sounds; frequency, intensity, time and wave composition. 3R, 3L. (Identical with Ling. 260)

280. Hearing Science (4) II Anatomy, neuroanatomy, physiology of the auditory mechanism; acoustics and psychoacoustics; decibel scale, normal auditory function. 3R, 3L.

367. Phonetics (3) I Scientific study of speech sounds; articulatory phonetics, transcription, dialects and articulatory errors.

370a-370b. Introduction to Communication Disorders: Children and Adults (3-3) Nature of disordered communicative processes; principles of assessment and intervention of these disorders. Open to majors only or consult department before enrolling. P, 260. Writing-Emphasis Course (370a). P, Satisfaction of the upper-division writing-proficiency requirement (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

402. Principles of Neuroanatomy (4) GC II (Identical with Anat. 402)

450. Structure of Speech and Language (3) GC I Study of the nature of language and linguistics; current approaches in linguistics.

451. Acquisition of Speech and Language (3) GC II Normal development of speech and language in the child; relationships with cognitive and social development. (Identical with Ling. 451)

458. Introductory Clinical Studies: Speech-Language Pathology (1 to 3) [Rpt./9 units] GC I II S Basic clinical procedures for managing a limited range of speech and language disorders. Includes observation and supervised practice. Open to majors only. P, 451 or CR 471.
DEPARTMENTS AND COURSES OF INSTRUCTION

459. Introductory Clinical Studies: Audiology (1 to 3) [Rpt./9 units] GC I II S Basic clinical procedures for identifying and managing a limited range of hearing losses in children and adults. Includes observation and supervised practice. Open to majors only. P, 483 or CR.

461R. Speech and Hearing Science Instrumentation (2) GC I Consideration of some common and specific instruments and methods employed in speech and hearing labs. and clinics. P, 260, 280 or CR.

461L. Speech and Hearing Science Instrumentation Laboratory (1) GC P, CR 461R.

471R. Articulation Disorders and Therapies (2) GC I Etiology, diagnosis, prognosis, and therapy for the articulatory aspects of communication problems. P, 370; 367; CR or subsequent registration in 471L (for majors).

471L. Laboratory in Articulation Disorders (1) GC I Open to majors only. P, 471 R or CR.

479. Speech and Hearing Disorders for Related Professions (3) GC I II Recognition and management of language, speech and hearing problems for related professions such as education, nursing, psychology, and speech communication. Open to nonmajors only.


484. Audiologic Rehabilitation: Adults (3) GC II Speech reading; auditory training; problems encountered with amplification units; social, psychological, educational, speech, and language difficulties encountered by the hearing handicapped. P, 280, 483.


494. Practicum
   a. Speech Pathology (1 to 2) [Rpt./6 units] I II Open to majors only. P, 370; 471 R or CR.
   b. Audiology (1 to 2) [Rpt./6 units] I II Open to majors only. P, 483; 484 or CR.

497. Workshop
   a. Speech, Language and Hearing Problems in Children and Adolescents (3) GC S Field trips.

500. Introduction to Graduate Study (3) II Introduction to the conduct of research and grad. study in speech and hearing sciences.

510. Counseling Techniques in Communication Disorders (3) II S Basic counseling techniques pertinent to clinical practice with the communication handicapped and their families.


553R. Language Disorders in Preschool Children (2) II Etiology, evaluation and therapy for children with delayed language and/or language disabilities; relationships with learning disabilities; dialect and bilingualism.

553L. Laboratory in Preschool Language Disorders (1) II

554R. Adult Aphasia (2) I Etiology, evaluation and therapy for language disorders associated with brain damage. P, 370; 450 or 451; CR or subsequent registration in 554L (for majors).

554L. Laboratory in Adult Aphasia (1) I P, 554R or CR.

558a-558b. Intermediate Clinical Studies: Speech-Language Pathology (1 to 3-1 to 3) [Rpt./9 units] I II S Under faculty supervision, students assess speech and language functioning, develop treatment plans, and carry out remedial programs based on empirical data and current technology. 558b is in an extern setting. Open to majors only. P, 451, 471.

559. Intermediate Clinical Studies: Audiology (1 to 3) [Rpt/9 units] I II S Under faculty supervision, students assess hearing impairments, formulate objectives, and carry out remedial programs with emphasis on the application of research data and current technology to clinical treatment. Open to majors only. P, 483.

560a-560b. Experimental Phonetics (3-3) 560a: Systematic examination of current experimentation and research in speech as motor behavior, with emphasis on physiological investigations of normal respiration, phonation, resonance, and articulation; critical evaluation of research design. P, 260. 560b: Systematic examination of current experimentation and research in speech as an acoustical phenomenon; critical evaluation of research design. P, 260, 461. 2R, 3L. 560a is not prerequisite to 560b.

565R. Aerodynamic Evaluation and Management of the Speech Mechanism (2) II Principles and clinical methods of aerodynamic evaluation and management of the disordered speech mechanism, with practical experience provided through case studies and class experiments. P, 260, 461, 560a.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>56L</td>
<td>Aerodynamic Evaluation and Management of the Speech Mechanism Laboratory (1) P, CR 565R.</td>
<td>Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports.</td>
<td>P, 370, 483; CR or subsequent registration in 570L (for majors).</td>
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<tr>
<td>57R</td>
<td>Evaluation Process (2) I Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports.</td>
<td>P, 370, 483; CR or subsequent registration in 570L (for majors).</td>
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<tr>
<td>570L</td>
<td>Laboratory in Evaluation Process (1) I II Open to majors only. P, 570R or CR.</td>
<td>Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports.</td>
<td>P, 370, 483; CR or subsequent registration in 570L (for majors).</td>
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<tr>
<td>571</td>
<td>Cleft Palate, Other Craniofacial Disorders, and Communication (2) I Communication disorders associated with cleft palate and other craniofacial defects. Speech assessment, evaluation and treatment; survey of dental and surgical services.</td>
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<td>P, 560a.</td>
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<tr>
<td>572R</td>
<td>Disorders of Phonation (2) I Etiology, diagnosis, prognosis, and therapy for disorders of voice; speech for the laryngectomized.</td>
<td></td>
<td>P, 260.</td>
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<tr>
<td>572L</td>
<td>Disorders of Phonation Laboratory (1) I II Open to majors only. P, 572R or CR.</td>
<td>Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports.</td>
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<tr>
<td>573R</td>
<td>Disorders of Fluency (2) I Primary study of stuttering: identification, nature and assessment; theoretic considerations; management approaches; proportionate attention to other anomalies of fluency.</td>
<td></td>
<td>P, 370; CR or subsequent registration in 573L (for majors).</td>
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<tr>
<td>573L</td>
<td>Laboratory in Disorders of Fluency (1) I Open to majors only. P, 573R or CR.</td>
<td>Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports.</td>
<td></td>
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<tr>
<td>576</td>
<td>Communicative Aspects of Aging (2) I Hearing, speech, voice, and language changes in the elderly caused by aging and disease. Emphasis on management of these problems.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
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<tr>
<td>577</td>
<td>Communication Disorders in Traumatic Brain Injury (3) II 1988-89 Communication consequences of traumatic brain injury with special reference to the evaluation and management of persons with such injury.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
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<tr>
<td>579</td>
<td>Organization and Administration of Speech and Hearing Programs (3) I II Problems in organizing a speech and hearing program: philosophy, case load, space, staff, budget, interagency cooperation.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
</tr>
<tr>
<td>580</td>
<td>Industrial Audiology (2) I II Auditory and non-auditory effects of noise, industrial hearing conservation, noise measurement and control.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
</tr>
<tr>
<td>581</td>
<td>Evaluation and Selection of Hearing Aids (3) I Development of hearing aid evaluations; circuitry of hearing aids and their physical characteristics; speech intelligibility and the electroacoustics of low-fidelity circuitry; patient evaluation and counseling.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 483; CR or subsequent registration in 494b (for majors)</td>
</tr>
<tr>
<td>582</td>
<td>Disorders of Hearing (3) I Pathologies of the hearing mechanism and their auditory manifestations in both adults and children.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 483.</td>
</tr>
<tr>
<td>583</td>
<td>Special Auditory Tests (3) I II Special audiologic procedures to differentiate conductive versus sensorineural, sensory versus neural, central versus peripheral, and organic versus functional hearing disorders.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
</tr>
<tr>
<td>584</td>
<td>Audiologic Habilitation: Children (3) I Amplification, room acoustics, auditory and visual processing, evaluation and remedial programming for children with mild to moderate hearing impairment.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 483 or 589.</td>
</tr>
<tr>
<td>585</td>
<td>Physiological Acoustics (3) I Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280.</td>
</tr>
<tr>
<td>587</td>
<td>Psychophysical Acoustics (3) I II Experimental procedures and instrumentation; study of psychoacoustics; stimulus integration, pitch and loudness limen and scales, masking, and auditory fatigue; binaural hearing; theory of signal detection.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
<tr>
<td>588</td>
<td>Principles of Audiology (3) I Basic techniques of pure-tone audiometric testing; interpretation of audiograms; disorders of hearing; anatomy and physiology of the hearing mechanism; basic acoustics.</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>Open to nonmajors only.</td>
</tr>
<tr>
<td>589</td>
<td>Seminar</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>Open to nonmajors only.</td>
</tr>
<tr>
<td>a.</td>
<td>Experimental Phonetics (1 to 3) [Rpt./2 or 9 units] I II</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
<tr>
<td>b.</td>
<td>Clinical Audiology (1 to 3) [Rpt./2 or 9 units] I II</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
<tr>
<td>c.</td>
<td>Hearing—Physiology and Psychophysics (1 to 3) [Rpt./2 or 9 units] I II</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
<tr>
<td>d.</td>
<td>Language and Language Disorders (1 to 3) [Rpt./2 or 9 units] I II</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
<tr>
<td>e.</td>
<td>Speech Pathology (1 to 3) [Rpt./2 or 9 units] I II</td>
<td>Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings.</td>
<td>P, 280, 461.</td>
</tr>
</tbody>
</table>
DEPARTMENTS AND COURSES OF INSTRUCTION

658a-658b. Advanced Clinical Studies: Speech-Language Pathology (1 to 3-1 to 3) [Rpt./9 units] I II
S With faculty consultation and supervision, students assume responsibility for all aspects of case management of children and adults. Exposure to clinical research methods and interdisciplinary staffings. 658b is in an extern setting. P, 471, 553.

659. Advanced Clinical Studies: Audiology (1 to 3) [Rpt./9 units] I II S With faculty consultation and supervision, students assume responsibility for all aspects of case management of adults and children. Exposure to clinical research methods and interdisciplinary staffings. Open to majors only. P, 483.

693. Internship
   a. Speech Pathology (1 to 6) I II Open to majors only. P, 494a.
   b. Audiology (1 to 6) I II Open to majors only. P, 494b.

695. Colloquium
   a. Motor Control (2) [Rpt./8 units] II (Identical with Ex.S.S. 695a)

STATISTICS

Professors J. L. Denny (Mathematics), Acting Head, Jean E. Weber
Assistant Professor Michael Trosset

The department offers a program leading to the Master of Science degree with a major in statistics.
A thesis is not required, but up to 6 units may be earned by writing one. For the Master of Science degree, at least 18 of the 30 units must be taken within the department. Of the 18 units, at least 12 must be at the 500 level or above. For further information, see the Graduate Catalog.

361. Statistics for Engineering and the Physical Sciences (3) I II Probability theory, point and interval estimation, hypothesis testing and regression analysis; applications to quality control and reliability theory. P, 9 units of calculus.

