

College of Liberal Arts and Sciences

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Dean

PURPOSE

Like all major research universities, Arizona State University provides the means for its undergraduates to acquire a liberal education, an education that broadens students' understanding in the major areas of human knowledge while providing students with in-depth knowledge in their chosen areas of focus. While the professional schools and colleges can and do provide for important dimensions of a liberal education, the central academic setting for accomplishing this basic university purpose is the College of Liberal Arts and Sciences. The college provides a particularly rich and varied set of opportunities for students to gain the kind of liberal education that helps to prepare them for a lifetime of continued learning and application of knowledge in a diverse and ever-changing world.

Much of the ASU faculty's discovery and dissemination of knowledge occurs in the college. Because of the wide range of subjects it offers in the humanities, the natural sciences and mathematics, and the social and behavioral sciences, the college provides instruction in a number of core areas for undergraduate students from all of the other colleges. Students with majors in business, education, engineering, nursing, and other professional colleges rely on the College of Liberal Arts and Sciences for basic foundation courses. The college also offers the majority of courses meeting the university general studies requirements.

The college initiated and continues to participate actively with the University Honors College. It also offers advisement to undergraduates who are working out their undergraduate programs, planning for graduate studies, or preparing to enter professional careers such as law and medicine.

ORGANIZATION

The College of Liberal Arts and Sciences consists of 22 academic departments, several interdisciplinary programs, six centers, and several research institutes and laboratories. The college offers 33 programs leading to a bachelor's degree, 27 programs leading to a master's degree, 18 programs leading to a doctoral degree, and interdisciplinary graduate programs in cooperation with other colleges.

ADMISSION

Any entering ASU student who has met the minimum university entrance requirements can be admitted to the College of Liberal Arts and Sciences. Students with fewer than 50 earned hours of credit can, if they wish, be admitted as "no preference" students. Students with 50 or more hours must declare a major to be accepted into the college.

Any student with a cumulative GPA of at least 2.00 who is currently registered (in good standing) in another college at ASU and who wishes to major in a subject offered by the College of Liberal Arts and Sciences and to follow a program of study in the major may transfer into the college by making application and being initially advised in the Office for Academic Programs, SS 111. Students admitted from other ASU colleges are under mandatory advisement during the first semester and must take courses leading directly to a degree in the College of Liberal Arts and Sciences. Failure to follow mandated advice on course selection can result in enrollment and registration problems, including cancellation and holds.

Transfer Students. The university standards for evaluation of transfer credit are listed on page 34. Transfer students are urged to contact the relevant academic department or the Office for Academic Programs, SS 111, to ensure a smooth transition to the College of Liberal Arts and Sciences. Students who have transferred courses from institutions other than Arizona community colleges must have their transcripts evaluated by an advisor in SS 111; students who have attended only Arizona community colleges have evaluations done in the department of the major.

Courses transferred from two-year (community) colleges are accepted as lower-division credit only. Students are urged to choose their community college courses carefully, in view of the fact that a minimum of 50 semester hours of work taken at the university must be upper-division credit (see page 35).

"Undecided" or "Undeclared" Majors. Students in the College of Liberal Arts and Sciences are not required to select a major upon entering the college as freshmen or at any time thereafter until the semester in which 60 semester

hours are earned. Until such students have chosen a major, they are advised through the University Academic Advising Center. It is important to consult an academic advisor before any enrollment activity. Before or during the semester in which they earn 60 semester hours, students must select their major and transfer into the appropriate department. *Note:* Students who wish to enter a program of study that has a rigidly structured curriculum should be aware that delay in choosing a major initially could result in added time and cost in the completion of requirements.

ADVISEMENT

All students are urged to seek advising in the appropriate college unit before registration. Students must follow the calendar published in the *Schedule of Classes* for each semester for information regarding enrollment, adding/dropping classes, and withdrawals.

Regular Advisement. All students are strongly urged to seek advisement in the appropriate college unit before registration. Students must follow the calendar published in the *Schedule of Classes* for each semester when conducting registration transactions such as enrollment, adding/dropping classes, and withdrawals.

Advising Locations. College of Liberal Arts and Sciences students should seek routine advisement in the following locations:

Student	Advisement Location
Declared majors	Department of major
No preference	University Academic Advising Center (call 602/965-4464.)
No preference, pre-medical	Call 602/965-2365.
No preference, pre-law	SS 111

The Office for Academic Programs, located in SS 111, is the central resource center for academic information in the college. Requests from students, departmental advisors, and faculty for clarification of rules, procedures, and advising needs of the college and university should be directed to that office.

Mandatory Advisement. The following categories of Liberal Arts and Sciences students *must* receive advisement and *must* be cleared on the Mandatory Advisement Computer System (MACS) before their classes may be scheduled:

1. students in their first semester at ASU;
2. students on probation;
3. students with less than a 2.00 cumulative GPA;
4. students who have admissions deficiencies;
5. other students with “special admissions” status; and
6. students who have been disqualified (these students are allowed to attend ASU summer sessions only and must be advised in the Office for Academic Programs, SS 111).

Students in the above mandatory advisement categories should consult an advisor in the appropriate location listed in the previous section. Additionally, the University Academic Advising Center, Matthews Center, has been assigned the task of monitoring all students in the College of Liberal Arts and Sciences who have admissions de-

ficiencies. All students with admissions deficiencies must check with the University Academic Advising Center, regardless of where they receive regular advisement, to verify that the courses they are taking will eliminate their deficiencies.

Advisement for Preprofessional Programs. Special advisement is available for students planning to enter the fields listed in the “Advisement for Preprofessional Programs” table. The professional programs shown in the table are not majors in themselves; that is, there are no majors called “pre-medical,” “pre-law,” etc. In each program, the student must eventually select an established major in the College of Liberal Arts and Sciences or in one of the other colleges.

DEGREES

Majors. Programs leading to the B.A. and B.S. degrees are offered by the College of Liberal Arts and Sciences, with majors in the subjects listed in the “College of Liberal Arts and Sciences Degrees, Majors, and Concentrations” table, pages 84–86. Each major is administered by the academic department indicated.

Advisement for Preprofessional Programs

Professional Field	Office Where Advisor Is Located
Dentistry*	Pre-Health Professions
Foreign service	Department of chosen major
Health physics	Pre-Health Professions
Law	Office for Academic Programs, SS 111
Medicine*	Pre-Health Professions
Ministry	Department of Religious Studies
Occupational therapy*	Pre-Health Professions
Optometry*	Pre-Health Professions
Osteopathy*	Pre-Health Professions
Pharmacy*	Pre-Health Professions
Physical therapy*	Pre-Health Professions
Podiatry*	Pre-Health Professions

* Students preparing for a career in these areas should register with the secretary in the Pre-Health Professions Office. Phone 602/965-2365 for the new location of the office. No school in the State of Arizona offers a program in dentistry, occupational therapy, optometry, osteopathy, or podiatry. Students interested in pursuing these professions should confer with the pre-health professions advisor concerning out-of-state schools where they may complete their training.

College of Liberal Arts and Sciences Degrees, Majors, and Concentrations

Major	Degree	Administered by
Baccalaureate Degrees		
Anthropology	B.A.	Department of Anthropology
Emphasis: Latin American studies		
Asian Languages (Chinese/Japanese)	B.A.	Department of Languages and Literatures
Biology	B.S.	Departments of Botany and Zoology
Botany	B.S.	Department of Botany
Concentrations: plant biochemistry and molecular biology, systematics and ecology, urban horticulture		
Chemistry	B.A.	Department of Chemistry and Biochemistry
Chemistry	B.S.	Department of Chemistry and Biochemistry
Emphasis: biochemistry		
Clinical Laboratory Sciences	B.S.	Department of Microbiology
Computer Science	B.S. ¹	Department of Computer Science and Engineering
Economics	B.A., B.S. ²	Department of Economics
Emphasis: Latin American studies		
English	B.A.	Department of English
Exercise Science/Physical Education	B.S.	Department of Exercise Science and Physical Education
Concentrations: exercise and sport studies, exercise and wellness		
Family Resources and Human Development	B.A., B.S.	Department of Family Resources and Human Development
Concentrations: family resources and human development in business, family studies/child development, human nutrition-dietetics		
French	B.A.	Department of Languages and Literatures
Geography	B.A., B.S.	Department of Geography
Emphases: Asian studies, Latin American studies, meteorology-climatology, urban studies		
Geology	B.S.	Department of Geology
German	B.A.	Department of Languages and Literatures
History	B.A., B.S.	Department of History
Emphases: Asian studies, Latin American studies		
Humanities	B.A.	Interdisciplinary Humanities Program
Interdisciplinary Studies	B.A., B.S.	College of Liberal Arts and Sciences
Italian	B.A.	Department of Languages and Literatures
Mathematics	B.A.	Department of Mathematics
Mathematics	B.S.	Department of Mathematics
Options: applied mathematics, computational mathematics, general mathematics, pure mathematics, statistics and probability		
Microbiology	B.S.	Department of Microbiology
Philosophy	B.A.	Department of Philosophy
Physics	B.S.	Department of Physics and Astronomy
Emphasis: astronomy		
Options: I, II		
Political Science	B.A., B.S.	Department of Political Science
Emphases: Asian studies, Latin American studies		
Psychology	B.A., B.S.	Department of Psychology
Religious Studies	B.A.	Department of Religious Studies

¹ The Department of Computer Science and Engineering is located administratively in the College of Engineering and Applied Sciences. The B.S. degree in Computer Science is offered by both the College of Liberal Arts and Sciences and the College of Engineering and Applied Sciences. Requirements differ according to college (see page 103 and pages 258–261).

² The Department of Economics is located administratively in the College of Business. The baccalaureate degree in Economics is offered by both the College of Liberal Arts and Sciences and the College of Business. Requirements differ according to college (see page 103 and pages 194–195).

³ This program is administered by the Graduate College. See the “Graduate College” section of this catalog.

⁴ The major has only one formalized concentration; other areas of study are available.

Major	Degree	Administered by
Russian	B.A.	Department of Languages and Literatures
Sociology	B.A.	Department of Sociology
Emphasis: public safety		
Spanish	B.A.	Department of Languages and Literatures
Emphases: Latin American studies, Mexican American studies		
Speech and Hearing Science	B.S.	Department of Speech and Hearing Science
Wildlife Conservation Biology	B.S.	Department of Zoology
Options: aquatic, terrestrial		
Women's Studies	B.A., B.S.	Women's Studies Program
Zoology	B.S.	Department of Zoology
Graduate Degrees		
Anthropology	M.A.	Department of Anthropology
Concentrations: archaeology, bioarchaeology, linguistics, museum studies, physical anthropology, social-cultural anthropology		
Anthropology	Ph.D.	Department of Anthropology
Concentrations: archaeology, physical anthropology, social-cultural anthropology		
Biological Sciences	M.S.	Departments of Botany, Microbiology, and Zoology
Botany ⁴	M.S., Ph.D.	Department of Botany
Concentration: ecology		
Chemistry	M.S., Ph.D.	Department of Chemistry and Biochemistry
Concentrations: analytical chemistry, biochemistry, geochemistry, inorganic chemistry, organic chemistry, physical chemistry, solid state chemistry		
Communication Disorders	M.S.	Department of Speech and Hearing Science
Creative Writing	M.F.A. ³	Creative Writing Committee
English	M.A.	Department of English
Concentrations: comparative literature, English linguistics, literature and language, rhetoric and composition		
English	Ph.D.	Department of English
Exercise Science	Ph.D. ³	Committee on Exercise Science
Concentrations: biomechanics, motor behavior/sport psychology, physiology of exercise		
Exercise Science/Physical Education	M.S.	Department of Exercise Science and Physical Education
Family Resources and Human Development	M.S.	Family Resources and Human Development
Concentrations: family studies, general family resources and human development		
French	M.A.	Department of Languages and Literatures
Concentrations: comparative literature, language and culture, literature		
Geography	M.A., Ph.D.	Department of Geography
Geology	M.S., Ph.D.	Department of Geology
German	M.A.	Department of Languages and Literatures
Concentrations: comparative literature, language and culture, literature		

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Major	Degree	Administered by
History Concentrations: Asian history, British history, European history, Latin American history, public history, U.S. history, U.S. Western history	M.A.	Department of History
History Concentrations: Asian history, British history, European history, Latin American history, U.S. history	Ph.D.	Department of History
Humanities	M.A. ³	Graduate Committee on Humanities
Mathematics	M.A., Ph.D.	Department of Mathematics
Microbiology	M.S., Ph.D.	Department of Microbiology
Molecular and Cellular Biology	M.S., Ph.D.	Interdisciplinary Committee on Molecular and Cellular Biology
Natural Science Concentrations: botany chemistry communication disorders geology mathematics microbiology physics zoology	M.N.S.	Department of Botany Department of Chemistry and Biochemistry Department of Speech and Hearing Science Department of Geology Department of Mathematics Department of Microbiology Department of Physics and Astronomy Department of Zoology
Philosophy	M.A.	Department of Philosophy
Physics	M.S., Ph. D.	Department of Physics and Astronomy
Political Science Concentrations: American politics, comparative politics, international relations, political theory	M.A., Ph.D.	Department of Political Science
Psychology Concentrations: clinical psychology, developmental psychology, environmental psychology, experimental psychology, physiological psychology, social psychology	Ph.D.	Department of Psychology
Religious Studies	M.A.	Department of Religious Studies
Science and Engineering of Materials	Ph.D. ³	Committee on the Science and Engineering of Materials
Sociology	M.A., Ph.D.	Department of Sociology
Spanish Concentrations: comparative literature, language and culture, linguistics, literature	M.A.	Department of Languages and Literatures
Spanish	Ph.D.	Department of Languages and Literatures
Speech and Hearing Science Concentrations: developmental neurolinguistic disorders, neuroauditory processes, neurogerontologic communication disorders	Ph.D. ³	Committee on Speech and Hearing Science
Statistics	M.S. ³	Committee on Statistics
Teaching English as a Second Language	M.TESL	Department of English
Zoology ⁴	M.S., Ph.D.	Department of Zoology

Concentration: ecology

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Minors. Although not required for graduation, special college-approved minors are available in most departments. Check department program descriptions for details. Minors offered by departments must have at least 18 hours of designated courses, including 12 hours of upper-division work. The college requires a grade of at least “C” in all upper-division courses in the minor. Some departments have stricter requirements. A minimum of six upper-division hours in the minor must be taken in residence (ASU Main).

