Professional Status Requirements

Student	School	High School Rank	ABOR GPA	Minimum Scores ACT	Minimum Scores SAT	Transfer GPA* Resident	Transfer GPA* Nonresident
Resident	Construction	Upper 25%	3.00	23	1140	—	—
	Engineering	Upper 25%	3.00	23	1140	—	—
Nonresident	Construction	Upper 25%	3.00	24	1140	—	—
	Engineering	Upper 25%	3.00	24	1140	—	—
Transfer	Construction	—	—	—	—	2.25	2.50
	Engineering	—	—	—	—	2.50	2.50

* The cumulative GPA is calculated using all credits from ASU as well as all transfer credits from other colleges and universities.

requirements as listed in the appropriate section of the "Professional Status Requirements" table, on this page. In addition, students who are required to take the Test of English as a Foreign Language (TOEFL) must earn a score of at least 550 (230 on the computerized version).

Students admitted to the university after successful completion of the General Education Development examination are admitted as preprofessional students within their major. Professional status is attained by meeting the minimum ACT or SAT score required for admission as listed in the "Professional Status Requirements" table, on this page.

For Computer Science and Computer Systems Engineering professional status requirements, see "Admission Requirements," page 234.

Preprofessional Status. In the College of Engineering and Applied Sciences, there are two versions of *preprofessional status*. One applies to a college-level preprofessional status; the conditions associated with the CEAS preprofessional status are described in the following material. The second version is of concern only to students interested in pursuing majors within the Department of Computer Science and Engineering (CSE); for descriptive material on the CSE preprofessional status, see "Department of Computer Science and Engineering," page 233, or access the CSE Web site at cse.asu.edu.

A student not admissible to professional status within the college but otherwise regularly admissible to ASU as stated in "Undergraduate Admission," page 59, may be admitted as a *preprofessional* student to any one of the academic programs of the college. A student admitted into this classification follows the freshman-sophomore sequence of courses as required by the chosen major. Courses are selected with the assistance of an academic advisor. After completing a minimum of 30 semester hours of required or approved elective courses *with a cumulative GPA equivalent to that required of transfer students and corresponding to the chosen major, students may apply for admission to professional status.* Preprofessional students are not permitted to register for 300- and 400-level courses in this college until the student's status is changed to professional.

Readmission. Students applying for readmission to professional status for any program in this college must have a cumulative GPA for all college course work equal to that of the transfer admission requirements shown in the "Professional Status Requirements" table, on this page.

Transfer into and Within the College. Students transferring between academic programs within the college or from other colleges within the university must meet both the cumulative GPA requirement and the catalog requirements of the desired program in effect at the time of transfer. Students who are transferring from an Arizona community college and have been in continuous residence may continue under the catalog in effect at the time of their entrance into the community college.

Transfer Students. A student who contemplates transferring into this college from another institution, whether a community college or four-year institution, should carefully study the catalog material pertaining to the particular program and consult an advisor in this college before enrolling in the other institution. These steps assure a smooth transition at the time of transfer. Transfer students may request admission to either preprofessional or professional status in any of the programs offered by this college.

The minimum requirements for admission of resident, nonresident, and transfer students to the professional program are shown in the "Professional Status Requirements" table, on this page. The academic units may impose additional admission and graduation requirements beyond the minimum specified by the college.

Credit is granted for transferred courses deemed equivalent to corresponding courses in the selected program of study, subject to grade and ASU resident credit requirements. No grades lower than "C" are accepted as transfer credit to meet the graduation requirements of this college. Credits transferred from a community college or two-year institution are applied only as lower-division credits. For a listing of the acceptable courses transferable to the various college degree programs, prospective Arizona transfer students should consult their advisors and refer to the ASU transfer tools available on the Web at www.asu.edu/provost/articulation.

It should be noted that some courses taken in other ASU colleges or other universities may be acceptable for general

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

College of Engineering and Applied Sciences Baccalaureate Degrees and Majors

Major	Degree	Concentration	Administered By
Del E. Webb School of Construction			
Construction[1]	B.S.	General building construction, heavy construction, residential construction, specialty construction	Del E. Webb School of Construction
School of Engineering			
Aerospace Engineering[1]	B.S.E.	—	Department of Mechanical and Aerospace Engineering
Bioengineering[1]	B.S.E.	—	Harrington Department of Bioengineering
Chemical Engineering[1]	B.S.E.	—	Department of Chemical and Materials Engineering
Civil Engineering[1]	B.S.E.	Construction engineering, environmental engineering	Department of Civil and Environmental Engineering
Computer Science[1]	B.S.	Software Engineering	Department of Computer Science and Engineering
Computer Systems Engineering[1]	B.S.E.	—	Department of Computer Science and Engineering
Electrical Engineering[1]	B.S.E.	—	Department of Electrical Engineering
Engineering Interdisciplinary Studies[2]	B.S.	—	School of Engineering
Engineering Special Studies[1]	B.S.E.	Premedical engineering	School of Engineering and the Harrington Department of Bioengineering
Industrial Engineering[1]	B.S.E.	—	Department of Industrial Engineering
Materials Science and Engineering[1]	B.S.E.	—	Department of Chemical and Materials Engineering
Mechanical Engineering[1]	B.S.E.	—	Department of Mechanical and Aerospace Engineering

[1] This major requires a minimum of 128 semester hours to complete.