461. Elements of Statistics (3) GC I II Advanced degree credit available for nonmajors only. (Identical with Math. 461)

464. Theory of Probability (3) GC I (Identical with Math. 464)

465. Statistics for the Medical Sciences (4) GC I Standard and nonparametric one- and two-sample procedures, ANOVA designs, linear and multiple regression, bioassay, probit analysis, and contingency tables. 3R, 3L. Not open to majors. P, two semesters of calculus. (Identical with Tox. 465)

466. Theory of Statistics (3) GC II (Identical with Math. 466)

468. Applied Stochastic Processes (3) GC II (Identical with Math. 468)


567a-567b. Statistical Inference (3-3) 1987-88 (Identical with Math. 567a-567b)

596. Seminar
   a. Research Methods (1 to 4) [Rpt./6 units] I II


663. Advanced Statistical Methods (3) [Rpt.] I In-depth study of a selected body of statistical techniques. Consult department for current course content. P, 466.

664. Applied Multivariate Analysis (3) II Consideration of multivariate statistical analyses, with emphasis on applications, interpretation of computer printouts and effects of violations of model assumptions. P, 660.

665. Applied Time Series Analysis (3) I Methods used in time series analysis, with emphasis on applications, including computer analysis of data and consideration of violations of model assumptions. P, 660.
The Department of Systems and Industrial Engineering in the College of Engineering and Mines offers the degrees of Bachelor of Science in Systems Engineering, Bachelor of Science in Industrial Engineering, Master of Science with a major in either systems or industrial engineering, and Doctor of Philosophy with a major in systems engineering. For specific undergraduate program requirements, see the College of Engineering and Mines section of this catalog.

150. Introduction to Systems and Industrial Engineering (3) II Basic ideas and tools for conceptualizing, describing, analyzing and designing system behavior. Development of creativity and problem solving skills. P, 170.

170R. Problem Solving Using Computers (FORTRAN) (2) I II S Problem analysis, structured programming techniques, design of algorithms for solving elementary engineering problems and FORTRAN 77 programming. Designed to accompany 170L. CR 170L and Math. 125a.


172R. Problem Solving Using Computers (PASCAL) (2) I II S Problem analysis, structured programming techniques, design of algorithms for solving elementary engineering problems and PASCAL programming. Designed to accompany 172L. CR 172L and Math 125a.


250. Introduction to Systems Engineering and System Theory (3) I The process of systems engineering, sets, system models, coupling of systems, subsystems, and system homomorphisms. P, 150.

258. Introduction to Industrial and Manufacturing Systems (3) I Analysis, design and control of manufacturing and production systems, including topics in facilities layout and location, materials handling, inventory control, computer-integrated manufacturing, information systems, and simulation. P, 170 or 172, Math. 125b.


270. Computer Methods for Engineering (3) I II S Application of numerical methods and computer programming techniques to the solution of numerical problems of engineering systems. P, 170 or 172, Math. 125b and Phys. 103a.

310. Human Factors Fundamentals (2) I II Human characteristics that must be taken into account in system design. Basic measurement analysis and design methods. P, Psyc. 101; CR 320a.


350. Deterministic Systems (3) I II Analysis and design of linear deterministic systems in both the time and frequency domains using Fourier analysis, Laplace transforms and state space methods. Attention will be given to modeling physical and engineering systems. P, Math. 254.

370. Microprocessors in System Control (4) I II Boolean algebra, combinational and sequential logic circuits, finite state machines, simple microcomputer architecture, assembly language programming, real-time computer control. 3R, 3L. P, 170 or 172, E.C.E. 208.
405. Digital Systems Simulation (3) GC I II Simulation modeling of systems using digital computer languages, emphasizing random variate generation, modeling, timekeeping structures and statistical design and analysis of simulation experiments. CR 320b or 420 and 340b.

406. Engineering Quality Control (3) GC I On-line statistical process control techniques for monitoring and improving the quality of manufactured products including an introduction to off-line Japanese methods. P, 320b or A.M.E. 413a or CR 420. (Identical with A.M.E. 406)

408. Reliability Engineering (3) GC I (Identical with A.M.E. 408)


411. Human Interaction with Computers and Software (3) GC II The interaction of technical requirements with the characteristics of computer users and programmers as they affect the design of software, and the physical and cognitive interfaces between people and computers. P, 310.


422. Engineering Decision Making under Uncertainty (3) GC I Application of principles of probability and statistics to the design and control of engineering systems in a random environment. Methodology includes utility theory, prior probability assessment, risk analysis and Bayesian decision analysis. P, 320b or 420.


455. Introduction to Robotics (3) GC I A study of the principles involved in the operation and design of robotics, including homogeneous transformations, kinematics, trajectory selection, dynamics, control and sensing. P, 350.

462. Production Systems Analysis (3) GC I Production systems, product and process design, quantitative methods for forecasting, aggregate planning, inventory control, materials requirement planning, production scheduling, manpower planning and facility design. P, 340a.

463. Production Systems Design (3) GC II Case studies emphasizing aspects of production systems design such as facility location, facility layout, group technology, product and process design, material handling, and automated assembly. The student will be required to work in groups. Solutions will be presented using both written and oral reports. P, 462.

465. Modeling Manufacturing Systems (3) GC II An intermediate level introduction to topics in hierarchical design, planning, and control of manufacturing systems and their applications. Topics include modeling automated transfer lines and flexible manufacturing systems. Attention will be given to the performance of manufacturing systems and operational issues such as the role of robots, flexible machines, computers, and material handling systems. P, 340b.

473. Concepts in Information and Communication Systems (3) GC II Introduction to signals and signal processing; signal representations; information measures and channels; modulation and demodulation, detection, estimation. P, 350.

474. Expert Systems (3) GC I Building, using and evaluating expert systems, computer systems that emulate the human and draw conclusions based on incomplete or inaccurate data.

475. Computational Methods for Games, Decisions, and Artificial Intelligence (3) GC II An introduction to automata, computer representation and optimal solution of games and decision problems. Principles of heuristic programming and machine learning. A programming project is to be selected from areas such as game strategies, graphics, recreational mathematics, and manufacturing simulation. Microcomputer experience is emphasized. P, 270 or C.Sc. 277.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>505</td>
<td>Digital Systems Simulation (3)</td>
<td>II Continuation of 405, with emphasis on current research problems including random variate generation, modeling, language development, and statistical analysis of output. P, 405.</td>
</tr>
<tr>
<td>506</td>
<td>Advanced Quality Control (3)</td>
<td>II Advanced statistical techniques for process control and improvement. Topics include multivariate quality control, economic design of process control charts, Japanese methods for quality and selected papers from the recent literature. P, 406 and 420. (Identical with A.M.E. 506)</td>
</tr>
<tr>
<td>508</td>
<td>Advanced Reliability Engineering (3)</td>
<td>II (Identical with A.M.E. 508)</td>
</tr>
<tr>
<td>510</td>
<td>Behavioral Judgment and Decision Making (3)</td>
<td>II Models and theories of human judgment and decision from an engineering perspective. Subjective probability, value and utility. Methods for aiding and supporting decision making. P, 310, 320b or 420.</td>
</tr>
<tr>
<td>513</td>
<td>Risk Estimation and Evaluation (3)</td>
<td>I (Identical with W.R.A. 513)</td>
</tr>
<tr>
<td>518</td>
<td>Reliability Testing (3)</td>
<td>II (Identical with A.M.E. 518)</td>
</tr>
<tr>
<td>535</td>
<td>Computer Integrated Manufacturing Systems (3)</td>
<td>I Modern manufacturing systems with emphasis on information requirements and data management. Includes CDO, CAM, CAPP, real time scheduling, networking and system justification.</td>
</tr>
<tr>
<td>537</td>
<td>Experimental Design for Manufacturing Quality II</td>
<td>(3) II Continuation of S.I.E. 536. Topics include fixed and random effects models, confounding, fractional factorials, nested designs and response surface methodology. P, 536.</td>
</tr>
<tr>
<td>540</td>
<td>Queueing Theory (3)</td>
<td>I Application of the theory of stochastic processes to queueing phenomena; introduction to semi-Markov processes; steady-state analysis of birth-death, Markovian, and general single- and multiple-channel queueing systems. P, 520.</td>
</tr>
<tr>
<td>544</td>
<td>Linear and Integer Programming (3)</td>
<td>I II Topics include linear and integer programming formulations, simplex method, geometry of the simplex method, sensitivity and duality theory, projective transformation methods, network flow problems, branch and bound algorithms, cutting plane algorithms, Lagrangian relaxation methods. P, 340a.</td>
</tr>
<tr>
<td>545</td>
<td>Algorithms and Heuristics for Graphs and Networks</td>
<td>(3) [Rpt/1] II State-of-the-art solution methods for several practical problems that may be formulated on graphs and networks. Emphasis on obtaining good solutions in reasonable time when optimization proves intractable. P, 544.</td>
</tr>
<tr>
<td>550</td>
<td>Theory of Linear Systems (3)</td>
<td>II An intensive study of continuous and discrete linear systems from the state-space viewpoint, including criteria for observability, controllability, and minimal realizations; and optionally, aspects of optimal control and filter theory. P, 350</td>
</tr>
<tr>
<td>554</td>
<td>Mathematical System Theory (3)</td>
<td>I Mathematical theory of discrete systems and models for application to large-scale, complex, man-machine systems.</td>
</tr>
<tr>
<td>556</td>
<td>Finite State Methods in Water Resources Management</td>
<td>(3) II 1988-89 (Identical with W.R.A. 556)</td>
</tr>
<tr>
<td>563</td>
<td>Facility Layout and Location (3)</td>
<td>II Mathematical characterizations of single and multifacility location models as minimum norm problems; mathematical programming methods for facility layout; investigation of computer-aided design systems. P, 544.</td>
</tr>
<tr>
<td>565</td>
<td>Multi-Objective Analysis of Engineering Systems</td>
<td>(3) I Systems design versus operation; multi-objective simplex; goal programming and other distance-based techniques; multi-attribute utility; techniques with qualitative criteria; interactive, quasi-interactive and dynamic approaches; model choice; resource and industrial engineering applications. P, 340b, CR 544.</td>
</tr>
</tbody>
</table>
454  DEPARTMENTS AND COURSES OF INSTRUCTION

575.  **Advanced Production Control (3)** II Quantitative models in the planning, analysis and control of production systems. Topics include aggregate production planning, capacity planning, inventory control and flexible manufacturing. P, 340a-340b.


620.  **Selected Topics in Probability Modeling (3)** II An advanced discussion of a subject in applied probability with significant interest to engineering. Individual projects in stochastic modeling. P, 520.


644.  **Numerical Methods for Nonlinear Programming (3)** II Unconstrained and constrained optimization problems from a numerical standpoint. Topics include variable metric methods, quadratic programming, active set methods, penalty function methods and successive quadratic programming methods. P, 544.


695.  **Colloquium**

   a.  **Motor Control (2) [Rpt./8 units]** II (Identical with Ex.S.S. 695a)

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**TEACHING AND TEACHER EDUCATION**


Associate Professors Ruth A. Beeker, Vivian E. Cox, Vivian F. Dutton (Emerita), Willis J. Horak, Virginia R. Koehler, Carol F. Larson, Glenn S. Pate, Alice Paul, D. Paul Robinson, Violet S. Thomas (Emerita)

Assistant Professors Kathy J. Carter, Sally N. Clark, Jacqueline J. McMahon, Guadalupe G. Romero, Janice L. Streitmatter

Lecturer Richard Lopez, Edward J. Van Metre (Emeritus)

At the undergraduate level, the division offers programs leading to the Bachelor of Arts in Education with majors in early childhood education and elementary education. In the area of secondary education, both the Bachelor of Arts in Education and the Bachelor of Science in Education degrees are available. Students interested in teaching at the secondary school level will select a subject area teaching major and earn the degree appropriate to the chosen major. For more information on selecting teaching majors, see the College of Education section of this catalog.