University policies prohibit the “double-counting” of courses from the major in the minor. Specific questions concerning double-counting, as well as general questions about the approval processes for minors, should be taken up with an academic advisor in the department offering the minor or the CLAS Office for Academic Programs.

DEGREE REQUIREMENTS

Credit Requirement. All candidates for graduation in the B.A. and B.S. degree curricula are required to present at least 126 semester hours, of which at least 50 hours must consist of upper-division courses. A minimum ASU cumulative GPA of 2.00 is required for graduation.

Course Load. The normal course load is 15–16 semester hours. First-semester freshmen and entering transfer students are not permitted to register for more than 18 semester hours in the initial semester. Other students who wish to register for more than 18 hours must have a GPA of at least 3.00 and must file a petition in the Office for Academic Programs, SS 111, before registration. Any petition for an overload in excess of 21 hours must be presented to the Standards Committee of the college.

Foreign Language Requirement. The College of Liberal Arts and Sciences requires knowledge of one foreign language equivalent to the completion of two years’ study at the college level. For more information, see page 124.

UNIVERSITY GENERAL STUDIES REQUIREMENTS

A well-planned program of study enables students to complete university general studies requirements while fulfilling College of Liberal Arts and Sciences graduation requirements.

General studies courses are regularly reviewed. For specific requirements and to determine whether a course meets one or more general studies course credit requirements, see pages 50–71. General studies courses are also identified in the course descriptions according to the “Key to General Studies Credit Abbreviations,” page 52. College graduation requirements are more extensive than the university general studies requirements. Additional course work in the humanities, natural sciences and mathematics, and social and behavioral sciences is required. It is also important to note that the college classification of the humanities, natural sciences and mathematics, and social and behavioral sciences is, in some courses, different from that used in the university general studies.

COLLEGE GRADUATION REQUIREMENTS

To graduate from the College of Liberal Arts and Sciences, a student must satisfy separate requirements of three kinds in addition to the university general studies requirements: *proficiency requirements* indicate a minimal level of competence in written communication, quantitative reasoning, and foreign language; *major requirements* involve concentrated course work in one field; and *distribution requirements* ensure that the student is exposed to disciplines outside the major field.

I. Proficiency Requirements. Each student is required to demonstrate proficiency in First-Year Composition, a foreign language, and mathematics.

Each student must demonstrate proficiency by completing the courses specified below with a grade of “C” or better in each

course. Courses used to meet a proficiency requirement may not ordinarily be used to satisfy the distribution requirement; the two exceptions are specified under III.A and III.B.

- A. First-Year Composition
 1. ENG 101 and 102 or
 2. ENG 105 or
 3. ENG 107 and 108 for foreign students.
- B. Foreign Language
 1. completion of foreign language course work at the intermediate level (202 or equivalent; see Department of Languages and Literatures listings for these equivalencies) or
 2. a foreign language course at the 300 level or above taught in the foreign language and having 202 or equivalent as a prerequisite or
 3. completion of secondary education at a school in which the language of instruction is not English.
- C. Mathematics
 1. MAT 114 or 117 or
 2. any higher-level MAT course.

II. Major Requirements. Each student is required to select a major from among the fields of study offered by the College of Liberal Arts and Sciences. The requirements for completion of the major are described under departmental listings.

- A. The major department may require up to 45 semester hours of course work. The minimum is 30 hours. A maximum of 18 additional hours may be required in related courses and prerequisites. No more than 63 semester hours of course work may be required to complete the major, related courses, and prerequisites. Some departments require calculus-level mathematics; up to five of these semester hours may be excluded from the 63-

hour maximum because they satisfy the mathematics proficiency requirement. A minimum of 12 upper-division hours in the major must be taken in residence (at ASU Main).

- B. No credit is granted toward fulfilling major or minor requirements in any upper-division course in that subject field unless the grade in that course is at least a "C." Normally a "Y" (satisfactory) grade needs confirmation that it is equivalent to a "C" or better.
- C. Major fields of study are classified into the following three divisions:
1. Humanities
 - Asian Languages
(Chinese/Japanese)
 - English
 - French
 - German
 - Humanities
 - Italian
 - Philosophy
 - Religious Studies
 - Russian
 - Spanish
 2. Natural Sciences and Mathematics
 - Biology
 - Botany
 - Chemistry
 - Clinical Laboratory Sciences
 - Computer Science
 - Geology
 - Mathematics
 - Microbiology
 - Physics
 - Wildlife Conservation
 - Biology
 - Zoology
 3. Social and Behavioral Sciences
 - Anthropology
 - Economics
 - Exercise Science/
Physical Education*
 - Family Resources
and Human
Development*
 - Geography
 - History
 - Political Science
 - Psychology
 - Sociology

Speech and Hearing
Science*
Women's Studies*

* Students majoring in these fields must satisfy the distribution requirements in all three divisions.

III. Distribution Requirements. The purpose of the distribution requirement is to ensure that the student is introduced to disciplines outside the division of the major. A list of major fields and their respective divisions is given under I.I.C.

Unless the major field carries an asterisk in I.I.C, students are considered to have fulfilled the distribution requirements in the division of the major.

Students majoring in Family Resources and Human Development, Exercise Science/Physical Education, Speech and Hearing Science, and Women's Studies must satisfy distribution requirements in social and behavioral sciences as well as in the other two divisions.

Students majoring in Anthropology, Geography, and Psychology may not use ASM courses in the case of Anthropology majors, GPH courses in the case of Geography majors, or PSY courses in the case of Psychology majors to satisfy the natural sciences and mathematics requirements.

A. Humanities (15 semester hours). Each student is required to complete five courses of at least three semester hours each. Course prefixes are identified below.

At least three of the five courses must be taken in the (CLAS) Departments of English, Languages and Literatures, Philosophy, and Religious Studies and the Interdisciplinary Humanities Program. Two of these three courses must be at the 300 level or above.

Note: Literature or "civilization" courses (300 level or above) taught in a foreign language may be used to satisfy the humanities distribution requirement, even if they are also used to demonstrate foreign language proficiency (see I.B).

Course prefixes for the humanities distribution requirement:

1. ENG (Department of English: any course except ENG 101, 102, 105, 107, 108, or their equivalents)
 2. CHI, FLA, FRE, GER, GRK, HEB, IDN, ITA, JPN, LAT, POR, RUS, SPA, THA (Department of Languages and Literatures: FLA 150 or any literature or "civilization" course at the 300 level or above)
 3. HUM (Interdisciplinary Humanities Program)
 4. PHI, HPS (Department of Philosophy)
 5. REL (Department of Religious Studies)
 6. APH (School of Architecture, College of Architecture and Environmental Design)
 7. ARS, DAH, MHL, MUS, THE (College of Fine Arts)
- B. Natural sciences and mathematics (14 semester hours)
1. Part A (eight semester hours). Two courses (either lecture courses with included laboratories or lecture courses with appropriate accompanying laboratories) to be taken in the Departments of Botany, Chemistry and Biochemistry, Geography (GPH 111, and 212 with 214 only), Geology, Microbiology, Physics and Astronomy, or Zoology. Laboratories need to meet for at least 30 hours per semester. See departmental listings.
 2. Part B (six semester hours). Two courses to be taken from the Departments of Anthropology (ASM only), Botany, Chemistry and Biochemistry, Computer Science and Engineering, Geography (GPH only), Geology, Mathematics, Microbiology, Physics and Astronomy, Psychology (PSY only), or Zoology. See departmental listings. Students who completed Part A using courses from only one department may

not use courses from that department in Part B. Biology courses are considered to be from the departments of both Botany and Zoology for the purposes of this restriction.

Note: Only mathematics courses for which MAT 117 or a higher-level mathematics course is a prerequisite may be used to satisfy natural sciences and mathematics distribution requirements. Mathematics courses for which MAT 117 is a prerequisite may be used to satisfy distribution requirements in natural sciences and mathematics, even if they were also used to demonstrate mathematics proficiency.

- C. Social and behavioral sciences (15 semester hours). Each student is required to complete five courses of at least three semester hours each.

Courses used to fulfill the social and behavioral sciences distribution requirement must be taken from no fewer than two but no more than three departments.

At least two courses must be at the 300 level or above.

Course prefixes for the social and behavioral sciences distribution requirement:

1. ASB (Department of Anthropology)
2. ECN (Department of Economics, College of Business)
3. GCU (Department of Geography)
4. HIS (Department of History)
5. POS (Department of Political Science)
6. PGS (Department of Psychology)
7. SOC (Department of Sociology)
8. WST (Women's Studies Program, only WST 100 or 300 but not both)

- IV. General Electives.** CLAS majors can meet all of the above requirements with fewer than the 126 hours of credit required for gradu-

ation. The remainder of their hours are general electives that may be selected from any of the departments of the College of Liberal Arts and Sciences and from the offerings of the other colleges.

Program of Study. The program of study, which is required by university regulations during the semester in which a student earns the 87th hour, must be filed and approved at least two weeks before the preregistration period for the subsequent semester. Students are expected to follow the approved program of study or to receive early college approval for proposed changes to the program of study. Students should contact the college graduation office, SS 111, regarding college graduation rules and deadlines. Deadlines for filing a program of study after enrolling in the 87th hour are March 1 and October 1 of each year. Students with 87 hours must have a college-approved program of study before registering for the next semester.

SPECIAL CREDIT OPTIONS

Pass/Fail Grade Option. The pass/fail grade option is intended to broaden the education of Liberal Arts and Sciences undergraduates by encouraging them to take advanced courses outside their specialization. A mark of "P" contributes to the student's earned hours but does not affect the GPA. A failing grade is computed into the GPA.

Only College of Liberal Arts and Sciences students with at least 60 semester hours may take courses under the pass/fail option. The option may be used under the following conditions:

1. enrollment for pass/fail needs the approval of the instructor and the college;
2. enrollment under this option must be indicated during registration and may not be changed after the late registration period; and
3. a maximum of 12 hours taken for pass/fail may be counted toward graduation.

Students may not enroll under the pass/fail option in the following courses:

1. those taken to satisfy the foreign language or English proficiency requirements;
2. those in the student's major or mi-

nor or certificate program;

3. those counted toward or required to supplement the major;
4. those counted as 499 Independent Study;
5. those taken for honors credits; or
6. those counted toward satisfying the proficiency and distribution requirements of the college or the university general studies requirements.

The above option is not available to College of Liberal Arts and Sciences students for courses offered by other colleges except for courses in economics offered by the College of Business.

Audit Grade Option. A student may choose to audit a course, in which case the student attends regularly scheduled class sessions but no credit is earned. The student should obtain the instructor's approval before registering for the course. For additional information see "Grading System," pages 45–48. *Note:* This grade option may not be changed after the late registration period.

Correspondence Study. Study by correspondence is not a normal part of a degree program; special circumstances must exist for a resident student to take correspondence courses. Any enrollment in correspondence courses must have prior approval of the college.

ACADEMIC STANDARDS

The standards for GPA and the terms of probation, disqualification, reinstatement, and appeal are identical to those of the university as set forth on page 49 of this catalog, except that the disqualified student in the College of Liberal Arts and Sciences is suspended for at least two regular semesters at the university. Students on probation normally have one semester in which to remove their probation. Students with cumulative GPAs of less than 2.00 who leave the university for a semester or more are not automatically readmitted. Such students, as well as all disqualified students, should contact the Office for Academic Programs, SS 111, regarding procedures and guidance for reinstatement and returning to good standing. By following recommendations and meeting established standards for summer school work or course work at other institutions, the possibility of successful reinstatement is en-

hanced.

Academic discipline is one of the functions of the Office for Academic Programs, SS 111. All students having academic difficulties of any kind should contact this office. Also available in this office is information on policies and procedures of the college on academic honesty, student grievances with respect to grades, and various petitions regarding college standards and graduation requirements.

Academic honesty is expected of all students in all examinations, papers, academic transactions, and records. The possible sanctions include but are not limited to appropriate grade penalties, loss of registration privileges, disqualification, and dismissal.

STUDENT RESPONSIBILITIES

Any student enrolling in courses offered by the College of Liberal Arts and Sciences is expected to follow the rules and deadlines specified in the *General Catalog* and the current *Schedule of Classes*. Students are urged to meet with their departmental academic advisors before registration. Students with additional questions or problems are also urged to meet with advisors in the college office, SS 111, regarding the academic rules of the college and the university.

SPECIAL PROGRAMS

University Honors College. The College of Liberal Arts and Sciences works closely with the University Honors College, which affords qualified undergraduates opportunities for enhanced educational experiences. For a complete description of the University Honors College requirements and opportunities, see the description on pages 79–81.

Interdisciplinary Studies. An Interdisciplinary Studies major leading to the B.A. or B.S. degree provides students of outstanding ability in the humanities, natural sciences and mathematics, and social and behavioral sciences opportunities to pursue courses of studies that cut across departmental boundaries and focus on specific topics or problem areas. Completion of 32 semester hours with a GPA of at least 3.25 and three letters of recommendation from ASU faculty members are required for admission. For more information about degree requirements, con-

tact the Office for Academic Programs in the College of Liberal Arts and Sciences, SS 111.

Washington Semester Program. Students have a variety of opportunities for practicum and internship experiences that enable them to meld classroom learning with practical application. Among the several individual departmental programs that provide internships for majors, the Department of Political Science is the ASU sponsor of the Washington Semester Program. The program provides students a one-semester opportunity to study in Washington, D.C., through any one of several programs sponsored by the American University. The program is available to outstanding juniors or seniors and requires careful planning with an academic advisor early in the student's career. Call the Department of Political Science, 602/965–6551, for more information.

Military Officer Training. The Departments of Aerospace Studies and Military Science offer programs leading to commissions in the armed forces, but they do not offer majors or minors. For further information, see the appropriate department descriptions in this catalog.

Certificate Programs and Areas of Emphasis

Asian Studies. An Asian Studies certificate is offered through the Center for Asian Studies and enables students to apply Asian emphasis courses toward an undergraduate degree from any college at ASU.

Students must complete two years (20 semester hours) of an Asian language plus 30 additional hours of Asian-area studies courses selected from core Asian studies courses or courses with a significant focus on Asia chosen in consultation with the Center for Asian Studies advisor. Students whose native language is an Asian language or who have otherwise mastered an Asian language may elect to take four additional Asian studies courses in place of the elementary and intermediate language classes. Language requirements may be selected from Chinese, Japanese, Vietnamese, Indonesian, and Thai.

An East Asian Studies certificate is also available. Students must complete two years (20 semester hours) of Chi-

nese or Japanese plus 30 additional semester hours of East Asian area studies courses selected from the core East Asian curriculum or course with a significant focus on East Asia chosen in consultation with the Center for Asian Studies director. Note that students whose native language is Chinese or Japanese or who have otherwise mastered these languages may elect to take four additional East Asian studies courses in place of the elementary and intermediate language courses.

The center houses a comprehensive library and is involved in student and faculty exchange programs with several Asian universities as well as serving as a liaison with various Asian organizations.

A Southeast Asian Studies certificate program is also available (see Southeast Asian Studies). For more information, contact the Center for Asian Studies, WHALL 109, 602/965–7184.

Health Physics. The curriculum of health physics involves work in the College of Liberal Arts and Sciences and the College of Engineering and Applied Sciences. The purpose of the concentration is to serve undergraduate students who wish to prepare themselves for careers in health physics. To qualify for professional status, a health physicist needs a B.S. degree in one of the physical or life sciences and a group of specialized courses in physics, mathematics, chemistry, engineering, and biology or zoology.

A Certificate of Concentration in Health Physics is awarded for the successful completion of a B.S. degree in a physical or life science that follows a prescribed program. Inquiries about the program should be addressed to the Pre-Health Professions Office, 602/965–2365, where academic advisement is available.

Jewish Studies. The Jewish studies program is designed with the following goals in mind:

1. to examine the history and culture of the Jews;
2. to provide a model for interdisciplinary teaching and research;
3. to generate and facilitate research on Judaica;
4. to provide the community with programs, courses, and research furthering the understanding of Judaica; and

5. to stand as an example of the university's commitment to a program of meaningful ethnic studies on a firm academic base.

The Certificate of Concentration in Jewish Studies may be combined with a major in any college. For information about the program, refer to the Department of History or the Department of Religious Studies or the chair of the Jewish Studies Committee listed in the current *Schedule of Classes*.

Latin American Studies. The Latin American area studies program is designed to give students an understanding of public affairs, culture, and national trends in Latin American nations and is offered as a combined degree program in cooperation with the Departments of Anthropology, Economics, Languages and Literatures, Geography, History, and Political Science and the College of Business. In this program, the students major in one of the cooperating departments, completing the degree requirements of that particular discipline. At least 30 upper-division semester hours of the total program must be in Latin American content courses, 15 hours in the major, and 15 hours in other disciplines. A reading knowledge of Spanish or Portuguese is required. Fulfillment of requirements is recognized on the transcript by a bachelor's degree in "(major)—Latin American Studies."

For more information, consult the Center for Latin American Studies, SS 213, 602/965-5127.

Museum Studies. The Department of Anthropology's program in museum studies is designed to prepare students for curatorial and associated positions in museums of anthropology, art, history, natural history, science, and related fields. Course offerings include the history and philosophy of museums, administration, collection management and conservation, exhibition design and preparation, public programming and interpretation, and computers in museums. The certificate is awarded to undergraduate, graduate, and unclassified students who successfully complete 12 hours of required course work plus a six-semester-hour internship at an approved museum. The certificate may be taken independently or in conjunction with the M.A. degree in Anthropology with a concentration in museum studies.

For more information, call the director of museum studies at 602/965-5266.

Russian and East European Studies.

Any undergraduate major can earn a Certificate in Russian and East European Studies by successfully completing one of the following options.

Option one requires three years of Russian or two years of Russian and one year of another East European language and 30 upper-division semester hours in Russian and/or East European course work. *Option two* requires two years of Russian and 36 upper-division hours in Russian and/or East European course work. Fulfillment of these requirements is recognized on the transcript by a bachelor's degree in "(Discipline)—Russian/East European Studies."

For more information, call the coordinator of the Russian and East European Consortium, in the Department of History at 602/965-5778.

Southeast Asian Studies. A Certificate in Southeast Asian Studies is awarded to any undergraduate student who elects an interdisciplinary focus in Southeast Asian studies while completing degree requirements in any discipline or professional program. The certificate program offers two options: (1) an area studies specialization emphasizing courses in the social sciences and humanities and requiring one year of Indonesian, Thai, or Vietnamese and (2) a language specialization requiring a two-year sequence in a Southeast Asian language and a proportional number of area studies courses. Students wishing to study a Southeast Asian language other than those offered on campus may transfer credits earned at the Southeast Asian Studies Summer Institute, a consortium for intensive language and area studies, or at other accredited programs. Qualified students may request placement testing on other national languages of the region, administered in accordance with the national ACTFL guidelines.

The ASU curriculum includes language instruction in Indonesian, Thai, or Vietnamese, ASB 240/GCU 240/HIS 240/POS 240/REL 240 Introduction to Southeast Asia, HIS 394 Modern Southeast Asian History, electives in the social sciences and humanities on the history, geography, culture, politics, and religion of the region, and a culmi-

nating capstone seminar in which the students share multidisciplinary approaches to the region and integrate knowledge of Southeast Asia with their respective disciplinary orientations.

Courses counting toward the Certificate in Southeast Asian Studies fulfill requirements for undergraduate majors and general studies in the social and behavioral sciences, humanities, literacy, and global and historical awareness areas. A two-year sequence in Southeast Asian language study meets the foreign language requirement for undergraduates in the College of Liberal Arts and Sciences.

The Program for Southeast Asian Studies is a federally funded National Resource Center for Southeast Asia. For more information, contact the Program for Southeast Asian Studies, LL C32, 602/965-4232.

Translation. See page 124 for information about the Certificate in Translation.

Women's Studies. The curriculum of women's studies involves courses from colleges throughout the university. The program is designed with the following goals in mind:

1. to examine the central issues of the quality and shape of women's lives;
2. to provide a model for interdisciplinary teaching and research;
3. to generate and facilitate research on women's experience;
4. to provide the university and the community with programs, courses, and research that acknowledge and expand the potential of women; and
5. to stand as a visible example of the university's commitment to change in the status of women.

A Certificate of Concentration in Women's Studies is awarded for the successful completion of either WST 100 or 300, 498, and an additional 15 semester hours from the list of approved women's studies courses, only six hours of which may also be applied toward the student's major.

Inquiries about the program should be addressed to the Women's Studies Program, SS 104, 602/965-2358, where the current list of approved courses is available.

GENERAL INFORMATION

103 Nature of U.S. Air Power. (2) S

Background on strategic missile defense forces, general purpose, and aerospace support forces in national defense.

104 Leadership Lab. (0) S

Continuation of AES 102 with more in-depth emphasis on learning the environment of an Air Force officer. Corequisite: AES 103.

201 Aerospace History to WWII. (2) F

Historical survey of events, trends, and policies leading to the emergence of air power through WW II.

202 Leadership Lab. (0) F

Application of advanced drill and ceremonies, issuing commands, knowing flag etiquette, and developing directing and evaluating skills to lead others. Corequisite: AES 201.

203 Aerospace History: WW II to Present. (2) S

Aerospace power from WW II to the present, emphasizing the impact of limited war and technology on roles and missions.

204 Leadership Lab. (0) S

Continuation of AES 202 with an emphasis on preparation for field training. Corequisite: AES 203.

301 U.S. Air Force Communication Management and Leadership. (3) F

The individual as a manager in the Air Force. Covers motivational and behavioral processes, leadership, communication, and group dynamics. *General studies: L2.*

302 Leadership Lab. (0) F

Advanced leadership experiences applying leadership and management principles to motivate and enhance the performance of other cadets. Corequisite: AES 301.

303 U.S. Air Force Management and Leadership. (3) S

Organizational and personal values, management of forces in change, organizational power, politics, managerial strategy, and tactics. *General studies: L2.*

304 Leadership Lab. (0) S

Continuation of AES 302 with emphasis on planning the military activities of the cadet corps and applying advanced leadership methods. Corequisite: AES 303.

401 National Security Institutional Policy and Strategy. (3) F

Emphasis on the broad range of American civil-military relations; the political, economic, and social constraints on the national defense. *General studies: L2.*

402 Leadership Lab. (0) F

Advanced leadership experience demonstrating learned skills in planning and controlling the military activities of the corps. Corequisite: AES 401.

403 Topical and Regional Security Issues. (3) S

Formulation and implementation of U.S. defense policies; impact of technological and international developments in the overall defense policymaking processes.

404 Leadership Lab. (0) S

Continuation of AES 402 with an emphasis on preparation for transition from civilian to military life. Corequisite: AES 403.

Omnibus Courses: See page 44 for omnibus courses that may be offered.

Anthropology

Charles L. Redman

Chair

(ANTH A124) 602/965-6213

REGENTS' PROFESSOR

TURNER

PROFESSORS

BAHR, CHANCE, CLARK, COWGILL, EDER, FOSTER, KOSS, MARTIN, MERBS, MORRIS, NASH, REDMAN, SCHOENWETTER, STARK, WILLIAMS

ASSOCIATE PROFESSORS

AGUILAR, ALVAREZ, BRANDT, CARR, FIRESTONE, HEDLUND, HUDAK, KINTIGH, MARZKE, RICE, SPIELMANN

ASSISTANT PROFESSORS

FALCONER, STEADMAN, WELSH

LECTURER

WINKELMAN

ACADEMIC PROFESSIONAL

BARTON

PROFESSORS EMERITI

DITTERT, GAINES, STEWART

ANTHROPOLOGY—B.A.

The program consists of 45 semester hours, of which 36 must be in anthropology and nine in related fields to be approved by the advisor in consultation with the student. Course requirements are distributed as follows:

1. ASB 102 and ASM 101;
2. six hours, including at least one course at the 300 level or above, in each of the following subfields: social-cultural anthropology, physical anthropology, and archaeology; and
3. three hours each in linguistics, an ethnographic area course, and an archaeological or physical anthropology area course.

Three of the nine hours in related fields must be in statistics. Each student's program of study must be approved by the advisor in consultation with the student. At least 18 semester hours must be in upper-division courses. For details see the departmental brochure. See "Foreign Language Requirement and Placement," page 124.

Latin American Studies Emphasis.

Students majoring in Anthropology may elect to pursue a Latin American Studies emphasis, combining courses from the major with selected outside courses of wholly Latin American content. See "Latin American Studies," page 91, for more information.

Minor in Anthropology

The Anthropology minor requires 18 semester hours. Two courses, ASB 102 and ASM 101, are required. The other 12 hours must be upper division and represent at least two of the three subfields of anthropology. For more information, consult the department office.

SECONDARY EDUCATION—B.A.E.

Social Studies. The major teaching field consists of 63 semester hours, of which 30 hours must be in the anthropology courses required for the B.A. degree. Of the remaining hours, two groups of 15 hours are to be taken in related social sciences. Psychology or a single natural science may be used as one of the 15-hour fields. SED 480 is taken to provide the remaining three hours.

Semester Hours

SED 480 Special Methods of Teaching Social Studies	3
Anthropology	30
Social sciences	15
Social sciences, natural sciences, or psychology	15
Total	63

The minor teaching field consists of 24 semester hours in anthropology. Courses ASB 102 and ASM 101 and two upper-division courses in each subdisciplinary field (archaeology, physical anthropology, and social-cultural anthropology) are required.

GRADUATE PROGRAM

The Department of Anthropology offers programs leading to the M.A. and Ph.D. degrees. Consult the *Graduate Catalog* for requirements.