Undergraduates who plan to select education majors must make formal application to and be admitted by the College of Education prior to enrolling in any professional education course for the purpose of earning a teaching certificate. Candidates for admission to the College of Education must have completed 56 semester units of credit applicable to a baccalaureate degree with a grade-point average of 2.5000 or better. Transfer students’ cumulative grade-point averages (including work taken at other institutions) must meet the 2.5000 standard at the time of admission to the College. In addition, all prospective teachers working toward an undergraduate degree must meet the testing requirement described below.

Important: Arizona law and Board of Regents policy require that all degree-seeking undergraduate students who plan to enroll in professional education courses for the purpose of obtaining a teaching certificate must receive passing scores on all three portions of the Pre-Professional Skills Test prior to registering for the courses. This testing requirement applies to all undergraduate students, whether or not they are majoring in the College of Education. Requirements for graduate and post-baccalaureate students will differ. For further information on restricted courses, see Restricted Enrollment in Professional Education Courses in the College of Education section of this catalog.
At the graduate level, the division offers major programs leading to the Master of Education in business education and distributive education. The availability of these programs was under review at the time of catalog production. Admissions to these programs have been withheld, pending review of these programs.

For information regarding the professional education course sequence, please consult a division advisor. Requirements for teaching majors and minors are listed under the appropriate academic department in the Departments and Courses of Instruction section of this catalog. For information on admission and degree requirements at the graduate level, please consult the Graduate Catalog.

At the time the catalog was being edited, many programs in the College of Education were being redesigned. All current and prospective students should check with the Office of Student Services in the College of Education or the Division of Teaching and Teacher Education for current admission and degree requirements in each major.

Most of the courses listed below have enrollment restrictions. Any student who is not admitted to the College of Education and who is considering taking an education course should check with the division office or the pre-education advisor in the Office of Student Services to determine his or her eligibility.

225. Introduction to Teaching (3) I II S Teaching as a profession: examination of current issues and trends, personal career development, and exploration of the social foundations of American education. Observation in elementary and secondary schools. 2R, 3L.

322. Teaching Language Arts in the Elementary School (3) I II S The teaching of language arts in the elementary school, with special emphasis on current approaches and organization of methods and materials. P, Ed.P. 301, 310, or CR. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (see "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

323. Teaching Reading in the Elementary School (3) I II S The teaching of reading in the elementary school, with special emphasis on current approaches and organization of methods and materials. Other aspects of communicative arts also included. P, Ed.P. 301, 310, or CR.

324. Teaching Science in the Elementary School (3) I II S Basic course in methods of elementary school science instruction, with special emphasis on the skills and structure of science in relation to the processes of inquiry. P, Ed.P., 301, 310, or CR.


327. Teaching Social Studies in the Elementary School (3) I II S Methods and materials for teaching elementary school social studies. P, Ed.P. 301, 310, or CR.


332. Classroom Organization (2) I Study and application of theoretical models and educational research related to effective elementary classroom management, organization, and communication. P, 322, 323, 324, 326, 327, or 323, 376, 377, 379, 326, 324.

338. The Teaching of Secondary School Subjects Specific methods, objectives, organization of subject matter, and evaluation in the various subjects.
   b. Business (3) I
   h. Science (3) I II
   j. Bilingual (3) I II
   l. Art (3) I II S 2R, 2S. P, Art 230. (Identical with Art 338l)
   m. Music (3) I (Identical with Mus. 338m)
DEPARTMENTS AND COURSES OF INSTRUCTION

1. Theatre Arts (3) II (Identical with Dram. 338t)
2. Social Studies (3) I
3. Mathematics (3) I

NOTE: Several specific methods courses, or courses in the teaching of the several high school subjects, are listed under the general number 338, with letters designating the teaching areas. Other methods courses are: 408, 410, 411, 412, 414. Required of prospective secondary teachers.


377. Early Childhood Education (3) I II Curriculum practices in the primary grades. P, Ed.P. 301, 310, or CR.

379. Kindergarten Education (3) I II Growth and learning of 4 to 6 year-old children and study of programs for children of these ages in creative arts, music, science, mathematics, social studies, and language arts; evaluation and reporting of pupil growth to parents. P, Ed.P. 301, 310, or CR.

383. Introduction to Business Communications (3) I II Introduction to writing clear and concise sentences and paragraphs in basic office communications.

384. Records/Information Management (3) I II Systems of records/information management; creation, distribution, storage, transfer, and disposition of office records; management aspects of establishing information systems and evaluating their efficiency.

389. Foundations of Business Education (3) I II Curriculum construction and implementation in business and distributive education; objectives, history, and philosophy of training for vocational office and distributive education; development and administration of vocational student organizations.

405. Mathematics in the Secondary School (3) GC I II Study and analysis of curriculum changes in school mathematics, with emphasis on the design and content of experimental programs such as SSMCIS. P, 3 units of education; Math. 125b. (Identical with Math. 405)

408. English as a Second Language in Bilingual Education (3) GC I II (Identical with Engl. 408)

409. Principles of Vocational Education (2) I I Social and economic values of vocational education; federal laws, state policies, and administration; theories and principles, with special reference to programs in the secondary school. P, CR 338a, A.Ed. 385. (Identical with A.Ed. 409)

410. Teaching English Composition (3) GC I II (Identical with Engl. 410)

411. Teaching of Literature (3) GC I II (Identical with Engl. 411)

412. The Teaching of the English Language (3) GC I II (Identical with Engl. 412)

414. Teaching of Modern Languages (3) GC I II Specific methods, objectives, organization of subject matter and evaluation in modern languages. (Identical with Fren. 414, Itsl. 414, Span. 414, Port. 414)

417. Media in Instruction (3) GC I II S Basic design and production of media for instruction; selection and integration of materials; equipment operation. (Identical with Li.S. 417)

429. Pedagogical Linguistics: Applied Linguistics for Language Teachers (3) GC I II (Identical with Or.S. 429)

441. Instructional Systems Curriculum Development (3) GC I II S Basic skills and knowledge required for curriculum developers to analyze, design, construct and evaluate instructional programs.

442. Implementing Systems Instruction (3) GC I II S Management and evaluation of systems instructional environment; concentration on management styles and internal and external evaluations.

443. Advanced Instructional Methods (3) GC I II S Theory and application of instructional methodologies; development and implementation of units of instruction using the methodologies studied.

444. Classroom Management for Training (3) GC I II S Strategies and objectives used in managing the learning environment, controlling student problems, and implementing due process procedures.

449. Techniques of Teaching Adults (3) GC I II S Techniques and issues of adult learning and the dynamics of the teaching and learning processes.

471. Office Procedures and Problems (3) GC I II S Effective procedures in handling routine office duties, creativity in planning for innovation in the solution of office problems; emphasis on preparation for advancement to administrative positions.

472. Office Administration (3) GC I Analysis of functions of office departments; their organization and administration; development and use of office manuals; selection, training, and promotion of office employees, quality and quantity of office production.

474. Word Processing Concepts (3) GC I II S Basic concepts of information/word processing with emphasis on proper utilization of people, procedures, and equipment.
482. **Teaching Vocational Office and Distributive Education** (3) GC I Development of vocational and career education; the organization and methods of teaching office and distributive education programs.

485. **Cooperative Vocational Education Programs** (3) GC II The role of the teacher-coordinator and the coordination, teaching, guidance, public relations, and administration of work-experience programs.

493. **Internship**
   a. Student Teaching in Elementary School (3 to 10) I II P, 322, 323, 324, 326, 327, Ed.P. 301, 310. (Early childhood education majors substitute 376, 377, and 379 for 322 and 327)
   b. Student Teaching in Secondary School (6 to 10) I II P, Ed.P. 311, 329, 330, L.R.C. 435, passing score on a basic skills proficiency examination, 338 or CR; CR 494b. Students must meet all other College of Education requirements and have satisfactory grades in major subject and professional courses. Application should be made several months in advance.

494. **Practicum**

497. **Workshop**
   a. Evaluating the Elementary School (1 to 3) GC I II S P, Ed.P. 301 or 310.
   b. Educational Video in the Classroom (3) GC I
   c. Elementary School Science (1 to 3) [Rpt./3 units] GC I II S P, Ed.P. 301, 310.
   d. Evaluating the Secondary School (1 to 3) [Rpt./3 units] GC I II
   e. Print Media in the Classroom (1 to 3) GC I II S P, Ed.P. 301 or 310.
   f. Investigating the Environment (1 to 3) GC II S Field trips.

516. **Coordination of Instructional Media Programs** (3) II Study of organization and distribution practices of media utilization; budgeting, public relations, and implementation of media preparation and media-service programs. P, 417. (Identical with Li.S. 516)

517. **Preparation of Instructional Materials** (3) II Study of techniques used in the development of instructional materials and processes. P, 417. (Identical with Li.S. 517)

518. **Research Trends in Instructional Technology** (3) I Past and current trends in instructional technology.

519. **Design of Instructional Media** (3) II Principles of instructional design and development including systems approaches, module development, and integration of media. P, 417.

520. **Science Curriculum in the Elementary School** (3) I II Trends in the science curriculum of the elementary school, with emphasis on selection of content, concepts and activities, methods of teaching, needed equip advancement, and community resources. Primarily for in-service, public-school personnel. P, 12 units of teacher education.

521. **Trends and Issues in Early Childhood Education** (3) I II S 1988-89 Trends and issues in contemporary early educational programs with emphasis on changing needs in the home, school, and society.

522. **Learning Through Play** (3) I II S Play theories as they relate to early childhood development, parenting, and curriculum design.

523. **Constructing the Elementary School Curriculum** (3) I II The elementary school curriculum and its relationships; basic theories and techniques of curriculum construction discussed, evaluated and applied. P, 12 units of teacher education.

524. **Mathematics Curriculum in the Elementary School** (3) I II Emphasis on selection and placement of content, coordination of concepts with strategies of teaching, and selection and use of materials and resources. P, 12 units of teacher education.

525. **Developing the Language Arts Curriculum in the Elementary School** (3) I II Trends in the language arts curriculum of the elementary school, with emphasis on linguistic theory and its application to the instructional program. P, 12 units of teacher education.

526. **Social Studies Curriculum in the Elementary School** (3) I II Trends in the social studies curriculum of the elementary school, with emphasis on selection of content, grade placement of concepts and activities, methods of teaching, needed equipment, and community resources. Primarily for in-service, public-school personnel. P, 12 units of teacher education.

527. **Parent Education and Involvement** (3) I II S Study of models for parent education; exploration of alternative strategies for improving parent/teacher interactions and parent involvement in the learning process.

528. **Curriculum in Early Childhood Education** (3) I II Emphasis on selection of criteria to determine classroom organization, curriculum construction, and instructional programs. P, 12 units of teacher education.
529. **Investigations in Elementary Education** (3) I II Critical study and evaluation of the investigations and experimental evidence basic to the aims and instructional practices of the elementary school.

530. **Classroom Communication and Interaction** (3) II The teacher's role in promoting effective communication and interaction in the classroom situation.

531. **Curricular Studies in School Mathematics** (3) II 1988-89 Experimental programs in school mathematics, with emphasis on selection of content and on problems in design and evaluation.

532. **Math Diagnosis and Remediation** (3) II Techniques for identifying mathematical learning difficulties and strengths; strategies for designing systematic instruction for correcting identified difficulties. 3R, IL, P, 326.

533. **Day Care Education** (3) I History, types, goals, environments, planning for adults, standards and licensing requirements, understanding public responsibility of comprehensive child care. Field trips.

534. **Analysis of Secondary School Teaching** (3) I Analysis of the teaching process; preparation of behavioral objectives; study of recent methods, trends; analysis of current classroom evaluation techniques.

535. **Organization and Functions of the Secondary School** (3) I Secondary school: its organization, structure and operation; role and responsibilities of the teacher, the administrator and other personnel.

536. **Innovations in Secondary Education** (3) II Change process in education, with emphasis on those elements which support or hinder change in the schools; detailed study of current secondary school innovations on the national and local levels.

538. **Constructing the Secondary School Curriculum** (3) I Curriculum and its relationships; basic theories and techniques of curriculum construction discussed, evaluated, and applied.

539. **Investigations in Secondary Education** (3) I Critical study and evaluation of the investigations and experimental evidence underlying the aims and instructional practices of the various subject-matter fields of the secondary school.

542. **The Middle School/Junior High** (3) II History, purposes, curriculum, and administration of the middle school/junior high.


595. **Colloquium**
   a. Issues (1 to 3) I II P, 535.
   b. Curriculum (1 to 3) I II P, 538.
   c. Instruction (1 to 3) I II P, 539.
   d. Evaluation (1 to 3) I II P, 535.
   e. Master's Colloquium (1 to 3) I II

597. **Workshop**
   a. Classroom Teaching Innovations (1 to 3) I II
   b. Simulation and Gaming in the Classroom (1 to 3) I II
   c. Values Education in the Classroom (1 to 3) I II
   d. Educational Implications of Prejudice (1 to 3) I II
   e. Equality in Education (3) I II S
   f. Problems and Processes in Teacher Appraisal (1 to 3) [Rpt./6 units] I II
   g. Learning Centers in Elementary School Math (3) S

618. **Research on Teaching** (3) II To acquaint educational researchers with the models, paradigms, strategies, and empirical research that are the basis for understanding how classroom teaching and learning are related. P, Ed.P. 510, 541, 558.

696. **Seminar**
   a. Topics in Teacher Education (1) [Rpt./6] I II

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**TOXICOLOGY**

*(See Pharmacology and Toxicology, College of Pharmacy)*

**URBAN PLANNING**

*(See Planning)*
The department offers counseling to preveterinary students seeking to fulfill the requirements for admission to schools and colleges of veterinary medicine throughout the United States. For students interested in animal health care and biomedical science, but not necessarily pursuing a career in veterinary medicine, guidance is provided in a curriculum which will prepare students for rewarding careers in research in animal health, biomedical sciences and biotechnology.

The degree of Bachelor of Science in Agriculture with a major in animal health science is available in the agricultural science curriculum. No major is offered in veterinary science. Programs of instruction leading to a Master of Science or Doctor of Philosophy degree may be arranged through departmental cooperation with the Committee on Animal Physiology.

The requirements for the major in animal health science may be found in the College of Agriculture section of this catalog under the curriculum in agricultural science. Since preveterinary studies do not constitute a major, students who elect a four-year preprofessional program must choose a major compatible with the course requirements of the veterinary college to which they seek admission. During completion of the animal health science major, students may complete all requirements for admission to professional programs in veterinary medicine at Colorado State University, Washington State University and Oregon State University. These states have entered into a compact with the state of Arizona through the Western Interstate Commission for Higher Education (WICHE) under the terms of which certain qualified Arizona students may attend the veterinary schools of these states without paying nonresident tuition. Such students must have completed preveterinary training and must have been bona fide residents of Arizona for five years immediately preceding admission to veterinary school. Admission to the professional schools depends to a great extent upon the quality of the student’s academic record.

250. Basic Principles of Animal Anatomy and Physiology (4) II Systematic anatomy and physiology of domestic species, stressing broad concepts and principles important in daily maintenance and progression of life. Designed for an.s. majors. 3R, 3L. Field trips. Not available for credit toward the major in animal health science. P, 3 units of biology

400a-400b. Animal Anatomy and Physiology (3-3) GC Physiology, gross and comparative anatomy. 400a: Nervous, musculoskeletal, immune, hemolymphatic, circulatory, and respiratory systems of domestic animals. 400b: Urinary, digestive, endocrine and reproductive systems. 400a is not prerequisite to 400b. P, Ecol. 104, Chem. 103a-103b, 104a-104b.

403R. Biology of Animal Parasites (3) GC I Biology of host-parasite relationships with emphasis on parasites of veterinary and human importance. Parasite morphology and physiology, life cycles, epidemiology, pathogenesis and zoonotic potential. P, 8 units of biology or microbiology. (Identical with Ento. 403R, Ecol. 403R, Micr. 403R)

405. Animal Diseases (3) GC I Integration of management, husbandry, and preventive veterinary medicine, as related to animal diseases.

415R. Physiology of Reproduction (3) GC I (Identical with An.S. 415R)

415L. Physiology of Reproduction Laboratory (1) GC I (Identical with An.S. 415L)

419R. General Immunology (3) GC I (Identical with Micr. 419R)

419L. General Immunology Laboratory (2) GC (Identical with Micr. 419L)

420R. Pathogenic Bacteriology (3) GC II (Identical with Micr. 420R)

420L. Pathogenic Bacteriology Laboratory (2) GC II (Identical with Micr. 420L)

423R. General Pathology (3) GC II Pathogenesis, pathophysiology and morphologic changes of human and animal diseases. P, Micr. 420R. (Identical with Micr. 423R and Tox. 423R)
423L. **General Pathology Laboratory** (1) GC II Gross and histologic changes occurring in tissues and organs in selected human and animal diseases and disease processes. P, 423R or CR. (Identical with Micr. 423L and Tox. 423L)

438. **Ecology of Infectious Disease** (3) GC II 1987-88 (Identical with Micr. 438)

450. **Medical Mycology** (4) GC II (Identical with Micr. 450)

458. **Comparative Vertebrate Anatomy** (4) GC I Evolution and gross structure of vertebrate organ systems. 2R, 6L. P, 8 units of animal biology (Identical with Ecol. 458)

459. **Comparative Vertebrate Histology** (4) GC II Structure, identification and function of normal vertebrate tissues. 2R, 6L. P, 8 units of animal biology. A vertebrate anatomy course is strongly recommended. (Identical with Ecol. 459)

601. **Experimental Surgery** (2) II 1987-88 Exercises in the surgical procedures commonly necessary in animal experimentation, including aseptic technique, anesthesiology, surgical operations, and care of the postsurgical patient. 1R, 3L. P, 3 units of mammalian anatomy.

630. **Immunology** (4) II 1988-89 (Identical with Micr. 630)

681. **Biostatistical Methods in Microbiology** (2) I 1988-89 (Identical with Micr. 681)

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**WATERSHED MANAGEMENT**
(See Renewable Natural Resources)

**WILDLIFE AND FISHERIES SCIENCE**
(See Renewable Natural Resources)

**WOMEN’S STUDIES**

Committee on Women’s Studies

Myra Dinnerstein, *Chairperson*
Professors Barbara Babcock (English and Anthropology), Herbert E. Carter (Arid Lands Resource Sciences), William Ittelson (Psychology), Eliana Rivero (Spanish and Portuguese), Alice Schlegel (Anthropology)
Associate Professors Susan Hardy Aiken (English), Karen Anderson (History), Leslie Flemming (Oriental Studies), Ingeborg Kohn (French and Italian), Patricia MacCorquodale (Sociology)
Assistant Professor Shirley Fahey (Psychiatry), Trudy Mills (Sociology)

Women’s Studies is an interdisciplinary academic program that offers courses focusing on the new scholarship on women’s experiences and perspectives. The committee offers the Bachelor of Arts degree with a major in women’s studies.

The major allows students to specialize in courses focusing on women and at the same time to pursue concentrated study in one major discipline and a supporting minor. The student is required to take 36 credit hours: two required courses 100 and 200; one course chosen from Soc. 150, Hist. 253a or Hist. 253b; one course in cross-cultural perspective chosen from either 489 or 424 or a course approved by the student’s adviser; four other upper-division Women’s Studies electives; and four upper-division courses in one of the humanities or social sciences departments. At least one of these four humanities or social science courses must be a writing-emphasis course (see “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).
The minor in women's studies consists of at least 20 units selected by the student in consultation with the chairperson of the committee in charge and approved by the student's advisor. Students with a minor in women's studies are encouraged to take courses sequentially, beginning with W.S. 100, then taking intermediate-level courses, and finishing with a senior proseminar.

A major in women's studies provides a sound liberal arts preparation for graduate or professional school. It is also useful for students who wish to pursue careers in journalism, social work, or administration of affirmative action with an emphasis on women's issues.

100. Introduction to Women's Studies (3) I II Introduction to the new information and research on women in literature, history, sociology, philosophy, anthropology, psychology, and political science; investigations of each discipline's approach to women's roles and status.

150. Sociology of Women (3) I II (Identical with Soc. 150)

200. Women in Western Culture: Plato to Plath (3) Women as depicted in leading works by outstanding male and female philosophers, painters, sculptors, and writers from the classical Greek period to the 1960s.

216. Psychological and Biological Perspectives on Gender Differences (3) II (Identical with Psyc. 216)

253a-253b. History of Women in the United States (3) I II (Identical with Hist. 253a-253b)

303. Sex Differences and Language (3) I 1988-89 (Identical with Anth. 303)

341. Women and Health (3) I II (Identical with Nurs. 341)

396H. Honors Proseminar (3) I

410. Women Authors (3) I (Identical with Engl. 417)

416. Women in Literature (3) II (Identical with Engl. 418)

424. Gender and Social Identity (3) GC II (Identical with Anth. 424)

439. Women in the Literature of the Americas (3) I 1987-88 (Identical with Engl. 439)

453. History of Women and Work (3) GC I (Identical with Hist. 453)

458. Feminism: A Comparative History (3) GC II (Identical with Hist. 458)

459. Sociology of Gender (3) GC I II (Identical with Soc. 459)

465. Women in International Development (3) GC II (Identical with Anth. 465)

469. History of Women in Latin America (3) GC II (Identical with Hist. 469)

476. Women and the Law (3) GC I 1988-89 (Identical with Pol. 476)

489. Mexican/Codalian Women's History (3) GC I CDT (Identical with M.A.S. 485)

499. Women in East Asia (3) GC I (Identical with Or.S. 489)

496. Proseminar
   a. Women's Studies (3) [2] I II

571. Counseling Women (3) II (Identical with Coun. 571)

595. Colloquium
   e. Advanced Studies in the History of Women (3) [5] I II (Identical with Hist. 595e, which is home)

ZOLOGY
(See Ecology and Evolutionary Biology)
University Affiliations
Organization,
Administration
and Faculty
University Affiliations, Organization, Administration and Faculty

Memberships and Accreditations

ACCREDITATIONS—Accreditation Board for Engineering and Technology; American Assembly of Collegiate Schools of Business; American Association for Accreditation of Laboratory Animal Care; American Association of Museums; American Chemical Society; American Council on Education for Journalism; American Council on Pharmaceutical Education; American Dietetic Association; American Library Association; American Planning Association; American Psychological Association (graduate program in clinical psychology and graduate program for school psychologists); American Society of Landscape Architects; American Speech-Language-Hearing Association; Association of American Law Schools and American Bar Association; Committee on Rehabilitation Education; Council on Rehabilitation Education (rehabilitation counselor education); Liaison Committee on Medical Education of the American Medical Association and the Association of American Medical Colleges; National Architectural Accreditating Board; National Association of Schools of Dance; National Association of Schools of Music; National Association of Schools of Public Affairs and Administration; National Council for Accreditation of Teacher Education; National League for Nursing; North Central Association of Colleges and Schools; Society of American Foresters.