ANTHROPOLOGY (ASM)

ASM 101 Human Origins and the Development of Culture. (3) F, S

Physical anthropology and archaeology. Evidence and processes of human evolution and of culture change. Primates. Fossil hominids and their tools. Race, variation, and heredity. Environment and human biology. Prehistoric culture and society. *General studies: SB.*

241 Biology of Race. (3) F, S

Human variation and its interpretation in an evolutionary context.

301 Peopling of the World. (3) S

Course reviews all evidence for human dispersal during the last 100,000 years, origins of language, cultures, races, and beginnings of modern humans. Prerequisite: ASM 101. *General studies:* SB, G.

338 Anthropological Field Session. (2–8) S

Anthropological field techniques, analysis of data, and preparation of field reports. May be repeated for credit. Prerequisite: instructor approval.

341 Human Osteology. (4) F

Osteology, human paleontology, and osteometry. Description and analysis of archaeological and contemporary human populations. 3 hours lecture, 3 hours lab. Prerequisite: ASM 101 or instructor approval.

342 Human Biological Variation. (4) S

Evolutionary interpretations of biological variation in living human populations, with emphasis on anthropological genetics and adaptation. Nutrition and disease and their relation to genetics and behavior. 3 hours lecture, 3 hours lab. Prerequisites: ASM 101 and MAT 106 (or equivalent) or instructor approval. *General studies:* S2.

343 Primatology. (3) F

Evolution and adaptations of nonhuman primates, emphasizing social behavior. Includes material from fossil evidence and field and laboratory studies in behavior and biology. Prerequisite: ASM 101 or instructor approval.

344 Fossil Hominids. (3) N

Ancient African, Asian, and European human and primate skeletal, dental, and cultural remains. Human biological, behavioral, and cultural evolution. Prerequisite: ASM 101 or instructor approval. *General studies:* SB.

345 Disease and Human Evolution. (3) F

Interaction of people and pathogens from prehistoric times to the present, with emphasis on disease as an agent of genetic selection. Prerequisite: ASM 101 or instructor approval. *General studies:* H.

346 Human Origins. (3) S

Humanity's place in nature; fossils; historic and recent concepts of human races; influence of culture on human evolution.

348 Social Issues in Human Genetics. (3) S

Moral and social implications of developments in genetic science, particularly as they affect reproduction, medicine, and evolution. *General studies:* SB.

365 Laboratory Methods in Archaeology. (4) N

Techniques of artifact analysis. Basic archaeological research techniques; methods of report writing. May be repeated for credit for total of 8 hours. Prerequisite: ASM 101 or instructor approval.

435 Archaeological Pollen Analysis. (3) F

Theory, methodology, and practice of pollen analytic techniques. Compares uses in botany, geology, and archaeology. 2 hours lecture, 3 hours lab, possible field trips. Prerequisite: instructor approval.

450 Bioarchaeology. (3) S

Surveys archaeological and physical anthropological methods and theories for evaluating skeletal and burial remains to reconstruct biocultural adaptation and lifeways. Prerequisite: ASM 101 or instructor approval.

452 Dental Anthropology. (4) F

Human and primate dental morphology, growth, evolution, and genetics. Within- and between-group variation. Dental pathology and behavioral-cultural-dietary factors. 3 hours lecture, 3 hours lab. Prerequisite: instructor approval. *General studies:* S2.

454 Comparative Primate Anatomy. (4) S

Functional anatomy of the cranial, dental, and locomotor apparatus of primates, including humans, emphasizing the relation of morphology to behavior and environment. Lectures, lab, dissections, demonstrations. 3 hours lecture, 3 hours lab. Prerequisite: instructor approval.

455 Primate Behavior Laboratory. (3) N

Instruction and practice in methods of observation and analysis of primate behavior. Discussion of the relationship between class work on captive animals and field techniques for studying free-ranging groups. Directed readings, 6 hours lab. Prerequisites: ASM 343; instructor approval. *General studies:* L2.

465 Quantification and Analysis for Anthropologists. (3) S

Statistical, quantitative, and geometric strategies for envisioning and exploring archaeological, physical anthropological, bioarchaeological, and sociocultural data. Univariate and multivariate methods. Prerequisites: introductory statistical course; instructor approval.

472 Archaeological Ceramics. (3) N

Analysis and identification of pottery wares, types, and varieties. Systems for ceramic classification and cultural interpretation. 2 hours lecture, 3 hours lab. Prerequisite: instructor approval.

548 Geoarchaeology. (3) F

Geologic context relevant to archaeological research. Topics include sediments, deposition environments, soils, anthropogenic and biogenic deposits, and Quaternary chronology. Prerequisite: instructor approval.

555 Advanced Human Osteology. (3) N

Laboratory and field techniques in dealing with the human skeleton. Emphasis on preparation, identification, radiography, sectioning, microscopy, and data processing. 1 hour lecture, 6 hours lab. Prerequisite: ASM 341 or instructor approval.

565 Quantitative Archaeology. (3) S

Formal methods of structuring, codifying, and analyzing data for archaeological problems. Designing research to yield data amenable to productive analysis.

566 Advanced Topics in Quantitative Archaeology. (3) F

Archaeological issues associated with quantitative analysis, e.g., Bayesian and Monte Carlo approaches, simulation, diversity. May be repeated for credit. Prerequisite: ASM 565 or instructor approval.

573 Lithic Analysis. (3) N

Analysis and interpretation of chipped stone artifacts. Focus on both techniques and underlying concepts and their application to real collections. Prerequisite: instructor approval.

591 Seminar. (3) N

Selected topics in archaeology and physical anthropology.

- (a) Physical Anthropology
- (b) Primates and Behavior
- (c) Bioarchaeology
- (d) Evolution and Culture
Cross-listed as ASB 591.
- (e) Interdepartmental Seminar
Cross-listed as ASB 591.

Omnibus Courses: See page 44 for omnibus courses that may be offered.

ANTHROPOLOGY (ASB)**ASB 102 Introduction to Cultural and Social Anthropology.** (3) F, S

Principles of cultural and social anthropology, with illustrative materials from a variety of cultures. The nature of culture. Social, political, and economic systems; religion, aesthetics, and language. *General studies:* SB, G.

202 Ethnic Relations in the United States. (3) F, S

Processes of intercultural relations; systems approach to history of U.S. interethnic relations; psychocultural analysis of contemporary U.S. ethnic relations. *General studies:* C, H.

210 Sex, Marriage, and Evolution. (3) F

Examination of the sexual nature and behavior of humans from both a biological and an anthropological point of view.

211 Women in Other Cultures. (3) N

Cross-cultural analysis of the economic, social, political, and religious factors that affect women's status in traditional and modern societies. *General studies:* G.

222 Buried Cities and Lost Tribes: Our Human Heritage. (3) S

Archaeology through its most important discoveries: human origins, Pompeii, King Tut, the Holy Land, Southwest Indians, and methods of field archaeology. *General studies:* HU.

231 Archaeological Field Methods. (4) S

Excavation of archaeological sites and recording and interpretation of data. Includes local field experience. 2 hours lecture, 8 hours lab. Prerequisite: ASM 101 or instructor approval. *General studies:* S2.

240 Introduction to Southeast Asia. (3) F

An interdisciplinary introduction to the cultures, religions, political systems, geography, and history of Southeast Asia. Cross-listed as GCU 240/HIS 240/POS 240/REL 240. *General studies:* G.

242 Asian American Experiences: An Anthropological Perspective. (3) F

The historical and contemporary experiences of Asian Americans in terms of the anthropological concepts of culture, ethnicity, and adaptation. *General studies:* L1, C.

250 Anthropology Topics. (3) S

Covers five areas of anthropological inquiry. Emphasizes library research, critical analysis, and communication skills relevant to upper-division anthropology course work. Prerequisites: ASB 102; ASM 101 or equivalent; completion of the First-Year Composition requirement. *General studies:* L1.

302 Ethnographic Field Study in Mexico. (3) SS

Fieldwork study of cultural adaptation, Mexican culture, United States-Mexican cultural conflict, ethnographic research methods, and local culture. Lecture, discussion, field research. Pre- or corequisite: Spanish 101 or equivalent.

311 Principles of Social Anthropology. (3) S

Comparative analysis of domestic groups and economic and political organizations in primitive and peasant societies. *General studies:* SB.

314 Comparative Religion. (3) F, S

Origins, elements, forms, and symbolism of religion; a comparative survey of religious beliefs and ceremonies; the place of religion in the total culture. Prerequisite: ASB 102 or instructor approval.

- 319 The North American Indian.** (3) A Archaeology, ethnology, and linguistic relationship of the Indians of North America. Does not include Middle America. Prerequisite: ASB 102 or instructor approval.
- 320 Indians of Arizona.** (3) F The traditional cultures and the development and nature of contemporary political, economic, and educational conditions among Arizona Indians.
- 321 Indians of the Southwest.** (3) S Cultures of the contemporary Indians of the Southwestern United States and their historic antecedents. Prerequisite: ASB 102 or instructor approval. *General studies:* L2, SB, H.
- 322 Indians of Mesoamerica.** (3) S Historic tribes and folk cultures. Prerequisite: ASB 102 or instructor approval. *General studies:* G.
- 324 Peoples of the Pacific.** (3) N Peoples and cultures of Oceania focusing particularly on societies of Melanesia, Micronesia, and Polynesia. Prerequisite: ASB 102 or instructor approval. *General studies:* G.
- 325 Peoples of Southeast Asia.** (3) F A cultural-ecological perspective on the peoples of mainland and insular Southeast Asia. Subsistence modes, social organization, and the impact of modernization. Prerequisite: ASB 102 or instructor approval. *General studies:* G.
- 330 Principles of Archaeology.** (3) F Prehistoric societies. Survey of dating methods, field techniques, and artifact inventories. Geographic, climatic, and geological relationships. *General studies:* SB.
- 333 New World Prehistory.** (3) F The variety of archaeological patterns encountered in the Western Hemisphere. Covers the period from the appearance of humans in the New World to European contact; covers the area from Alaska to Tierra del Fuego. Prerequisite: completion of the First-Year Composition requirement. Pre- or corequisite: 1 upper-division ASU course. *General studies:* L2, SB.
- 334 Arctic Anthropology.** (3) S Past and present Aleut-Eskimo prehistory, origins, physical features, adaptations, variation, and culture, with comparisons of Asian Arctic populations. Prerequisite: instructor approval. *General studies:* G.
- 335 Southwestern Anthropology.** (3) N Past cultures in the Southwest and their relation to present peoples using archaeological, ethnological, and linguistic evidences. Environmental and resource utilization from earliest times to the present. *General studies:* SB, C, H.
- 337 Pre-Hispanic Civilization of Middle America.** (3) S Pre-conquest cultures and civilizations of Mexico. The Aztecs, Mayas, and their predecessors. Prerequisite: ASM 101 or instructor approval. *General studies:* H.
- 338 Archaeology of North America.** (3) N Origin, spread, and development of the prehistoric Indians of North America up to the historic tribes. Does not include the Southwest. Prerequisite: ASM 101 or instructor approval.
- 350 Anthropology and Art.** (3) A Art forms of people in relationship to their social and cultural setting. Prerequisite: ASB 102 or instructor approval.
- 351 Psychological Anthropology.** (3) S Approaches to the interrelations between the personality system and the sociocultural environment. Prerequisite: ASB 102 or instructor approval. *General studies:* SB.
- 353 Death and Dying in Cross-Cultural Perspective.** (3) S Humanistic and scientific study of aging, sickness, dying, death, funerals, and grief and their philosophy and ecology in non-Western and Western cultures. *General studies:* HU, SB, G.
- 355 Shamanism, Healing and Consciousness.** (3) S World views, practices and roles of shamans and traditional and contemporary healers; explanatory biopsychological models of consciousness. *General studies:* HU, SB.
- 361 Old World Prehistory I.** (3) F Biosocial evolution in the Pleistocene, emphasizing technological achievements and the relationship between technology and environment in western Europe, sub-Saharan Africa. Prerequisite: ASM 101 or instructor approval. *General studies:* H.
- 362 Old World Prehistory II.** (3) S Transition from hunting and collecting societies to domestication economies; establishment of settled village life, emphasizing the Near East, Egypt, Southwest Europe. Prerequisite: ASM 101 or instructor approval. *General studies:* H.
- 383 Linguistic Theory: Phonetics and Phonology.** (4) F Basic articulatory phonetics and contemporary theories of the sound system of language. 3 hours lecture, 1 hour lab. *General studies:* SB.
- 400 Cultural Factors in International Business.** (3) S Anthropological perspectives on international business relations; applied principles of cross-cultural communication and management; regional approaches to culture and business. Cross-listed as IBS 400.
- 411 Kinship and Social Organization.** (3) S Meanings and uses of concepts referring to kinship, consanguinity, affinity, descent, alliance, and residence in the context of a survey of the varieties of social groups, marriage, rules, and kinship terminological systems. Prerequisite: 6 hours of anthropology or instructor approval.
- 412 History of Anthropology.** (3) F Historical treatment of the development of the culture concept and its expression in the chief theoretical trends in anthropology between 1860 and 1950. Prerequisite: ASB 102 or instructor approval. *General studies:* L2, SB.
- 416 Economic Anthropology.** (3) F Economic behavior and the economy in preindustrial societies; description and classification of exchange systems; relations between production, exchange systems, and other societal subsystems. Prerequisite: ASB 102 or instructor approval. *General studies:* L2, SB.
- 417 Political Anthropology.** (3) A Comparative examination of the forms and processes of political organization and activity in primitive, peasant, and complex societies. Prerequisite: ASB 102 or instructor approval.
- 426 Historical Archaeology.** (3) N Principles, techniques, and important sites. Use of ethnohistory, laboratory techniques, and artifact analysis. Discussion of value to historical understanding. Prerequisite: 1 course in archaeology or instructor approval.
- 462 Medical Anthropology: Culture and Health.** (3) F '94 Role of culture in health, illness, and curing; health status, provider relations, and indigenous healing practices in United States ethnic groups. Lecture, discussion. *General studies:* C.
- 471 Introduction to Museums.** (3) F History, philosophy, and current status of museums. Exploration of collecting, preservation, exhibition, education, and research activities in different types of museums. Prerequisites: ASB 102 and ASM 101 or instructor approval.
- 480 Introduction to Linguistics.** (3) F Descriptive and historical linguistics. Survey of theories of human language, emphasizing synchronic linguistics. *General studies:* SB.
- 481 Language and Culture.** (3) S Application of linguistic theories and findings to nonlinguistic aspects of culture; language change; psycholinguistics. Prerequisite: ASB 102 or instructor approval. *General studies:* SB.
- 483 Sociolinguistics and the Ethnography of Communication.** (3) N Relationships between linguistic and social categories; functional analysis of language use, maintenance, and diversity; interaction between verbal and nonverbal communication. Prerequisites: ASB 480 and ENG 213 (or FLA 400) or instructor approval. *General studies:* SB.
- 530 Ecological Anthropology.** (3) A Relations among the population dynamics, social organization, culture, and environment of human populations, with special emphasis on hunter-gatherers and extensive agriculturalists.
- 532 Graduate Field Anthropology.** (2-8) S Independent research on a specific anthropological problem to be selected by the student in consultation with the staff. May be repeated for credit. Prerequisites: ASM 338 or equivalent; instructor approval.
- 535 Public Archaeology.** (4) N Theoretical and practical applications of cultural resources legislation and policy. Legal and administrative requirements; conservation, development, and management of cultural resources; CRM research design formulation. Seminar, field work. Prerequisites: regular graduate student standing; 12 completed graduate hours in archaeology; instructor approval.
- 537 Topics in Mesoamerican Archaeology.** (3) N Changing organization of pre-Columbian civilizations in Mesoamerica is explored through interpretive issues, such as regional analysis, chiefdoms, urbanism, and exchange. Prerequisite: instructor approval.
- 540 Method and Theory of Sociocultural Anthropology and Archaeology I.** (3) F Basic issues concerning concepts of social and ethnic groups, cultural and sociological theory, and the nature of anthropological research. Prerequisite: instructor approval.

541 Method and Theory of Social and Cultural Anthropology. (3) S

Continuation of ASB 540. Prerequisite: ASB 540 or instructor approval.

542 Method and Theory of Archaeology II. (3) S

Models of human evolution, culture change and interpretation of hunter-gatherer and tribal societies, ceramic, lithic and faunal materials. Prerequisite: instructor approval.

543 Method and Theory of Archaeology III. (3) F

Covers concepts of social complexity along with economy, demography, and social dynamics, followed by archaeological research design. Prerequisite: instructor approval.

544 Settlement Patterns. (3) N

Spatial arrangement of residences, activity sites, and communities over landscape. Emphasis on natural and cultural factors influencing settlement patterns. Prerequisite: instructor approval.

546 Pleistocene Prehistory. (3) F

Development of society and culture in the Old World during the Pleistocene epoch, emphasizing technological change through time and the relationship of people to their environment. Prerequisite: ASB 361 or equivalent.

547 Issues in Old World Domestication Economies. (3) S

Archaeological evidence for transitions in Old World subsistence economies from hunting and gathering to dependence on domesticated plants and/or animals. Prerequisite: ASB 362 or equivalent.

550 Economic Archaeology. (3) N

Prehistoric economies in hunter-gatherer, tribal, and complex societies. Subsistence strategies, craft production and specialization, and exchange covered. Prerequisite: instructor approval.

551 Prehistoric Diet. (3) N

Includes (1) a critical review of techniques for recovering dietary information and (2) theoretical models concerned with explaining diet and nutrition. Prerequisite: instructor approval.

555 Complex Societies. (3) S

Structural variations in hierarchically organized societies, along with origins, dynamics, and collapse, are examined. Seminar.

559 Archaeology and the Ideational Realm. (3) N

"Post-processual" and other views concerning relevance of mental phenomena for understanding sociocultural change. Various approaches to inferring prehistoric meanings.

563 Hunter-Gatherer Adaptations. (3) N

Evolution of prehistoric hunter-gatherer societies in the Old and New Worlds from the most ancient times through protohistoric chiefdoms. Prerequisite: instructor approval.

567 Southwestern Archaeology. (3) S

Broad coverage of Southwestern cultural developments focusing on current debates and rigorous use of archaeological data in making cultural inferences.

568 Intrasite Research Strategies. (3) F

Research issues within a single site context. Topics include quantitative spatial analysis, site definition, sampling, distributional analysis, and substantive interpretation.

571 Museum Principles. (3) F

History, philosophy, and current status of museums. Exploration of collecting, preservation, exhibition, education, and research activities in different types of museums. Prerequisites: ASB 102 and ASM 101 or instructor approval.

572 Museum Collection Management. (3) S

Principles and practices of acquisition, documentation, care, and use of museum collections; registration, cataloging, and preservation methods; legal and ethical issues. Prerequisite: ASB 571 or instructor approval.

573 Museum Administration. (3) S

Formal organization and management of museums; governance; personnel matters; fund raising and grantsmanship; legal and ethical issues. Prerequisite: ASB 571 or instructor approval.

574 Exhibition Planning and Design. (3) S

Exhibition philosophies and development; processes of planning, designing, staging, installing, evaluating, and disassembling temporary and long-term exhibits. Prerequisites: ASB 571 and 572 or instructor approval.

575 Computers and Museums. (3) F

Basics of museum computer application; hardware and software; fundamentals of database management; issues of research, collections management, and administration.

576 Museum Interpretation. (3) F

Processes of planning, implementing, documenting, and evaluating educational programs in museums for varied audiences—children, adults, and special interest groups. Lecture, discussion. Prerequisite: ASB 571.

577 Principles of Conservation. (3) S

Preservation of museum objects: nature of materials, environmental controls, and causes of degradation; recognizing problems, damage, and solutions; proper care of objects. Prerequisites: ASB 571 and 572 or instructor approval.

582 Linguistic Theory: Syntax. (3) N

Contemporary theories of the grammatical structure of languages. Prerequisite: ASB 480 or FLA 400 or instructor approval.

585 Linguistic Theory: Phonological Systems. (3) F

Origins and development of contemporary phonological systems with particular attention to non-Western languages. Prerequisite: ASB 480 or FLA 400 or instructor approval.

591 Seminar. (3) N

Selected topics in archaeology, linguistics, and social-cultural anthropology.

- (a) Cultural Anthropology
 - (b) Social Anthropology
 - (c) Problems in Southwestern Ethnology
 - (d) Culture and Personality
 - (e) Linguistics
 - (f) Museum Studies
 - (g) Problems in Southwestern Archaeology
 - (h) Archaeology of North America
 - (i) Historical Archaeology
 - (j) Archaeological Ceramics
 - (k) Evolution and Culture
- Cross-listed as ASM 591.
- (l) Interdepartmental Seminar
- Cross-listed as ASM 591.

Omnibus Courses: See page 44 for omnibus courses that may be offered.

Biological Sciences

The following curricula are offered jointly by the Departments of Botany and Zoology. Students who elect one of these programs are advised by a member of one of the two departments.

BIOLOGY—B.S.

The major in Biology is offered jointly by the Departments of Botany and Zoology. Students are advised by a member of either department. This major serves students desiring a broader program in the biological sciences than that provided by the more specialized majors in the degree programs of the individual departments.

The major consists of 43 hours and 20 hours in supplementary areas, plus a mathematics proficiency. The required major courses, totaling 31 hours, are as follows: BIO 181, 182, 320, 340; BOT 300, 360 (or ZOL 360); MIC 206, 220; ZOL 350. The remaining 12 hours (upper-division) are to be selected so that the total major hours reflect a balance between the two departments. Required supplementary courses are as follows: CHM 113, 115; CHM 231 and 235 or the sequence CHM 331 and 332 and 335 and 336; CSE 181 or 183; MAT 210 or any calculus; PHY 101 or the sequence 111 and 112 and 113 and 114.

SECONDARY EDUCATION—B.A.E.

Biological Sciences. Offered jointly by the Departments of Botany and Zoology, the major teaching field consists of a minimum of 40 semester hours and at least 22 hours in supporting courses. Required major courses are as follows: BIO 181, 182, 320, 340, 445; BOT 300 (or 370 or ZOL 350 or 370), 360; MIC 206, 220; ZOL 360. The remaining courses in the major (six hours minimum) should be selected to reflect a balance between ZOL and BOT courses. Required supporting courses are as follows: CHM 113, 115; GLG 102 or 300; HPS 330 (or ZOL 316); MAT 118; PHY 101 or the sequence 111 and 112 and 113 and 114. BIO 480 is required in the professional education program.

The minor teaching field consists of 24 semester hours as follows: BIO 181, 182; 16 additional hours in BIO, BOT, MIC, and ZOL courses selected to reflect a balance across the disciplines and subdisciplines in biology. BIO 480 is required in addition to the 24 semester hours in biological sciences.

BIOLOGY

BIO 100 The Living World. (4) F, S

Principles of biology. Cannot be used for major credit in the biological sciences. 3 hours lecture, 3 hours lab. *General studies:* S1, S2.

181 General Biology. (4) F, S

Biological concepts emphasizing fundamental principles and the interplay of structure and function at the molecular, cellular, organismal, and population levels of organization. 3 hours lecture, 3 hours lab. For majors in biological sciences and preprofessional students in health-related sciences. Secondary school chemistry strongly recommended. *General studies:* S1 or S2.

182 General Biology. (4) F, S

Continuation of BIO 181. Secondary school chemistry strongly recommended. Prerequisite: BIO 181. *General studies:* S2.

217 Conservation Biology. (3) F

The scientific and technical means for management, protection, maintenance, and restoration of biological resources on this planet. Prerequisite: 8 hours of biology.

218 Medical History. (1) F

Brief survey of humankind's important inventions and discoveries in the art and science of medicine, illustrating interrelationships of medical ideas.

300 Natural History of Arizona. (3) F, S

Plant and animal communities of Arizona. Cannot be used for major credit in the biological sciences. Prerequisite: junior standing.

301 Field Natural History. (1) F, S

Organisms and their natural environment. 2 weekend field trips, field project. Cannot be used for major credit in the biological sciences. Pre- or corequisite: BIO 300.

310 Special Problems and Techniques. (1–3) F, S

Qualified undergraduates may investigate a specific biological problem under the direction of a faculty member. May be repeated for a total of 6 semester hours. Prerequisites: formal conference with the instructor; approval of the problem by the instructor and department chair.

320 Fundamentals of Ecology. (3) F, S

Organization, functioning, and development of ecological systems; energy flow; biogeochemical cycling; environmental relations; population dynamics. Prerequisite: BIO 182 or instructor approval.

321 Introductory Ecology Laboratory. (3) S Laboratory and field observations and experiments to test current concepts and theories in ecology. Lab. Pre- or corequisite: BIO 320.

330 Ecology and Conservation. (3) F

Ecological and biological concepts of conservation used to understand ecological problems caused by humans. Cannot be used for major credit in the biological sciences. *General studies:* G.

332 Cell Biology. (3) F

Survey of major topics in cell biology, including structural, biochemical, and molecular aspects of cell function. Prerequisite: BIO 182.

340 General Genetics. (4) F, S, SS

Science of heredity and variation. 3 hours lecture, 1 hour recitation. Prerequisite: BIO 182.

343 Genetic Engineering and Society. (3) F

Introduction to genetic engineering, with emphasis on applications (gene therapy, DNA fingerprinting, bioremediation transgenic animals and plants). Cannot be used for major credit in the biological sciences. Prerequisite: BIO 100 or equivalent.

410 Professional Values in Science. (2–3) A

Considers issues related to values in science such as collaboration, finances, legal issues, media, mentoring, ownership of ideas, scientific integrity. Discussion, student projects. Cross-listed as HPS 410.

415 Biometry. (4) F

Statistical methods applied to biological problems, design of experiments, estimation, significance, analysis of variance, regression, correlation, chi square, and bioassay; the use of computers. Does not satisfy laboratory requirements for the liberal arts General Studies Program. 3 hours lecture, 3 hours lab. Prerequisite: MAT 210 or equivalent. *General studies:* N2.

420 Computer Applications in Biology. (3) F

Computer analysis techniques in biology, emphasizing data entry, management and analysis, and graphic portrayal. Employs mainframe and microcomputers. Prerequisites: BIO 182 and MAT 117 and 118 or instructor approval. *General studies:* N3.

426 Limnology. (4) S

Structure and function of aquatic ecosystems, with emphasis on freshwater lakes and streams. 3 hours lecture, 3 hours lab or field trip. Prerequisite: BIO 320 or instructor approval. *General studies:* L2.

428 Biogeography. (3) F

Environmental and historical processes determining distributional patterns of animals and plants, emphasizing terrestrial life. Prerequisites: BIO 182 or equivalent; junior standing. *General studies:* L2.

430 Advanced Developmental Biology. (3) S

Current concepts and experimental methods involving differentiation and biosynthetic activities of cells and organisms, with examples from microorganisms, plants, and animals. Prerequisite: ZOL 330.