MEMBERSHIPS—American Association for Higher Education; American Association for Laboratory Animal Science; American Association of Colleges for Teacher Education; American Association of Colleges of Nursing; American Association of Colleges of Pharmacy; American Association of Collegiate Registrars and Admissions Officers; American Association of University Women; American College Theatre Festival; American Council of Learned Societies; American Council on Education; American Home Economics Association; American Psychological Association; American Society for Engineering Education; American Society for Public Administration; American Statistical Association; Argonne Universities Association; Associated Western Universities; Association for Gerontology in Higher Education; Association for Public Policy and Management; Association for University Business and Economic Research; Association of Academic Health Centers; Association of American Colleges; Association of American Medical Colleges; Association of American State Geologists; Association of American University Presses; Association of Collegiate Schools of Architecture; Association of Collegiate Schools of Planning; Association of Research Libraries; Association of Systematics Collections; Association of Universities for Research in Astronomy; Association of University Summer Sessions; Border State Universities Consortium for Latin America; Broadcasters Educational Association; College Art Association of America; College Entrance Examination Board; Consortium of Western Universities and Colleges; Council for Advancement and Support of Education; Council of Graduate Schools in the United States; Council of United States Universities for Soil and Water Development in Arid and Subhumid Areas; EDUCOM, Interuniversity Communications Council; Eisenhower Consortium; Graduate Management Admissions Council; Institute of International Education; International Museum of Photography; Latin American Scholarship Program of American Universities; Mid-America College Art Association; Midwestern Association of Graduate Schools; National Association of Colleges and Teachers of Agriculture; National Association of College and University Attorneys; National Association of Schools of Art and Design; National Association of State Universities and Land Grant Colleges; National Consortium for Black Professional Development; National Public Radio; National University Continuing Education Association; North American Association of Summer Sessions; Pacific Mountain Network; Public Broadcasting Service; Rocky Mountain Science Council; Society of Architectural Historians; Speech Communication Association; Travel Research Association; Universities Council on Water Resources; Universities Research Association; University Corporation for Atmospheric Research; University Film Association; University Resident Theatre Association; University Space Research Association; Western Association of Graduate Schools; Western College Association; Western Interstate Commission for Higher Education (WICHE); Western Institute of Nursing.
History

THE UNIVERSITY—AN HISTORICAL SKETCH

In 1885—nearly three decades before Arizona became a state—the thirteenth territorial legislature approved $25,000 for building the University of Arizona in Tucson. The first classes convened in 1891, when 32 students and six teachers met in the original building now known as Old Main.

The University has developed in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act. This legislation created the land-grant colleges and enabled the institution to obtain federal funds for its original schools of agriculture and mines.

In its early days, there were more students in the preparatory department than in the University proper, and the number of university graduates was never more than ten a year. Then came a decade of rapid expansion. The territory became a state, high schools multiplied, and the preparatory department was closed. In 1915, the University was reorganized as three colleges—the College of Letters, Arts, and Sciences (later Liberal Arts); the College of Mines and Engineering; and the College of Agriculture. The Arizona Bureau of Mines was established the same year.

In 1922 the College of Education was organized, and in 1925 offerings in law, originally established in 1915, were organized under the College of Law. The School of Business and Public Administration, established within the College of Letters, Arts, and Sciences in 1934, was reorganized as a separate college in 1944. In 1934 the Department of Home Economics was enlarged to a school within the College of Agriculture. In 1934 the College of Fine Arts, including the School of Music, and the Graduate College were established. In 1940 the Board of Regents reorganized the College of Mines and Engineering into two separate colleges. In 1967 the School of Earth Sciences was organized within the College of Mines, and became the College of Earth Sciences in 1971. In 1947 the School of Pharmacy was organized within the College of Liberal Arts, and was given separate status as the College of Pharmacy in 1949. The Board of Regents in 1956 authorized the establishment of the School of Nursing as a division of the College of Liberal Arts, and in 1964 the school became the College of Nursing. The Department of Architecture in the College of Fine Arts, authorized in 1958, became the College of Architecture in 1964. The Board of Regents authorized the College of Medicine in 1961. In 1974 the School of Renewable Natural Resources was approved as a new unit of the College of Agriculture. The School of Health-Related Professions was authorized by the Board of Regents in 1977. In 1982 the College of Liberal Arts and the College of Fine Arts were reorganized into the College of Arts and Sciences which includes the Faculty of Fine Arts, the Faculty of Humanities, the Faculty of Science, and the Faculty of Social and Behavioral Sciences. In 1984, the departments that constituted the former College of Earth Sciences were reorganized to become part of the College of Arts and Sciences and the College of Engineering and the School of Home Economics was renamed the School of Family and Consumer Resources. In 1985, the College of Mines combined with the College of Engineering to become the College of Engineering and Mines.

The 40-acre campus of the 1890s has grown to 340 acres and 175 buildings. Its purpose remains, in the language of the organic law, "to provide the inhabitants of this state with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and, insofar as possible, to provide a technical education adapted to the development of the resources peculiar to Arizona. The University is maintained by funds appropriated by the State of Arizona and the United States government, and by fees and collections including private grants from many sources.

ACADEMIC DIVISIONS

More detailed information may be found under listings for the specific college or department.
ACADEMIC DIVISIONS

COLLEGE OF AGRICULTURE. School of Family and Consumer Resources (with divisions of Child Development and Family Relations; Clothing, Textiles and Interior Design; Counseling and Guidance; Home Economics Education/Consumer Studies); School of Renewable Natural Resources (with divisions of Landscape Resources; Range Resources; Forest-Watershed Resources; Wildlife Fisheries and Recreation Resources). Departments of: Agricultural Economics; Agricultural Education; Agricultural Engineering; Animal Sciences; Entomology; Nutrition and Food Science; Plant Pathology; Plant Sciences; Soil and Water Science; Veterinary Science. University Departments of: Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology.

COLLEGE OF ARCHITECTURE.

COLLEGE OF ARTS AND SCIENCES. School of Music; Graduate Library School. Departments of: Anthropology; Art; Astronomy; Atmospheric Sciences; Chemistry; Classics; Communication; Computer Science; Drama; Ecology and Evolutionary Biology; English; French and Italian; Geography and Regional Development; Geosciences; German; History; Journalism; Linguistics; Mathematics; Media Arts; Oriental Studies; Philosophy; Physics; Planetary Sciences; Political Science; Psychology; Russian and Slavic Languages; Sociology; Spanish and Portuguese; Speech and Hearing Sciences; Statistics. University Departments of: Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology. Committee on Dance.

COLLEGE OF BUSINESS AND PUBLIC ADMINISTRATION. Departments of: Accounting; Economics; Finance and Real Estate; Management and Policy; Management Information Systems; Marketing.

COLLEGE OF EDUCATION. Divisions of: Educational Foundations and Administration; Language, Reading and Culture; Special Education and Rehabilitation; and Teaching and Teacher Education.

COLLEGE OF ENGINEERING AND MINES. Departments of: Aerospace and Mechanical Engineering; Chemical Engineering; Civil Engineering and Engineering Mechanics; Electrical and Computer Engineering; Hydrology and Water Resources; Materials Science and Engineering; Mining and Geological Engineering; Nuclear and Energy Engineering; Systems and Industrial Engineering.

COLLEGE OF LAW.

COLLEGE OF MEDICINE. Departments of: Anatomy; Anesthesiology; Family and Community Medicine; Internal Medicine; Neurology; Obstetrics-Gynecology; Ophthalmology; Pathology; Pediatrics; Pharmacology; Physiology; Psychiatry; Radiation Oncology; Radiology; Surgery. University Departments of: Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology.

COLLEGE OF NURSING.

COLLEGE OF PHARMACY. Departments of: Pharmaceutical Sciences; Pharmacology and Toxicology; Pharmacy Practice.

GRADUATE COLLEGE. Committees on: American Indian Studies; Animal Physiology; Applied Mathematics; Arid Lands Resource Sciences; Business Administration; Environment and Behavior; Genetics; Gerontology; History and Philosophy of Science; Latin American Studies; Medieval Studies; Nutritional Sciences; Optical Sciences; Pharmacology and Toxicology; Planning; Plant Protection; Remote Sensing; Romance Languages.

GENERAL DEPARTMENTS. Exercise and Sport Sciences; School of Health-Related Professions; School of Military Science, Naval Science, and Military Aerospace Studies.

UNIVERSITY DEPARTMENTS. Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology.
GENERAL COMMITTEES. American Indian Studies; Applied Mathematics; Biomedical Engineering; Black Studies; Business Administration; Gerontology; Humanities; Latin American Studies; Mexican American Studies; Religious Studies; Remote Sensing; Women's Studies.

CONTINUING EDUCATION.

THE UNIVERSITY LIBRARIES.

RESEARCH AND SPECIAL PUBLIC SERVICE UNITS

The following divisions are a part of or are affiliated with the University. Additional information regarding their organization and services may be obtained upon inquiry to the director concerned.

The AGRICULTURAL EXPERIMENT STATION (1890), one of the divisions of the College of Agriculture, is responsible for the basic and applied research programs in the schools, departments, and other units within the College of Agriculture. It is administered by the Director of the Experiment Station. Modern facilities for laboratory and field research and extension, as well as graduate and undergraduate teaching, are available on the University campus and at agricultural centers throughout the state of Arizona. Research is also conducted on farms, orchards, ranches, rangelands, and forests in cooperation with farmers, ranchers, and officials of various state and federal agencies.

ARIZONA CENTER FOR EDUCATIONAL EVALUATION AND MEASUREMENT (1980) initiates and conducts multidisciplinary research on such topics as nondiscriminatory psychological assessment; assessment of developmental competencies, sequencing of instruction, cognitive skills in children; and evaluation of school effectiveness. The center maintains state-of-the-art research technology, prepares graduate students in research methodology; and provides technical assistance to public and private agencies regarding testing, student services, curriculum development and systems for program evaluation.

ARIZONA CENTER FOR EDUCATIONAL RESEARCH AND DEVELOPMENT (1971) initiates and conducts research and development programs in such areas as early childhood education, teaching and learning, language and literacy, cultural diversity and learning, and education of exceptional children.

The ARIZONA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT engages in graduate education, research, and extension. The unit is supported by the University of Arizona, the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute. The facilities and personnel of the unit are available to graduate students who wish to pursue both class work and research programs leading to advanced degrees in fisheries science and wildlife biology. The unit is housed in the School of Renewable Natural Resources.

The ARIZONA COOPERATIVE NATIONAL PARK RESOURCES STUDY UNIT (1973), located in the School of Renewable Natural Resources, is engaged in research to support the natural science program of the National Park Service. In cooperation with the University of Arizona, the unit provides graduate research opportunities and instructional support in a broad array of natural resource problem areas.

The ARIZONA HEART CENTER (1986) is an interdisciplinary organization intended to further research into cardiovascular biology and disease. The center's major objectives include conduct of basic and clinical research, provision of medical and surgical care to individuals, and provision of graduate, post-graduate, and continuing educational programs, both regionally and nationally. Coordination of cardiovascular research in the state and region is a major aim; close ties with investigators will be fostered. Research will include transplant immunology, echocardiography, clinical electrophysiology, molecular biology, experimental pharmacology and cell physiology, all applicable to cardiovascular problems.

The Arizona Heart Center operates as a division of the College of Medicine, reporting to the Dean of the College. Its programs are linked to faculty and staff in the college, in the University Medical Center, and in other colleges and units in the University.
The ARIZONA POISON AND DRUG INFORMATION CENTER (1980) is operated by the College of Pharmacy and is located in the Arizona Health Sciences Center Library. The center provides comprehensive poison information and advice on treatment of poisoning to the public on a state-wide basis. It also offers drug information and therapeutic consultations to health professionals. The center has a toll-free telephone number (listed on the inside cover of Arizona telephone directories) and can be reached 24 hours a day, seven days a week. Full-time clinical pharmacists staff the center and serve as poison and drug information specialists. Serving as consultants are medical toxicologists and specialists in plant and animal poisons, drugs, and environmental and industrial poisons. The Arizona Poison and Drug Information Center also provides for clinical training of pharmacy students in the areas of drug and poison information. The Arizona Poison and Drug Information Center is a component of the Arizona Poison Control System which was established at the University of Arizona by the Arizona State Legislature in 1980. The Arizona Poison Control System is certified as a regional poison control program by the American Association of Poison Control Centers.