432 Biochemical Cytology. (3) S

Eukaryotic cell functions as affected by intracellular compartmentation. Emphasis on the application of electron microscopic analyses, cell fraction, and selected biochemical procedures. Prerequisites: BIO 332 or BOT 360 or ZOL 360 or equivalent; CHM 231 or 331 or equivalent.

441 Cytogenetics. (3) F '94

Chromosomal basis of inheritance. Prerequisite: BIO 340.

442 Cytogenetics Laboratory. (2) F '94

Microscopic analysis of meiosis, mitosis, and aberrant cell division. 6 hours lab. Pre- or corequisite: BIO 441.

443 Molecular Genetics. (3) F

Nature and function of the gene; emphasis on the molecular basis of inheritance and gene expression in prokaryotes and eukaryotes. Prerequisites: BIO 340; a course in organic chemistry.

445 Organic Evolution. (3) F

Processes of adaptive change and speciation in sexual populations. Prerequisite: BIO 340 or ZOL 241.

464 Photobiology. (3) F '94

Principles underlying the effects of light on growth, development, and behavior of plants, animals, and microorganisms. Prerequisites: CHM 231 or 331; 12 hours of courses in life sciences.

480 Methods of Teaching Biology. (3) S

Methods of instruction, experimentation, organization, and presentation of appropriate content in biology. Prerequisite: 20 hours in the biological sciences.

512 Transmission Electron Microscopy. (5) F

Theory, use, and methods of preparing biological materials for transmission electron microscopy. Materials fee. Lecture, lab. Prerequisite: instructor approval.

515 Scanning Electron Microscopy. (3) N

Theory, use, and methods of preparing biological materials for scanning electron microscopy. Materials fee. 2 hours lecture, 3 hours lab. Prerequisite: instructor approval.

520 Biology of the Desert. (2) N

Factors affecting plant and animal life in the desert regions and adaptations of the organisms to these factors. Prerequisite: 10 hours of biological sciences or instructor approval.

524 Ecosystems. (3) F '95

Structure and function of terrestrial and aquatic ecosystems, with emphasis on productivity, energetics, biogeochemical cycling, and systems integration. Prerequisite: BIO 320 or equivalent.

526 Quantitative Ecology. (3) N

Sampling strategies, spatial pattern analysis, species diversity, classification, and applications of multivariate techniques to ecology. 2 hours lecture, 3 hours lab. Prerequisites: BIO 415 or equivalent; 1 course in ecology.

529 Advanced Limnology. (3) N

Recent literature, developments, methods, and limnological theory; field and lab application to some particular topic in limnology. Prerequisite: BIO 426.

535 Biomembranes. (3) N

Structure and function of biological membranes, emphasizing synthesis, fluidity, exocytosis, endocytosis, and cell responses to hormones and neurotransmitters. Prerequisites: BIO 332 or equivalent; CHM 231 or 331 or equivalent.

Omnibus Courses: See page 44 for omnibus courses that may be offered.

Botany

J. Kenneth Hooper
Chair
 (LS E218) 602/965-3414

PROFESSORS

ARONSON, BACKHAUS, KLOPATEK,
 NASH, PATTEN, PINKAVA,
 SOMMERFELD, TRELEASE

ASSOCIATE PROFESSORS

CLARK, STUTZ, SZAREK,
 TOWILL, VERMAAS

ASSISTANT PROFESSORS

FRASCH, MARTIN, PIGG,
 ROBERSON, WEBBER

ACADEMIC PROFESSIONALS

BINGHAM, LANDRUM,
 LOBRUTTO, SHARP

PROFESSORS EMERITI

CANRIGHT, SWAFFORD

BOTANY—B.S.

The Department of Botany provides a broad and flexible curriculum for students interested in the plant sciences. After a minimal number of core courses, a specific program can be designed with a concentration in plant biochemistry and molecular biology, systematics and ecology, or urban horticulture, depending on the student's specific interests and career goals. The program prepares students for positions in education, industry, and technical fields, as well as advanced degree programs in the plant sciences.

The program of study consists of 63 hours in the major. All students are required to take the same 19 hours of courses from the core area. Courses within the three different areas of concentration account for 34 to 39 additional hours. The balance of the 63 hours is electives within the life sciences and related areas selected by the student through consultation with a faculty advisor.

The required courses for the botany core are as follows: BIO 181, 182, 320; BOT 350, 360.

Systematics and Ecology. Additional required courses for this concentration are as follows: BIO 340; BOT 370, 420, 499 (three hours). Also required

is *at least* one of the following: BOT 410, 434, 450. Required supplemental courses include CHM 113, 115, and those selected from one of the following two options:

1. CHM 331 and 335, 332 and 336; or
2. CHM 231 and 235, 361.

Courses meeting the college numeracy requirement are as follows: BIO 415 or 420; MAT 210.

Plant Biochemistry and Molecular Biology. Additional required courses for this concentration are as follows: BIO 332, 340, 432; BOT 494, 499 (three hours). Required supplemental courses include CHM 113, 115, 331, 332, 335, 336, 361 and 367.

Courses meeting the college numeracy requirement are as follows: BIO 415 or 420; MAT 210.

Urban Horticulture. Additional required courses for this concentration are as follows: BOT 231, 380, 381, 382, 485, 499 (three hours). Also required is *at least* one of the following: BOT 386, 388, 488. Required supplemental courses include those selected from one of the following three options:

1. CHM 101, 231 and 235; ERA 325, 326 (industry track);
2. CHM 113, 115, 231 and 235; ERA 325, 326 (graduate school track, applied or field research); or
3. CHM 113, 115, 331, 332, 335, 336; ERA 325, 326 (graduate school track, basic or laboratory research).

Courses meeting the college numeracy requirement are as follows: BIO 415 or 420 or ERA 350; MAT 117 and 118 *or* MAT 210.

GRADUATE PROGRAMS

The Department of Botany offers programs leading to the degrees of Master of Natural Science, Master of Science, and Doctor of Philosophy. Consult the *Graduate Catalog* for requirements.

The department participates in the new interdisciplinary program for the Master of Science and Doctor of Philosophy degrees in Molecular and Cellular Biology. See page 140 for courses. For more information, contact Dr. Douglas Chandler, LS C592, 602/965-5662.

BOTANY

BOT 108 Plants and Society. (4) F, S, SS
 The study of plants in relation to human affairs. Emphasis on edible, medicinal, and commercially significant plants, how they live and grow, and how mankind has applied knowledge to manipulate them. Not for majors in the biological sciences. 3 hours lecture, 3 hours lab. *General studies:* S1, S2.

231 Horticultural Science. (4) S
 Principles and practices of horticulture, emphasizing growth, development, and propagation of horticultural plants and environmental factors that affect these processes. 3 hours lecture, 3 hours lab. Prerequisite: BIO 182 or BOT 108. *General studies:* S2.

300 Survey of the Plant Kingdom. (4) F
 Systematic and evolutionary survey of the plant kingdom, emphasizing diversity of gross and cellular structure, reproduction, life cycles, and habitat. 3 hours lecture, 3 hours lab. Prerequisite: BIO 100 or 182 or BOT 108 or equivalent. *General studies:* S2.

301 Economic Botany. (3) F
 Plants and plant products used by people throughout the world, including their cultivation, processing, and uses in modern life. Fibers, medicinals, beverages, perfumes, and foods. Prerequisite: BIO 100 or equivalent.

350 Plant Anatomy. (4) F
 Development and mature structure of tissues of vascular plants; patterns and modifications of the leaf, stem, root, and the flower. 3 hours lecture, 3 hours lab. Prerequisite: BIO 182 or equivalent.

360 Plant Physiology. (4) S
 Plant growth and development, nutrition, water relations, reproduction, metabolism, and photosynthesis. 3 hours lecture, 3 hours lab. Prerequisites: BIO 182 or equivalent; CHM 101 or 115 or 231.

370 The Flora of Arizona. (4) S
 Principles of taxonomy; identification of Arizona plants. 2 hours lecture, 6 hours lab. Prerequisite: BIO 182 or equivalent or instructor approval.

380 Landscape Plants. (3) S
 Identification, culture, and use of plants in urban landscapes. Prerequisite: BOT 231 or equivalent.

381 Landscape Practices. (3) S '95
 Propagation, installation, and maintenance of landscape plants with an emphasis on integrated landscaping techniques. 2 hours lecture, 3 hours lab. Prerequisites: BIO 182 and BOT 231 *or* equivalents.

382 Urban Forestry. (3) F
 The establishment, care, and maintenance of ornamental trees, shrubs, and vines. Prerequisite: BOT 231 or equivalent.

386 Indoor Plants. (3) SS
 Identification, culture, and use of container-grown plants for interior environments. Prerequisite: BOT 231 or instructor approval.

388 Turf Management. (3) N
 Selection, establishment, and maintenance of turf grasses for lawn and sports areas. 2 hours lecture, 3 hours lab. Prerequisite: BOT 231 or equivalent.

410 Lichenology. (3) S '95
 Chemistry, ecology, physiology, and taxonomy of lichens. 2 hours lecture, 3 hours lab. Prerequisite: BIO 182 or equivalent.

420 Plant Ecology. (4) S

Plants in relation to environments, emphasizing terrestrial population, community and ecosystem processes. 3 hours lecture, 3 hours lab or field trip, 1 weekend field trip. Prerequisite: BIO 320 or equivalent.

425 Plant Geography. (3) N

Plant communities of the world and their interpretation, emphasizing North American plant associations. Prerequisite: BIO 182 or equivalent or instructor approval.

434 General Mycology. (3) S

Fundamentals of fungal morphology and systematics with an introduction to fungal cell biology, growth and development, ecology, and economic significance. 2 hours lecture, 3 hours lab. Prerequisite: BIO 182 or MIC 206 or equivalent.

445 Morphology of the Vascular Plants. (4) S '96

Comparative form and evolutionary trends in the major groups of vascular plants. 3 hours lecture, 3 hours lab. Prerequisite: BOT 300 or equivalent.

448 Palynology. (3) S

Significance of fossil and extant pollen, spores, and other palynomorphs to systematics, evolution, ecology, and stratigraphy. 2 hours lecture, 1 hour lab. Prerequisite: instructor approval.

450 Phycology. (4) S

The algae (both fresh water and marine forms), emphasizing field collection and identification of local representatives. Morphological, ecological, and economic aspects of the algae. 3 hours lecture, 3 hours lab. Prerequisite: BIO 182 or instructor approval.

461 Physiology of Lower Plants. (3) N

Cellular physiology and biochemistry of algae and fungi; responses of these organisms to chemical and physical stimuli and their process of morphogenesis. Prerequisites: BIO 182 or equivalent; CHM 231.

465 Plant Growth and Development. (3) F '95

Environmental factors affecting the adaptation, distribution, growth, and development of plants, with emphasis on cultivated species. Prerequisites: BIO 182; BOT 381; CHM 231.

470 Taxonomy of Southwestern Vascular Plants. (4) SS

Identification of the vascular plants of the Southwest and the principles underlying their classification. 3 hours lecture, 6 hours lab, 2 field trips. Not open to students who have had BOT 370.

475 Angiosperm Taxonomy. (3) S '96

Principles underlying angiosperm phylogeny. 2 hours lecture, 3 hours lab. Prerequisite: BOT 370 or instructor approval.

480 Plants: Pleasures and Poisons. (3) SS

Poisonous, medicinal, and other drug plants. Plant products and their effects on humans; historical and modern perspectives. Prerequisites: BIO 100, 182; BOT 108 or equivalent; CHM 231 or equivalent.

485 Plant Pathology. (3) F

Identification and control of biotic and abiotic factors which cause common disease problems to plants. Prerequisite: BOT 360. *General studies: L2.*

488 Greenhouse/Nursery Management. (3) F '95

Greenhouse structures, environment, and nursery operation. Includes irrigation, nutrition, and other principles relative to container-grown species. Prerequisites: BOT 381; ERA 325.

489 Plant Pest Management. (3) S

Principles of management of plant pests, including insects, plant pathogens, and weeds, covering the use of chemical and nonchemical methods. Prerequisite: BIO 182 or equivalent.

490 Paleobotany. (4) S '95

A broad survey of plant life of the past, including the structure of plant fossils, their geologic ranges, geographic distribution, and paleoenvironment. 3 hours lecture, 3 hours lab or field trip. Prerequisite: BIO 182 or equivalent.

510 Experimental Design. (3) S '96

ANOVAS, one-way classification of factorial and partially hierarchic designs; introductory multivariate statistics. 1 3-hour lecture at night. Prerequisite: BIO 415 or equivalent.

520 Biophysical Ecology. (2) F '95

Physical processes in a plant's microenvironment; radiation, heat, and water transfer; pollutant and ion uptake. Prerequisite: BIO 320 or equivalent.

525 Ecophysiology. (3) F '94

Physiological adaptation to environmental stresses and its ecological significance for plant survival. Environmental and biological control of photosynthesis and transpiration. Prerequisite: BOT 360 or instructor approval.

560 Plant Molecular Biology. (2) S '96

Biochemistry and molecular biology of plant organelles, including protein targeting, plant viruses, and molecular designs for plant improvements. Prerequisite: instructor approval.

562 Plant Genetic Engineering. (3) S '96

Plant transformation utilization of transgenic plants, transient gene expression assays, and applications of plant genetic engineering. Prerequisite: instructor approval.