The ARIZONA REMOTE SENSING CENTER (1972) is the focus of remote sensing research in the College of Agriculture. The staff of the center is involved in interdisciplinary remote sensing and computer mapping projects related to agriculture and natural resource management. The center contains equipment for manual analysis of satellite and aircraft imagery and a computer system for digital processing and display of images and maps. These facilities are available to faculty, students and cooperators from outside the University.

The ARIZONA RESEARCH LABORATORIES (1979) is an interdisciplinary research unit established to provide a mechanism for administering and fostering research which bridges disciplines embraced by departments from more than one collegiate unit. A major thrust of the organization is to form research groups to initiate new programs of high priority to the development of the educational and research mission of the University. The organization of the laboratories also provides a mechanism for serving as an organized research component for those teaching and research units that do not have such a capability.

The ARIZONA STATE MUSEUM, founded as a territorial museum in 1893, is an educational, research, and service division of the University. Museum exhibits emphasize prehistoric and recent Indian cultures of Arizona and the Southwest. Special temporary exhibits on a variety of subjects are presented throughout the year. The museum is open daily to the public. Closed major holidays.

The ARIZONA TRANSPORTATION AND TRAFFIC INSTITUTE (1959) is engaged in broad research aimed at developing advanced methods of analysis and obtaining answers to the transportation problems in Arizona. Topics considered include the planning, design, and operation of transportation facilities, including pavement design and highway materials, as well as maintenance of these systems. The institute acts as a technical information center, and its activities are closely tied to those of the Department of Civil Engineering and Engineering Mechanics.

The ARIZONA VETERINARY DIAGNOSTIC LABORATORY was initiated by the Department of Veterinary Science in 1934 and has provided continuous service to the animal owners of Arizona since its establishment. Increased funding from the Arizona Legislature in 1983 has permitted an increased number and variety of diagnostic services in toxicology, microbiology, histopathology and field investigations for companion animal and livestock owners referred through veterinary practitioners.

The BOYCE THOMPSON SOUTHWESTERN ARBORETUM (1927) is operated cooperatively by the University of Arizona (College of Agriculture), Arizona State Parks Board, and the Boyce Thompson Southwestern Arboretum Board. This public botanic garden has facilities for teaching and research. Situated on the edge of the low desert near Superior, Arizona, the arboretum is a two-hour drive from the campus. Thirty acres of native and introduced plants from arid and semi-arid regions, together with about 1,000 additional acres of undisturbed fauna and flora, are under arboretum control. Additionally, large tracts of relatively undisturbed habitats in a variety of biomes lie in the surrounding Tonto National Forest. Laboratory facilities and housing are available. The arboretum is open daily except for Christmas Day.
The BUREAU OF APPLIED RESEARCH IN ANTHROPOLOGY (1952), a division of the Department of Anthropology, is a regional and international center for basic and applied research relating to culture change, urban and rural living, technological innovation, social and cultural impact assessment, agricultural and institutional development, educational innovation, and research methods.

The BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY (1915) is a state agency affiliated with the University of Arizona and is directly charged with developing, maintaining, and disseminating to the people of Arizona information relating to mining, metallurgy, and earth sciences generally. The bureau's primary functions are those of a state geological survey and mines bureau and, therefore, include scientific investigation and public service activities comparable to those conducted by similar organizations in other states.

The close union of the bureau with programs of the Department of Materials Science and Engineering and the Department of Geosciences has been exceptionally productive in the development and dissemination of knowledge about the mineral resources and environmental characteristics of Arizona. The bureau is a member of the Association of American State Geologists, the national affiliation of geological surveys of individual states.

The CENTER FOR COMPUTING AND INFORMATION TECHNOLOGY (CCIT) provides campus-wide services and facilities in support of the instructional, research, and administrative computing needs of the University. The University's network of shared computers consists of a Control Data Corporation CYBER 175 computer, Digital Equipment Corporation DECsystem-10, three VAX 11/780's, a VAX 11/750, a VAX 8600 computer system in a cluster environment, two IBM 4381 computers, five Prime computer systems, and a Scientific Computer Systems SCS-40 mini-supercomputer. These computers are interconnected to allow data transfer between systems.

The CCIT provides a campus-wide data communications network supporting both central and distributed processors. Access to facilities is available 24 hours a day. Additionally, CCIT provides access to outside networks such as Bitnet and Telenet, and to major national supercomputer networks. The CCIT provides terminal access centers at various locations on campus and dial-up access to the University system.

The CCIT offers many services to assist users in taking advantage of available computing resources. Services include consulting on the use of the University's computers and various microcomputers; assistance in user acquisition of computing facilities; communications and networking between user-owned equipment and the University's systems; computer facility planning and preparation; selection, acquisition, and installation of microcomputer hardware and software; mainframe and microcomputer training facilities; programming and applications services; and dissemination of information through user publications, manuals, and program library documentation.

The CENTER FOR CREATIVE PHOTOGRAPHY (1975), a division of the University Library, is an internationally acclaimed research museum and study center devoted to the collections and archives of 20th-century photographers. Its collections include over 50,000 master prints, more than 500,000 study prints and negatives, correspondence, manuscripts, artifacts, and related documents. It contains a major research library of over 12,000 volumes and a rare book collection. The center sponsors a lecture series of internationally prominent photographers, historians, critics, and related scholars. The center has an extensive publishing program, which includes a journal entitled The Archive. This publication is available through subscription. Photographs and archive materials are available through both exhibition and personal print viewing appointments.

The CENTER FOR THE STUDY OF HIGHER EDUCATION (1978) in the College of Education conducts research studies and provides related service activities to meet state and institutional needs, as well as those of national, international and regional governmental units and other organizations. It develops and disseminates information about higher education, policy, and operation and facilitates the research of faculty members and students. Special research and service projects are provided through university funds and outside support.

The COOPERATIVE EXTENSION SERVICE (1914) brings information to interested people of Arizona. One of the three divisions of the College of Agriculture, it emphasizes agricultural production and natural resources, family and consumer sciences, youth development (4-H), and
rural development. The service is financed from federal, state, and county appropriations. It operates through the county extension agent, state and area specialist system with faculty trained in their specialty, and in the practical application of scientific information on farms, ranches and in rural and urban homes. Assistance is provided to target audiences in problem solving, information dissemination and educational programs.

The DIVISION OF ECONOMIC AND BUSINESS RESEARCH (1949) is a research and service organization within the College of Business and Public Administration. Its broad objectives are to conduct research relating to business, economics, planning, and public policy; to complement the formal education of students with research experience; and to disseminate information. To achieve its objectives, DEBR builds and maintains regional economic models for applications in forecasting and impact simulation, conducts research on state and local market conditions, analyzes the effects of public policy alternatives, and provides technical assistance for computerized corporate and government planning applications. It publishes the semi-annual Arizona Review, the monthly Arizona's Economy, and the chart book Arizona Economic Indicators, and conducts both forums and seminars for the public. In addition, DEBR answers requests from business, government, and the general public for tabular information and maps showing local demographic and business patterns and, as a member of the State Data Center, for computerized census information.

The DIVISION OF MEDIA AND INSTRUCTIONAL SERVICES (1939) provides a wide range of instructional media, production, research and public broadcasting services to the University, community and state. The division operates three maximum-power public broadcasting stations: KUAT-TV (Channel 6 and Translator Channel 27 in the Catalina Foothills), KUAT-AM (1550 kHz), and KUAT-FM (90.5 MHz and Translator Frequency, 89.7 MHz in northwest Tucson and Sierra Vista and 105.5 in Phoenix). Professional production facilities are maintained in the Modern Languages Building, the Audiovisual Building and the Harvill Building. Production capability includes color studio and mobile television, and 16mm motion picture equipment.

The stations are affiliated with Public Broadcasting Service (PBS), National Public Radio (NPR) and American Public Radio (APR).

The Microcampus produces and distributes university courses to business and industry in the Tucson area through a two-channel interactive Educational Television System (IETS) and through the nation by videotape and live satellite transmission. See below for further information.

Instructional Production and Engineering provides high technology educational support including:

- Pre-production and instructional design for video and audio. Production and post-production and distribution via nationwide Ku Band up-link facilities, ITFS and Microwave Transmission to Tucson and Fort Huachuca, satellite reception facilities, large screen viewing facilities and teleconference facilities.
- Videotaping for teaching assistant evaluations, meetings, conferences and seminars is available as well as satellite reception of Soviet and French television programs for use in foreign language classes, big screen television playback facilities for large class viewing and multi-image slide presentations for promotional and fund raising events.
- Equipment maintenance and repair for departments is an additional service of Engineering and Production.
- The Graphics Center provides outstanding graphic and photography services to the University.
- The Film Library and Equipment Services provide media and audiovisual materials to both the University and other educational institutions.

The ECONOMIC SCIENCE LABORATORY (1985) is a research unit of the College of Business and Public Administration. Its purpose is to support innovative research and instruction through the use of laboratory economics experiments. Recent areas of investigation include the performance of asset markets, comparative behavior of different auctions and forms of market organization, incentive systems in hierarchies, and comparative evaluation of processes for the provision of public goods. ESL operates a computer laboratory dedicated to conducting economics
experiments. Other programs include lectures by visiting scholars; seed money for faculty and graduate student research, and organization of internationally attended conferences.

The ENGINEERING EXPERIMENT STATION (1941) administers the funds of all sponsored grants and contracts of the faculty of the College of Engineering and Mines. Students are often supported by wages or work-study arrangements under individual projects. Using state-appropriated funds, the station promotes, initiates, and conducts engineering research of potential benefit to the State of Arizona.

The ENVIRONMENTAL RESEARCH LABORATORY (1967) conducts research in controlled-environment agriculture (CEA) for intensive food production, in seawater crop irrigation, and in solar heating and cooling. ERL has designed CEA vegetable systems which produce crops in the desert sands of the United States, Mexico and the Middle East, and it has developed CEA for the intensive culture of marine shrimp. ERL is developing halophytic crops for livestock feeds and other uses—plants which are irrigated solely with seawater or other highly saline water. ERL consults on such special projects as the portrayal of agriculture of the future at the EPCOT Center at Walt Disney World in Florida. ERL has also developed a series of demonstration solar homes at Tucson International Airport, where the laboratory is located. It is also applying this technology to prototype systems for future cities.

The GRACE H. FLANDRAU PLANETARIUM (1975), a part of the College of Arts and Sciences, was built as a result of a gift to the University by Grace H. Flandrau. It houses a 50-foot projection dome, a Minolta Series IV planetarium projector, and a hemispheric 35mm motion picture projector. It is used as a teaching facility for university classes in astronomy, and 25,000 Tucson public school children attend its special educational programs each year. The planetarium presents dramatic public programs on astronomy and planetary science that take audiences on cosmic journeys through time and space. The science exhibit halls and 16-inch telescope are open free to the public. Open daily except Mondays.

The HUMAN DEVELOPMENT LABORATORY (1979) is an interdisciplinary research and training center within the Division of Child Development and Family Relations in the School of Family and Consumer Resources. The laboratory is charged with promoting and conducting applied research to enhance the welfare of families and individuals. The laboratory supports and conducts funded and nonfunded research on issues relating to all stages of human life. Priority is given to research that is interdisciplinary, preventive, and issue-oriented. The facility is equipped for audio and video taping and sponsors colloquia and a semiannual newsletter.

The INSTITUTE OF ATMOSPHERIC PHYSICS (1954) conducts research on the fundamental processes that are important in the study of weather and climate. Particular emphasis is given to investigations in radiative transfer, remote sensing, atmospheric aerosols, atmospheric chemistry, cloud and precipitation physics, lightning and atmospheric electricity, atmospheric dynamics, mesoscale meteorology, and the mathematical modeling of global climate.

The JEFFREY M. GOLING CLINICAL RESEARCH UNIT (1984) is a specially equipped facility located in the College of Pharmacy. Its primary objective is to provide clinical scientists at the University of Arizona with the opportunity to study the action of drugs in humans with the ultimate goal of developing improved methods of treatment. The research unit has three rooms: a patient waiting room, a private office for conducting patient interviews or preliminary examinations, and the main room which houses two hospital beds and is equipped with specialized medical equipment.

The KARL ELLER CENTER FOR THE STUDY OF THE PRIVATE MARKET ECONOMY (1983) is a research and education organization within the College of Business and Public Administration. It has three broad objectives: (1) to promote research in basic market processes, (2) to sponsor an Entrepreneurial Studies Program, and (3) to provide for business/academic exchange. Research is supported through the recruitment of Karl Eller Chair holders in the disciplines represented in the college. Faculty research fellowships are also available. The Entrepreneurial Studies Program offers both academic courses for students interested in entrepreneurship and practical courses on the development of business plans. Approximately 35 students are included in the program annually. Business/academic exchange occurs through an annual di-
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alogue on significant national economic issues and through semiannual new venture forums where entrepreneurs present business plans.

The LABORATORY OF TREE-RING RESEARCH (1937) is an outgrowth of the pioneering tree-ring studies initiated by Andrew Ellicott Douglass at the University of Arizona in 1906. A division of the College of Arts and Sciences, the Laboratory conducts a unique program of teaching and research in all aspects of dendrochronology. Graduate-level instruction is offered through cooperating academic departments, and a limited number of graduate research assistantships are available to qualified students. Current research efforts are directed toward the quantification of tree-ring parameters, the establishment of new tree-ring chronologies throughout the world, the understanding of basic tree growth and environmental relationships, the reconstruction of paleohydrologic and paleoclimatic variables, and the documentation and development of prehistoric chronological controls. Along with the world's largest collection of tree-ring specimens from living trees and ancient timbers, the laboratory maintains a variety of specialized equipment and data files containing processed tree-ring chronologies, relevant climatic and hydrologic records, and archaeological tree-ring dates and site-information.

The LUNAR AND PLANETARY LABORATORY (1960) is the research institute associated with the Planetary Sciences Department. Laboratory staff engage in research and graduate instruction in conjunction with the Planetary Sciences Department and frequently undertake projects in collaboration with other campus units as well, including the Departments of Astronomy, Geosciences, and Physics, and the Steward Observatory.

Research programs at the Lunar and Planetary Laboratory are closely associated with the NASA space program and include numerous lunar and planetary missions. Several of the faculty of the department and the laboratory have been principal investigators or coinvestigators on space experiments, including Apollo, Mariner, Voyager, and Pioneer spacecraft. Major ground-based research facilities include the University of Arizona telescopes (150 cm, 100 cm, 70 cm aperture reflectors on Mt. Lemmon; 154 cm aperture reflector and 46/71 cm Schmidt camera near Mt. Bigelow; 53 cm reflector on Tumamoc Hill; 220 cm Cassegrain reflector on Kitt Peak; and the multiple-mirror telescope on Mt. Hopkins), a scanning electron microprobe, a neutron activation analysis laboratory, and the Space Imagery Center. In addition, the laboratory conducts high-altitude observational programs for solar, planetary, and stellar infrared spectroscopy using NASA jet aircraft.

Research interests of the laboratory and department include experimental and theoretical geochemistry and cosmochemistry, lunar and planetary geology, spacecraft imaging of planetary surfaces, the physics of planetary interiors, cosmic rays, the sun and solar wind, astrophysical plasmas, polarimetry and studies associated with the origin of the solar system, infrared Fourier spectroscopy, planetary atmospheres, infrared astronomy, and astrometry. The laboratory is housed in the Gerard P. Kuiper Space Sciences Building.

The MICROCAMPUS (1972) is an education delivery system which uses video cassettes, live interactive microwave and satellite transmission to make University of Arizona classes available to students throughout the U.S. Students in remote locations who want university credit must be admitted to the University and register for classes in absentia. Successful completion of a course results in a university credit transcript entry. In addition to regular courses, videotaped short courses provide up-to-date information on diverse subjects, but are not available for university credit. Developed in the College of Engineering, Microcampus has grown to include courses from many other colleges and is now part of the Division of Media and Instructional Services.

The MINERAL MUSEUM (1919) emphasizes Arizona's unique mineral heritage in a spectacular collection of minerals, fossils, and gems. The museum, a part of the collections of the Department of Geosciences since its establishment, is open to students and the general public.

The OFFICE OF ARID LAND STUDIES (1964), administratively located within the College of Agriculture, is active in international studies, natural resources development and management, environmental studies, economic botany, new crop development, water and energy conservation, information services, Indian programs, remote sensing, geographic information systems, publications and education. Activities are conducted within the framework of the arid environment. The office provides interdisciplinary project management and works closely with local and
campus communities as well as with local, state, federal, and international government agencies. The office administers the interdisciplinary Doctor of Philosophy degree with a major in arid lands resource sciences.

The OPTICAL SCIENCES CENTER (1967) is a graduate center for research in applied and theoretical optical physics. Areas in which research is currently being conducted include electro-optics, image formation, image processing, laser physics, materials, medical optics, nonlinear optics; optical bistability, optical design, optical fabrication and testing, optical properties of materials, pattern recognition, quantum optics, remote sensing, spectroscopy, surface physics, and thin-film technology. Interdisciplinary programs in progress involve the departments of Astronomy, Chemistry, Civil Engineering and Engineering Mechanics, Electrical and Computer Engineering, Physics, and Radiology, as well as the Microelectronics Laboratory, Arizona Research Laboratory, the Optical Circuitry Cooperative and the Optical Data Storage Center.

Special facilities of the Optical Sciences Center include CVD and vacuum-deposition thin-film facilities, dark rooms, an electronics shop, infrared laboratory, instrument shop, massive-optics shop, small-optics shop, student/faculty machine shop, and teaching laboratories. In addition, a multitude of computing facilities are available for use in both research and training programs.

The RUTH E. GOLDING CLINICAL PHARMACOKINETICS LABORATORY (1977) in the College of Pharmacy is primarily an analytical laboratory where new assays are developed to quantify drugs and their metabolites from biological fluids. These assays are used in conjunction with animal and clinical research projects to better define the disposition of and response to drugs. The results of these studies along with the monitoring of drug plasma concentrations in patients are used to optimize therapy by individualizing drug administration.

The SOCIAL AND BEHAVIORAL SCIENCES RESEARCH INSTITUTE promotes fundamental and applied research focusing on both individuals and social groups. The areas of fundamental research encompass individual behavior, including its linguistic and psychological expression, social organization, theory and values, and public and private policy. Knowledge gained through this social and behavioral research is applied to the practical problems confronting society and the individual. This mission is achieved by stimulating and supporting the varied substantive research of faculty in the broad range of disciplines and interdisciplinary programs represented by the Faculty of the Social and Behavioral Sciences. Major departments and organized research units cooperate in establishing, maintaining, and operating the centralized research facilities of the institute. Primary among these is the SBSRI Data and Software Library which supplies technical support in computer software, and maintains an extensive data library. Cognitive Science, a research unit within SBSRI, coordinates research activity in linguistics, psychology and philosophy. It seeks to link theories of human mental capacities with experimental approaches, to discover the ways in which the brain carries out high-level mental functions, and to understand the nature of computation as it plays a role in the workings of the human mind. Laboratories designed for study of human perception and cognition and of experimental psycholinguistics support cognitive science research.

The SOUTHWEST CENTER (1982) is a university unit which seeks to encourage and facilitate teaching, research, and the dissemination of information related to the history, culture, and ecology of the Mexican Northwest and the U.S. Southwest. The center is affiliated with the Universidad Nacional Autonoma de Mexico, U.N.A.M. Courses on the Southwest are taught through many university departments and programs, including American Indian studies, anthropology, English, geograhphy, history, Latin American studies, linguistics, Mexican American studies, political science, sociology, Spanish and Portuguese, and women's studies.

The SOUTHWEST INSTITUTE FOR RESEARCH ON WOMEN (SIROW) (1979) is a regional research and resource center within the Committee on Women's Studies. The institute develops and conducts research on women in the Southwest (Arizona, Colorado, New Mexico, and Utah) or of interest to scholars in the region. SIROW publishes a newsletter and a working paper series, links researchers with community organizations and policy makers through a research clearinghouse, and provides professional development and training for people in education, research, business, and government.
The STEWARD OBSERVATORY (1916) was established by the generous gift from Lavinia Steward, in honor of her husband, George Steward. For many years, the observatory's principal telescope was its 36-in. (91-cm) reflector, constructed with the aid of the Steward bequest. At this time, the primary research telescopes of the observatory include the Multiple Mirror Telescope (MMT), located on the Mt. Hopkins summit in the Santa Rita Mountains, the 90-in. (2.3-m) Ritchey-Chretien reflector at the Kitt Peak site, and the 61-in. (1.55-m) Cassegrain reflector found at the Mt. Bigelow station in the Santa Catalina Mountains. The MMT, operated jointly with the Smithsonian Astrophysical Observatory, represents an innovative and highly successful concept for construction of large optical telescopes; it has become the prototype for future large-aperture telescopes. The major telescopes are used with a wide variety of instrumentation and detectors and are supported by several smaller instruments used for teaching or special research projects.

The Steward Observatory offices and laboratories are located on the northeast part of the University campus adjacent to the original 36-in. dome which now houses a 21-in. instructional telescope. The main areas of research at the observatory include extragalactic and galactic astronomy, with major specializations in the areas of quasars, degenerate stars, infrared sources, novae, and radio galaxies. Observational work is concentrated in the optical and infrared but includes work at radio, ultraviolet and x-ray wavelengths using other facilities. The observatory is developing facilities for work at mm and sub-mm wavelengths in collaboration with the Max Planck Institute for Radio-astronomy in Bonn, West Germany. The observatory's Large Mirror Lab is collaborating in the development of optics for the next generation of giant optical/infrared telescopes. The research programs also include a new initiative in theoretical astrophysics, and an active involvement in astronomy in space, such as the Infrared Astronomy Satellite (IRAS), Space Infrared Telescope Facility (SIRTF) and Space Telescope.

Located across North Cherry Avenue from Steward Observatory are the administrative offices and laboratories of the National Optical Astronomical Observatories. The two optical observatories and the National Radio Astronomy Observatory jointly sponsor a weekly series of professional colloquia. Steward Observatory also maintains close working ties with the University's Lunar and Planetary Laboratory, the Department of Planetary Sciences, the Optical Sciences Center, the Department of Physics and the Grace M. Flandrau Planetarium. In addition, close collaboration is maintained through Steward facilities shared by the Vatican Observatory, Smithsonian Astrophysical Observatory, and the National Radio Astronomy Observatory.

The UNIVERSITY ANALYTICAL CENTER was established in response to the increasing need for various segments of the academic community to have access to modern chemical analysis methodology. The Analytical Center provides the University with a centralized system consisting of analytical equipment and personnel trained in various areas of chemical analysis. This facility is available to all university disciplines requiring or desiring to use various analytical procedures in teaching or research activities. The UAC serves the university community by providing analytical equipment, analytical advice, methods development, sample analysis, and the training of both technical and nontechnical personnel in various aspects of analytical measurements. In addition, the UAC maintains an active program of both basic and applied analytical research. The research activities provide a means of continuously expanding Analytical Center capabilities and ensuring that equipment and personnel are kept at "state-of-the-art" levels in various analytical areas. The UAC is a state-certified laboratory.