563 Plant Genetic Engineering Laboratory.

(2) S '96

Plant transformation, utilization of transgenic plants, transient gene expression assays, and applications of plant genetic engineering. 6 hours laboratory. Prerequisite: instructor approval.

564 Plant Metabolism. (3) N

General plant metabolism and typical plant products, emphasizing biosynthesis and functions of storage products, cell wall constituents, plant acids, pigments, hormones, and numerous secondary products. Prerequisite: BOT 360 or CHM 231 or instructor approval.

568 Molecular Mechanisms of Photosynthesis. (3) F '95

Structure and function of photosynthetic complexes; mechanism of energy conversion in plants, bacteria and model systems. Cross-listed as CHM 568. Prerequisite: instructor approval.

570 Plant Secondary Chemistry. (3) N

Biosynthesis and distribution of plant natural products within various plant taxa. 3 hours lecture. Prerequisites: CHM 331, 332 (or equivalent).

581 Plant Tissue and Cell Culture. (3) N

Aseptic, clonal propagation of plants and in vitro culture of cells, tissues, and organs. 2 hours lecture, 3 hours lab. Prerequisite: BOT 360 or 381.

585 Diagnosis of Plant Problems. (4) N

Principles and techniques for diagnosis of biotic and abiotic agents that cause problems in economic plants. 2 hours lecture, 2 three-hour labs. Prerequisite: BOT 485.

591 Seminar. (1) F, S

Topics may be selected from the following:

- Biosystematics
- Ecology
- Horticulture
- Nonvascular Plants/Fungi
- Photosynthesis
- Plant Physiology

Omnibus Courses: See page 44 for omnibus courses that may be offered.

Chemistry and Biochemistry

Morton E. Munk
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REGENTS' PROFESSORS

BUSECK, LIN, C. MOORE,
PETTIT, WAGNER

PROFESSORS

ANGELL, BALASUBRAMANIAN,
BIEBER, BIRK, BLANKENSHIP,
T. BROWN, CRONIN, FUCHS,
GLAUNSINGER, GLICK, GUST,
HOLLOWAY, JUVET, LIU, LOHR,
McMILLAN, T. MOORE, MUNK,
O'KEEFFE, ROSE, WILLIAMS

ASSOCIATE PROFESSORS

A. MOORE, PETUSKEY, SKIBO,
STEIMLE, WOLF, ZIURYS

ASSISTANT PROFESSORS

ALLEN, GROTJAHN, KOUVETAKIS,
PENA, WOODBURY, YAGHI

REGENTS' PROFESSOR EMERITUS

EYRING

PROFESSORS EMERITI

D. BROWN, BURGOYNE, BURKE,
HARRIS, LUCHSINGER, MOELLER,
STUTSMAN, THOMSON, YUEN,
WHITEHURST, ZASLOW

CHEMISTRY—B.A.

The program consists of 46 semester hours, of which 30 must be in chemistry and 16 in closely related fields. Required courses are as follows: CHM 113 and 115 *or* CHM 117 and 118 (strongly recommended for qualified students); CHM 225, 226; CHM 331 and 332 and 335 and 336 *or* CHM 317 and 318 and 319 and 320 (strongly recommended for qualified students); CHM 341, 343, 453. Related courses must include the following: MAT 270 and 271 *or* equivalents; PHY 111 and 112 and 113 and 114 *or* more advanced PHY courses. The remaining courses to complete the major are determined by students in consultation with their advisors.

CHEMISTRY—B.S.

The program consists of 42 semester hours in chemistry. Required courses are as follows: CHM 113 and 115 *or* CHM 117 and 118 (strongly recommended for qualified students); CHM 331 and 332 and 335 and 336 *or* CHM 317 and 318 and 319 and 320 (strongly recommended for qualified students); CHM 425 and 426 and 427 and 428 *or* CHM 225 and 226 and 421 and 422; CHM 441, 442, 444, 452, 453; MAT 290 and 291 *or* MAT 270 and 271 and 272; PHY 121, 122, 131, 132, 241. MAT 274 and an appropriate course in computer language (CSE 181 or 183) are strongly recommended. The remaining chemistry courses to complete the major are determined by the student in consultation with an advisor. With the consent of the department chair, selected advanced courses from other related scientific disciplines may be accepted in lieu of elective chemistry courses to complete the major.

Transfer students are interviewed and advised of possible preparatory work. They must contact the department to arrange for the interview in advance of registration. See "Degree Requirements," page 87.

American Chemical Society Certification.

A student who satisfactorily completes the Bachelor of Science degree program is certified by the Department of Chemistry and Biochemistry to the American Chemical Society (ACS) as having met the specific requirements for undergraduate professional training in chemistry. Graduates meeting ACS guidelines can receive a certificate to indicate this fact.

Emphasis in Biochemistry. The major in Chemistry with an emphasis in biochemistry consists of 38 semester hours in chemistry plus work in related fields. Required courses are as follows: BIO 181, 182, 340; CHM 113 and 116 (or 115) *or* CHM 117 and 118 *or* equivalents; CHM 225 and 331 and 332 and 335 and 336 *or* CHM 317 and 318 and 319 and 320; CHM 441 and 442 and 444 *or* CHM 341 and 463 and 464; CHM 453, 461, 462, 467; MAT 290 and 291 *or* MAT 270 and 271 and 272; PHY 121, 122, 131, 132. The remaining courses to complete the major are determined by students in consultation with their advisors.

MINOR IN CHEMISTRY

A minor in Chemistry and Biochemistry is awarded to students who complete a minimum of 24 hours of chemistry courses. Required courses are CHM 113 and 116 (or equivalents); CHM 225 and 226; CHM 231 and 235 and 361 *or* CHM 331 and 332 and 335 and 336; CHM 341 and 343 (or equivalents).

**SECONDARY EDUCATION—
B.A.E.**

Chemistry. Students may pursue one of two options for the chemistry major teaching field.

Option One. The academic specialization consists of 48 semester hours in chemistry and related fields. Required courses are as follows: CHM 113, 115, 225, 226, 331, 332, 335, 336, 341 (or 441 or 442), 361, 480 (or PHY 480); MAT 270, 271; PHY 111, 112, 113, 114. The remaining courses to complete the specialization are determined by students in consultation with their advisors.

Option Two. The academic specialization consists of 31 semester hours of chemistry, which includes all of the required chemistry courses listed in option one and selection of the corresponding option in either mathematics or physics, that is, completion of an additional 30 semester hours in the chosen area as specified by the department selected.

The minor teaching field consists of 24 semester hours in chemistry. Required courses are as follows: CHM 113, 115; CHM 225 and 226 and 231 and 361 *or* CHM 331 and 332 and 335 and 336; CHM 341. The remaining courses to complete the specialization are determined by students in consultation with their advisors.

GRADUATE PROGRAMS

The Department of Chemistry and Biochemistry offers programs leading to the M.S. and Ph.D. degrees. Consult the *Graduate Catalog* for requirements.

The department participates in the new interdisciplinary program for the Master of Science and Doctor of Philosophy degrees in Molecular and Cellular Biology. See page 140 for courses. For more information, contact Bonnie Engel, PS D121, 602/965-0743.

CHEMISTRY

CHM 101 Introductory Chemistry. (4) F, S, SS
Elements of general chemistry. Adapted to the needs of students in nursing, home economics, agriculture, and physical education. Recommended for general studies credit. Normally followed by CHM 231. 3 hours lecture, 1 hour discussion, 2 hours lab. Credit is allowed for *only* CHM 101, 113, 114, or 117. *General studies:* S1, S2.

113 General Chemistry. (4) F, S, SS
Principles of chemistry. Adapted to the needs of students in the physical, biological, and earth sciences. 3 hours lectures, 1 hour discussion, 2 hours lab. 1 year of high school chemistry recommended. Credit is allowed for *only* CHM 101, 113, 114, or 117. Prerequisite: MAT 106 or 3 semesters of high school algebra. *General studies:* S1, S2.

114 General Chemistry for Engineers. (4) F, S
One semester college chemistry with emphasis toward engineering. 3 hours lecture, 1 hour discussion, 2 hours lab. Students without high school chemistry or chemical engineering majors must enroll in the CHM 113, 116 sequence instead of CHM 114. Credit is allowed for *only* CHM 101, 113, 114, or 117. Credit is allowed for *only* CHM 114, 115, 116, or 118. Prerequisites: MAT 106 or 3 semesters of high school algebra; 1 year of high school chemistry. *General studies:* S1, S2.

115 General Chemistry with Qualitative Analysis. (5) F, S, SS
Continuation of CHM 113. Equilibrium theory, chemistry of metals, nonmetals, and metalloids and the introduction to organic chemistry. Laboratory includes qualitative analysis. 3 hours lecture, 2 hours discussion, 4 hours lab. Credit is allowed for *only* CHM 114, 115, 116, or 118. Prerequisite: CHM 113 or 2 years of high school chemistry. *General studies:* S1, S2.

116 General Chemistry. (4) F, S
Continuation of CHM 113. Equilibrium theory, chemistry of metals, nonmetals, and metalloids and the introduction to organic chemistry. 3 hours lecture, 1 hour discussion, 2 hours lab. Credit is allowed for *only* CHM 114, 115, 116, or 118. Prerequisite: CHM 113 or 2 years of high school chemistry. *General studies:* S1, S2.

117 General Chemistry for Majors I. (4) F
Atomic and molecular structure, properties and physical states of matter, thermodynamics, kinetics, acids and bases, chemical analysis, and stoichiometry. 3 hours lecture, 1 conference, 2 hours lab. Credit is allowed for *only* CHM 101, 113, 114, or 117. Prerequisites: minimum of 1 year each of high school chemistry (with a grade of "B" or better) and physics; 3 years of high school mathematics. *General studies:* S1, S2.

118 General Chemistry for Majors II. (5) S
Continuation of CHM 117. 3 hours lecture, 1 conference, 5 hours lab. Credit is allowed for *only* CHM 114, 115, 116, or 118. Prerequisite: CHM 117. Corequisite: MAT 270 or 290. *General studies:* S1, S2.

225 Analytical Chemistry. (3) F, SS
Principles and methods of chemical analysis. Primarily for students in agriculture, premedicine, pre dentistry, and medical technology. Credit is allowed for *only* CHM 225 or 425. Prerequisite: CHM 115 or 116.

226 Analytical Chemistry Laboratory. (2) F, SS
Experiments in chemical analysis. 1 conference, 5 hours lab. Credit is allowed for *only* CHM 226 or 427. Corequisite: CHM 225.

231 Elementary Organic Chemistry. (3) F, S
Survey of organic chemistry, with emphasis on the reactivity of basic functional groups. Credit is allowed for *only* CHM 231, 317, or 331. Prerequisite: CHM 101 (or 114 or 115 or 116 or 117) or 1 year of high school chemistry with grades of "A" or "B" or instructor approval. *General studies:* S1, S2 (if taken with CHM 235).

235 Elementary Organic Chemistry Laboratory. (1) F, S
Organic chemistry experiments in synthesis, purification, analysis, and identification. Lab. Pre- or corequisite: CHM 231. *General studies:* S1, S2 (if taken with CHM 231).

301 Chemistry and Society. (3) S
A qualitative survey of chemistry and its impact on modern technology and the environment. May not be counted toward the chemistry major.

302 Environmental Chemistry. (3) S
Explores major environmental issues, problems, and solutions from analytical and chemistry perspectives. Prerequisites: CHM 114 (or 115 or 116 or 118), 231 (or 331).

317 Organic Chemistry for Majors I. (3) F
Structures, reaction mechanisms and kinetics, and systematic syntheses of organic compounds. Credit is allowed for *only* CHM 231, 317, or 331. Prerequisite: CHM 115 or 118. Corequisite: CHM 319.

318 Organic Chemistry for Majors II. (3) S
Continuation of CHM 317. Credit is allowed for *only* CHM 318 or 332. Prerequisite: CHM 317. Corequisite: CHM 320.

319 Organic Chemistry Laboratory for Majors I. (1) F
Emphasis on mechanisms, kinetics, and products of organic reactions. 1 conference, 3 hours lab. Credit is allowed for *only* CHM 319 or 335. Pre- or corequisite: CHM 317.

320 Organic Chemistry Laboratory for Majors II. (2) S
Continuation of CHM 319. 1 conference, 7 hours lab. Credit is allowed for *only* CHM 320 or 336. Prerequisite: CHM 319. Corequisite: CHM 318.

331 General Organic Chemistry. (3) F, S, SS
Chemistry of organic compounds. Credit is allowed for *only* CHM 231, 317, or 331. Prerequisite: CHM 115 or 116 or 118.

332 General Organic Chemistry. (3) F, S, SS
Continuation of CHM 331. Credit is allowed for *only* CHM 318 or 332. Prerequisite: CHM 331.

335 General Organic Chemistry Laboratory. (1) F, S, SS
Microscale organic chemical experiments in separation techniques, synthesis, analysis and identification, and relative reactivity. 4 hours lab. Credit is allowed for *only* CHM 319 or 335. Corequisite: CHM 331.

336 General Organic Chemistry Laboratory. (1) F, S, SS
Continuation of CHM 335. 4 hours lab. Credit is allowed for *only* CHM 320 or 336. Prerequisite: CHM 335. Corequisite: CHM 332.