The UNIVERSITY OF ARIZONA MUSEUM OF ART—The University of Arizona is exceptionally fortunate in that it possesses several outstanding art collections. Housed in our modern building are the masterpieces of the Samuel H. Kress Collection, which include the surviving panels of the Retablo of Ciudad Rodrigo by Fernando Gallego and one of the finest university collections of Renaissance sixteenth- and seventeenth-century art in the United States. Contemporary international painting and sculpture are well represented in the Edward Joseph Gallagher III Memorial Collection; 61 sketches and models by Jacques Lipchitz which comprise one of the largest collections of his work in the world; the C. Leonard Pfeiffer Collection includes American paintings from the 1930s and was the first collection of art donated to the University. An active exhibition and educational program is available throughout the year. The Museum of Art is open to the public on weekdays from nine to five and on Sunday from noon to four. There is no admission fee.
The UNIVERSITY OF ARIZONA PRESS (1959), founded as a department of the University of Arizona, is a nonprofit publisher of regional and scholarly books. As a delegate of the University of Arizona to the larger world, the press publishes the work of scholars wherever they may be, concentrating upon scholarship that reflects the special strengths of the University of Arizona, Arizona State University, and Northern Arizona University.

The press publishes scholarly books in anthropology and archaeology, space sciences, arid lands studies, biology, Latin American studies, Asian studies, American Indian studies, and other fields. Also on the UA Press list are trade books on the Southwest borderlands, including accounts by scholars and professional writers of the natural history, geography, history, folklore, and life-ways of the region. The UA Press does not publish children's books or volumes of original fiction or verse.

The University of Arizona Press invites inquiries from the authors of works—whether scholarly books or works of general interest—that are appropriate to its list.

Also appearing under the press imprint is the historical quarterly Journal of the Southwest, whose separate editorial and subscription office is in the UA Main Library.

The WATER RESOURCES RESEARCH CENTER (1965), an interdisciplinary organization is primarily devoted to assistance to water-related research activities at the three state universities. This assistance is in the form of federal Water Resources Research Act funds for research on water-related issues, providing access to water data and publications, bringing water research findings to the attention of potential users, and facilitating interdisciplinary research. The center is also responsible for the dissemination of results of water-related research in the state.
The University of Arizona Alumni Association

The University of Arizona Alumni Association was organized June 2, 1897. It is incorporated under Arizona state law and operates in accordance with the Articles of Incorporation and By-Laws adopted by the membership in open meeting at Homecoming October 27, 1956, and amended October 20, 1981.

MEMBERSHIP—All persons who have received a degree from the University of Arizona or former students who have completed at least 30 units are members of the Alumni Association and receive all of the publications and services afforded by the association.

In 1982 the Alumni Association initiated the Endowed Membership Program. An endowed membership costs $1,000 for an individual or $1,500 per couple. The principal of the endowment will remain intact and only the interest will be used toward essential Alumni Association programs. Purchase of an endowed membership is not required for the former student to receive the services afforded by the Alumni Association.

OBJECTIVES—The objectives of the Alumni Association generally are to promote the interest and welfare of the State of Arizona and the cause of education. More specifically they are "to promote the objectives of the University of Arizona, Tucson, Arizona, through the establishment and maintenance of contact between the University, its graduates and its students—present, former, prospective, and otherwise." The Association operates as a liaison between the University and former students. It is the former student's immediate and direct contact with his or her alma mater. Its basic motivating principle is service, both to the former student and the University. Because of the large number of alumni in Phoenix and southern California, offices are maintained in both geographic areas.

STRUCTURE—The Alumni Association is guided by a board of directors. Vacancies on the board are filled through a general election held each summer and by appointment by the president. The activities of the association are managed by a full-time Director of Alumni responsible to the board of directors and a staff of 18. The director manages the central alumni office on campus, the Phoenix office, and an office in southern California. The campus office, headquarters for all alumni activities, houses computerized record files of more than 280,000 graduates and former students.

ACTIVITIES—The Alumni Association fosters the involvement of alumni with their alma mater in several ways:

Clubs—There are active University of Arizona alumni clubs in 30 cities throughout the United States, with immediate plans to organize in an additional 14 cities. The clubs assist the University in its student recruitment efforts, raise funds for and award scholarships, and support university events in their cities. The Alumni Office provides speakers from campus, video tapes, and films for club meetings, as well as mailing event notices. Students and former students may obtain information about the club in their home area from the Alumni Office.

Councils—Of the 11 colleges within the University of Arizona, 9 have organized alumni councils, which serve to strengthen the ties between the college's students, its faculty, and its alumni. The councils provide service both to the community and to the college.

Homecoming and Reunions—Alumni are encouraged to return to the University to interact with other alumni and students and to view the progress of their alma mater.

Travel—The Association sponsors an international travel program designed to meet educational objectives of alumni, while generating revenue for the Alumni Office.

Awards and Recognition—Each year alumni are honored for outstanding service to the University and/or for outstanding personal achievement.

Publications—The Alumni Office publishes the Arizona Alumnus, the official publication of the Alumni Association. Published two times a year, it is sent to all members. This publication represents the most immediate contact for alumni with university programs and progress, with
news of former classmates, all alumni activities, and news about the University and its faculty and staff. An alumni club newsletter is published quarterly and the association also produces a weekly radio program and monthly T.V. show.

The Alumni Association, recognizing the need to inform current students about the mission of the association, sponsors a student alumni organization. The objective of the organization is to involve current students in alumni activities, thereby promoting the concept of a lifelong commitment to the University through Alumni Association programs.

All students and alumni are invited to visit the alumni office in the Slonaker Alumni building. Their opinions, suggestions and needs will receive full attention. The association will move to new headquarters at Speedway and Cherry Street in the spring of 1988.
The University of Arizona Foundation

Every institution of higher learning, whether supported by public or by private funds, needs a group of friends who have a special interest in its welfare. The need is great and the opportunities are many for contributions of private funds to improve and develop educational and research programs outside the limited scope of state funds and tuition income.

In Arizona and elsewhere many people, aware of these needs, are assisting the University of Arizona. In order to unite these efforts, the University of Arizona Foundation was established in 1958 as a private, nonprofit corporation intimately associated with the University. The foundation is governed by a board of directors. Membership in the foundation is dependent upon becoming a member of the Presidents Club.

The Presidents Club came into being in 1967 to recognize the generosity of especially dedicated donors and to provide the framework for substantial and continuing support. Membership in the Presidents Club is by invitation only, and nominees may become eligible with a gift of $10,000 or more in a variety of other ways involving deferred gifts, including bequests.

The principal objectives of the foundation and the Presidents Club are:

1. To acquaint its members and the public with programs, plans, and needs of the University, and
2. To attract gifts and bequests to the foundation which may be directed into the University's activities as advantageously as possible.

Monthly luncheons are held where members of the University faculty and administration discuss topics of concern and interest to the University and to foundation members.

The foundation assists prospective donors and testators in planning trust and will arrangements for the foundation. The foundation invests, manages and controls the gifts in accordance with the terms of the trust instruments and deeds of gift. This united effort of friends of the University is helping to meet the changing requirements of education and to enrich higher education for the ultimate benefit of the people of Arizona.

THE UNIVERSITY OF ARIZONA FOUNDATION

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Marcia Grand .................................................. Vice President
Humberto S. Lopez ............................................ Treasurer
Jamie Matanovich .......................................... Secretary
Richard F. Imwalle ........................................ Executive Vice President

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APPOINTED

JOSEPH P. MIKITISH ............................................................ May, 1988
RALPH WATKINS, JR. ............................................................. January, 1988
TIO A. TACHIAS ...................................................................... January, 1988
DONALD G. SHROPSHIRE, President Elect ............................... January, 1990
A. JACK PFISTER, LL.B., President .......................................... January, 1990
EDITH S. AUSLANDER, M.A., Treasurer ..................................... January, 1992
HERMAN CHANEN, Secretary .................................................. January, 1992
DONALD PITT, J.D. ................................................................. January, 1994
ESTHER N. CAPIN, M.Ed. ....................................................... January, 1994
ADMINISTRATIVE OFFICERS

(Year of first University appointment in parentheses after each name)

HENRY KOFFLER (1982) .................................................. President of the University
B.S., 1943, University of Arizona; M.S., 1944, Ph.D., 1947, University of Wisconsin; D.Sc., 1977, Purdue University.

RICHARD A. HARVILL (1934) ........................................... President Emeritus of the University

NILS HASSELMO (1983), Senior Vice President for Academic Affairs and Provost; B.A., 1957, Augustana College; Ph.D., 1961, Harvard University.

BEN J. TUCHI (1985), Senior Vice President for Administration and Finance; B.S., 1959, M.S., 1962, Pennsylvania State University; Ph.D., 1970, St. Louis University.

LAUREL L. WILKENING (1973) Vice President for Research; Dean of the Graduate College; B.A., 1966, Reed College; Ph.D., 1970, University of California at San Diego.


BARTLEY P. CARDON (1980), Dean, College of Agriculture; B.S., 1939, M.S., 1940, University of Arizona; Ph.D., 1946, University of California at Berkeley.

JACK R. COLE (1957), Dean, College of Pharmacy; B.S., 1953, University of Arizona; Ph.D., 1957, University of Minnesota.


WILLIS R. BREWER (1949), Dean Emeritus, College of Pharmacy; Director, Med-Start Program; B.S., 1942, South Dakota State College; Ph.D., 1948, Ohio State University.

BARTLEY P. CARDON (1980), Dean, College of Agriculture; B.S., 1939, M.S., 1940, University of Arizona; Ph.D., 1946, University of California at Berkeley.

PETER W. CULICOVER (1984), Acting Dean of the Faculty of Social and Behavioral Sciences, College of Arts and Sciences; B.A., 1966, City College of New York; Ph.D., 1971, Massachusetts Institute of Technology.


RONALD GOURLEY (1978), Dean, College of Architecture; B.Arch., 1943, University of Minnesota; M.Arch., 1948, Harvard University.

ROBERT LESLIE HULL (1964), Dean Emeritus of the College of Fine Arts; Professor Emeritus of Music, B.Mus., 1939, M.Mus., 1941, University of Rochester; Ph.D., 1945, Cornell University.

DONALD J. IRVING (1982), Dean of the Faculty of Fine Arts, College of Arts and Sciences; B.S., 1955, Massachusetts College of Art; M.A., 1956, Ed.D., 1963, Columbia University.

LOUIS J. KETTEL (1968), Dean, College of Medicine; B.S., 1951, Purdue University; M.D., 1954, M.S., 1958, Northwestern University.

RICHARD P. KINKADE (1965-71; 1982), Dean of the Faculty of Humanities, College of Arts and Sciences; B.A., 1960, Ph.D., 1965, Yale University.

PAUL MARCUS (1963), Dean, College of Law; A.B., 1968, J.D., 1971, University of California at Los Angeles.

EDGAR J. McCULLOUGH, JR. (1957), Dean of the Faculty of Science, College of Arts and Sciences; A.B., 1953, M.S., 1955, West Virginia University; Ph.D., 1963, University of Arizona.

DARREL S. METCALFE (1958), Dean Emeritus, College of Agriculture, B.S., 1940, University of Wisconsin; M.S., 1942, Kansas State College; Ph.D., 1950, Iowa State College.

HAROLD E. MYERS (1956), Dean Emeritus, College of Agriculture; B.S., 1928, Kansas State University; M.S., 1929, University of Illinois; Ph.D., 1937, University of Missouri.

J. CLAIRE PARSONS (1987), Dean, College of Nursing, B.S., 1954, Northwestern State College; M.S., 1964, University of Houston; M.S.N., 1986, University of Virginia; Ph.D., 1968, University of Texas.

F. ROBERT PAULSEN (1964), Dean Emeritus, College of Education; B.S., 1947, Utah State University; M.S., 1949, Ed.D., 1956, University of Utah.

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<td>University Library/Science-Engineering-Oriental Studies</td>
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<td>Yuma Hall C2</td>
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</table>
Mailing Address:

The University of Arizona
Tucson, Arizona 85721

For Further Information On:

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Summer Session
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