- 341 Elementary Physical Chemistry.** (3) F Thermodynamics, equilibrium, states of matter, solutions, and chemical kinetics. For students in premedical, biological, and educational curricula. Not open to students who have taken CHM 441. Prerequisites: CHM 114 (or 118 or 225), 231 (or 331); MAT 271.
- 343 Physical Chemistry Laboratory.** (1) F Physical chemical experiments. 3 hours lab. Credit is allowed for *only* CHM 343 or 444. Corequisite: CHM 341 or 441.
- 361 Principles of Biochemistry.** (3) F, SS Structures, properties, and functions of proteins, enzymes, nucleic acids, carbohydrates, and lipids; the utilization and synthesis of these materials by living systems, and the relationship of these processes to energy production and utilization. Not open to students who have taken CHM 461. Credit is allowed for *only* CHM 361 or 461. Prerequisite: CHM 231 or 318 or 332.
- 367 Elementary Biochemistry Laboratory.** (1) F, SS Experiments include qualitative and quantitative analyses of constituents of biological systems, measurement of enzyme activities, and metabolic studies. 3 hours lab. Pre- or corequisite: CHM 361 or instructor approval.
- 392 Introduction to Research Techniques.** (1–3) F, S, SS Instrumental methods and philosophy of research by actual participation in chemical research projects. May be repeated for a total of 6 credits. Prerequisites: approval of advisor and research supervisor.
- 421 Instrumental Analysis.** (3) S Principles of instrumental methods in chemical analysis. Electroanalytical and optical techniques. Credit is allowed for *only* CHM 421 or 426. Prerequisites: CHM 225, 226. Pre- or corequisite: CHM 442.
- 422 Instrumental Analysis Laboratory.** (1) S Experiments in chemical analysis by electroanalytical and optical techniques. 3 hours lab. Credit is allowed for *only* CHM 422 or 428. Corequisite: CHM 421.
- 424 Separation Methods and Quantitative Organic Analysis.** (3) N Theory and practice of gas, liquid, ion-exchange, and gel permeation chromatography, countercurrent distribution, electrophoresis, and distillation; qualitative and quantitative interpretation of IR, mass, and NMR spectroscopy; quantitative methods of organic analysis via functional groups. 2 hours lecture, 4 hours lab. Prerequisites: CHM 318 or 332 or 442 or instructor approval.
- 425 Chemical Analysis.** (2) F Principles of chemical equilibria, separations, and analyses; chemical instrumentation. Pre- or corequisite: CHM 341 or 441.
- 426 Chemical and Instrumental Analysis.** (3) S Instrumental techniques for chemical analysis; methods for the interpretation of analytical data. Credit is allowed for *only* 421 or 426. Prerequisite: CHM 425.
- 427 Chemical and Instrumental Analysis Laboratory.** (2) F, S Classical and instrumental techniques in chemical analyses, with emphasis on accuracy and precision. 1 conference, 5 hours lab. Credit is allowed for *only* CHM 226 or 427. Pre- or corequisite: CHM 425.
- 428 Chemical and Instrumental Analysis Laboratory.** (2) F, S Continuation of CHM 427. Credit is allowed for *only* CHM 422 or 428. Pre- or corequisite: CHM 426.
- 431 Qualitative Organic Analysis.** (3) S Systematic identification of organic compounds. 1 hour lecture, 6 hours lab. Prerequisites: CHM 118 (or 226) and 320 (or 336) or instructor approval.
- 441 General Physical Chemistry.** (3) F Laws of thermodynamics and their applications, properties of gases, solids, liquids and solutions, reaction kinetics, wave mechanics, molecular spectroscopy, and statistical thermodynamics. Credit is allowed for *only* CHM 341 or 441. Prerequisites: MAT 272 or 291; PHY 241.
- 442 General Physical Chemistry.** (3) S Continuation of CHM 441. Prerequisite: CHM 441.
- 444 General Physical Chemistry Laboratory.** (2) S Physical chemical experiments. 1 conference, 5 hours lab. Credit is allowed for *only* CHM 343 or 444. Prerequisite: CHM 441. *General studies:* L2 (if taken with CHM 452).
- 452 Inorganic Chemistry Laboratory.** (1–2) S Preparation and characterization of typical inorganic substances, emphasizing methods and techniques. 1 conference, 5 hours lab. Prerequisite: instructor approval. *General studies:* L2 (if taken with CHM 444).
- 453 Inorganic Chemistry.** (3) S Principles and applications of inorganic chemistry. Prerequisite: CHM 341 or 441.
- 461 General Biochemistry.** (3) F Structure, chemistry, and metabolism of biomolecules and their role in the biochemical processes of living organisms. Prerequisites: CHM 318 (or 332) and 341 (or 441) or instructor approval.
- 462 General Biochemistry.** (3) S Continuation of CHM 461. Prerequisite: CHM 461 or instructor approval.
- 463 Biophysical Chemistry.** (3) S Principles of physical chemistry as applied to biological systems. Prerequisite: CHM 341 or 441.
- 464 Biophysical Chemistry Laboratory.** (2) S Introduction to physical methods in modern biochemistry. Corequisite: CHM 463. *General studies:* L2 (if taken with CHM 467).
- 467 General Biochemistry Laboratory.** (2) S The application of modern chemical and physical methods to biochemical problems; purification and characterization of biological macromolecules; quantitative measurement of enzyme activity and properties; evaluation of metabolic processes. 1 conference, 5 hours lab. Prerequisite: CHM 461. *General studies:* L2 (if taken with CHM 464).
- 471 Solid State Chemistry.** (3) F Crystal chemistry, thermodynamics and electrochemistry of solids, nonstoichiometric compounds, diffusion and solid state reactions, crystal growth, and selected topics. Pre- or corequisite: CHM 441 or instructor approval.
- 480 Methods of Teaching Chemistry.** (3) S Organization and presentation of appropriate content of chemistry; preparation of reagents, experiments, and demonstrations; organization of stock rooms and laboratories; experience in problem solving. Prerequisite: instructor approval.
- 481 Geochemistry.** (3) F Origin and distribution of the chemical elements. Geochemical cycles operating in the earth's atmosphere, hydrosphere, and lithosphere. Cross-listed as GLG 481. Prerequisite: CHM 341 or 441 or GLG 321.
- 485 Meteorites and Cosmochemistry.** (3) N Chemistry of meteorites and their relationship to the origin of the earth, solar system, and universe. Cross-listed as GLG 485.
- 501 Current Topics in Chemistry.** (1) F, S May be repeated for credit. Prerequisite: instructor approval.
- 521 Computer Interfacing to Chemical Instrumentation.** (3) N Assembly and machine language programming of laboratory-size computers for data acquisition and on-line, real-time control of chemical instrumentation. Digital logic and timing considerations in hardware interfacing of computers. No prior knowledge of computers or electronics assumed. Sound knowledge of chemical instrumentation desirable. 2 hours lecture, 4 hours lab.
- 523 Advanced Analytical Chemistry.** (3) A Theoretical principles of analytical chemistry. Prerequisites: CHM 225 and 442 or equivalents.
- 525 Spectrochemical Methods of Analysis.** (4) N Theoretical and practical considerations involving the use of optical instruments for chemical analysis, emphasizing emission and absorption spectroscopy. 3 hours lecture, 3 hours lab. Prerequisite: CHM 442.
- 526 X-Ray Methods of Analysis.** (4) N Theoretical and practical considerations involving the use of X-ray diffraction and spectroscopy for chemical and structural analyses. 3 hours lecture, 3 hours lab. Prerequisite: CHM 442.
- 527 Electrical Methods of Chemical Analysis.** (4) N Theoretical and practical considerations of polarography, potentiometric, amperometric, and conductometric titrations. 2 hours lecture, 6 hours lab. Prerequisite: CHM 442.
- 531 Advanced Organic Chemistry I.** (3) F Reaction mechanisms, reaction kinetics, linear free energy relationships, transition state theory, molecular orbital theory, and Woodward-Hoffmann rules. Prerequisites: CHM 318 (or 332), 442.
- 532 Advanced Organic Chemistry II.** (2) S Continuation of CHM 531. Prerequisite: CHM 531.
- 537 Organic Reactions.** (3) S Important synthetic reactions of organic chemistry emphasizing recently discovered reactions of preparative value. Prerequisite: CHM 531.
- 541 Advanced Thermodynamics.** (3) F Equilibrium thermodynamics, chemical reactions, and phase equilibria. Introduction to statistical thermodynamics, critical phenomena, and kinetics. Prerequisite: CHM 442.

545 Quantum Chemistry I. (3) F

Basic quantum theory, chemical bonding, and molecular structure. Prerequisite: CHM 442.

546 Quantum Chemistry II. (3) S

Quantum theory of rate processes. Principles of spectroscopy and nonlinear optics. Prerequisite: CHM 545.

548 Chemical Kinetics. (2) N

Kinetic theory and rate processes. Prerequisite: CHM 545.

553 Advanced Inorganic Chemistry. (3) S

Principles of modern inorganic chemistry and their applications over the entire periodic system. Prerequisites: CHM 442 and 453 or equivalents.

556 Topics in Inorganic Chemistry. (3) N

May be repeated for credit. Prerequisites: CHM 553; instructor approval.

563 Biophysical Chemistry. (3) N

Physical chemistry of macromolecules, especially proteins, nucleic acids, and polysaccharides. Thermodynamics, hydrodynamics, and spectroscopy of and their relation to structure. Prerequisites: CHM 442, 462.

568 Molecular Mechanisms of Photosynthesis. (3) N

Structure and function of photosynthetic complexes; mechanism of energy conversion in plants, bacteria, and model systems. Cross-listed as BOT 568. Prerequisite: instructor approval.

579 Topics in Solid State Chemistry. (3) N

May be repeated for credit. Prerequisite: instructor approval.

581 Isotope Geochemistry. (3) N

Geochemistry and cosmochemistry of stable and radioactive isotopes; geochronology; isotope equilibria. Cross-listed as GLG 581. Prerequisite: instructor approval.

582 Topics in Geochemistry and Cosmochemistry. (3) N

Topics of current interest for students in chemistry and other fields. Sampling of data and thought concerning phase equilibria, element distribution, meteorites, the Earth, and other planets. May be repeated for credit. Prerequisite: instructor approval.

583 Phase Equilibria and Geochemical Systems. (3) N

Natural reactions at high temperatures and pressures; silicate, sulfide, and oxide equilibria. Cross-listed as GLG 583.

Omnibus Courses: See page 44 for omnibus courses that may be offered.

Computer Science

A major in Computer Science is available in both the College of Liberal Arts and Sciences and the College of Engineering and Applied Sciences. Faculty and course descriptions appear on pages 258–263.

COMPUTER SCIENCE—B.S.

The program in Computer Science consists of 30 hours of core course work and 15 semester hours of senior-level breadth courses in the major. Also required are 18 semester hours of technical elective and mathematics courses approved by the department. The university requirement for literacy and critical inquiry is to be met in part by ECE 400 and ENG 301.

A minimum cumulative GPA of 2.50 is required to begin upper-division work in the major. A minimum grade of “C” is required in all CSE courses used for degree credit.

For further information on college requirements, contact an advisor in the Office for Academic Programs, SS 111, or the Department of Computer Science and Engineering, GWC 206.

Economics

A major in Economics is offered in both the College of Liberal Arts and Sciences and the College of Business. Faculty, course descriptions, and the major requirements in the College of Business are listed on pages 194–195.

ECONOMICS—B.A. OR B.S.

The program in Economics consists of 45 semester hours of course work, 24 of which, at a minimum, must be in economics, and the remainder in closely related fields to be selected from the “Approved List of Related Field Courses” in consultation with the faculty advisor.

The following lower-division courses are required and must be counted as part of the 45-hour major:

	<i>Semester Hours</i>
ECN 111 Macroeconomic Principles	3
ECN 112 Microeconomic Principles	3
MAT 210 Brief Calculus	3
STP 226 Elements of Statistics	3
Total	12

While MAT 210 meets the minimum mathematics requirement to major in Economics, all Economics majors who anticipate going on to graduate school in economics or in business or to law school are encouraged to take MAT 270 Calculus with Analytic Geometry I

(4), offered in sections taught via the “reform calculus” method. The relevant section line numbers are available from the Department of Mathematics. Majors are encouraged to pursue further course work in mathematics. MAT 270 may be taken in lieu of MAT 210.

To qualify for upper-division course work in economics, the Economics major must earn a minimum grade of “C” in each of the above listed courses, have junior class standing (56 semester hours), and have a minimum cumulative GPA of 2.50. ECN 313 Intermediate Macroeconomic Theory and ECN 314 Intermediate Microeconomic Theory are required and should be taken after the completion of the above listed courses and before other upper-division courses in economics.

Credit earned by an Economics major in ECN 484 Economics Internship, whether as a legislative intern or through the Department of Economics Internship Program (and ECN 493 Honors Thesis), may not be used to satisfy the minimum 24 hours of economics course work requirement. However, up to six hours of ECN 484 and 493 may be used to meet the related fields requirement. See “Degree Requirements,” page 87.

Latin American Studies Emphasis.

Students majoring in Economics may elect to pursue a Latin American Studies emphasis, combining courses from the major with selected outside courses of wholly Latin American content. See “Latin American Studies,” page 91, for more information.

SECONDARY EDUCATION—B.A.E.

The minor teaching field consists of 21 semester hours. ECN 111 and 112 and MAT 210 are required. The remainder is to be approved by the advisor in consultation with the student.

Social Studies. See page 153.

GRADUATE PROGRAMS

The Department of Economics offers programs leading to the M.S. and Ph.D. degrees. Consult the *Graduate Catalog* for requirements.

Faculty and course descriptions are listed on pages 194–195 of this catalog.