[2] Applications for this program are not being accepted at this time.

university credit but may not be applicable toward the degree requirements of this college. Determination of those particular courses applicable to a specific degree program is made within the appropriate academic unit with the approval of the dean.

ADVISING

For assistance and counseling in planning a program of study, each student in this college is assigned a faculty advisor who is familiar with the chosen field of specialization and who must be consulted before registering each semester. The student should inform the advisor of any outside work or activity so that course loads may be adjusted accordingly.

Most students attending college find it necessary to obtain part-time employment; consequently, it is suggested that a careful balance of work and class requirements be considered to avoid academic problems.

Students enrolled in an undergraduate degree program in this college may register for a maximum of 19 semester hours each semester. Any student wanting to register for more than the maximum must submit a petition and have an approval on file before registering for the overload.

Students who are enrolled in an undergraduate nondegree status in this college must obtain advising and approval to register before registering each semester from the director of Student Academic Services in ECG 205. For more information, see "Admission of Undergraduate Nondegree Applicants," page 65.

UNDERGRADUATE DEGREES

The faculty in the College of Engineering and Applied Sciences offer programs leading to the B.S. and B.S.E. degrees with majors in the subjects shown in the "College of Engineering and Applied Sciences Baccalaureate Degrees and Majors," on this page. Each major is administered by the academic unit indicated.

Integrated B.S.E.-M.S. Program. To provide greater program flexibility, qualified students of the School of Engineering may undertake a program with an integrated fourth- and fifth-year sequence of study in one of several fields of specialization in engineering. This program provides an opportunity to meet the increasing demands of the profession for graduates who can begin their engineering careers at an advanced level.

College of Engineering and Applied Sciences Graduate Degrees and Majors

Major	Degree	Concentration	Administered By
Del E. Webb School of Construction			
Construction	M.S.	Construction science, facilities, management	Del E. Webb School of Construction
School of Engineering			
Aerospace Engineering	M.S., M.S.E., Ph.D.	—	Department of Mechanical and Aerospace Engineering
Bioengineering	M.S., Ph.D.	—	Harrington Department of Bioengineering
Chemical Engineering	M.S., M.S.E., Ph.D.	—	Department of Chemical and Materials Engineering
Civil Engineering	M.S., M.S.E., Ph.D.	—	Department of Civil and Environmental Engineering
Computer Science	M.C.S., M.S., Ph.D.	—	Department of Computer Science and Engineering
Electrical Engineering	M.S., M.S.E., Ph.D.	—	Department of Electrical Engineering
Engineering	M.E.[1]	—	School of Engineering
Engineering Science	M.S., M.S.E., Ph.D.	—	School of Engineering
Industrial Engineering	M.S., M.S.E., Ph.D.	—	Department of Industrial Engineering
Materials Engineering	M.S., M.S.E.	—	Department of Chemical and Materials Engineering
Materials Science	M.S.[2]	—	Committee on the Science and Engineering of Materials
Mechanical Engineering	M.S., M.S.E., Ph.D.	—	Department of Mechanical and Aerospace Engineering
Science and Engineering of Materials	Ph.D.[2]	High-resolution nanostructure analysis, solid-state device materials design	Committee on the Science and Engineering of Materials

[1] This collaborative program is offered by the three state universities.

[2] This program is administered by the Graduate College.

Students admitted to this program are assigned a faculty committee that supervises a program of study in which there is a progression in the course work and in which earlier work is given application in the later engineering courses for both the bachelor's and master's degrees.

Entry into the integrated program requires an application submitted to the dean through the faculty advisor and the department chair. Applications are reviewed by a school committee that recommends the appropriate action to the dean. The application may be submitted in the fifth semester.

GRADUATE DEGREES

The faculty in the College of Engineering and Applied Sciences offer master's and doctoral degrees as shown in the "College of Engineering and Applied Sciences Graduate Degrees and Majors" table, on this page. School of Engineering faculty participate in offering the Master of Engineering (M.E.) as a collaborative degree program offered by Arizona's three state universities. For more information, see the *Graduate Catalog.*

ASU EXTENDED CAMPUS

The College of Extended Education was created in 1990 to extend the resources of ASU throughout Maricopa County, the state, and beyond. The College of Extended Education is a university-wide college that oversees the ASU Extended Campus and forms partnerships with other ASU colleges, including the College of Engineering and Applied Sciences, to meet the instructional and informational needs of a diverse community.

The ASU Extended Campus goes beyond the boundaries of the university's three physical campuses to provide access to quality academic credit and degree programs for working adults through flexible schedules; a vast network of off-campus sites; classes scheduled days, evenings, and weekends; and innovative delivery technologies including television, the Internet, and Independent Learning. The Extended Campus also offers a variety of professional continuing education and community outreach programs.

For more information, see "ASU Extended Campus," page 671, or access the Web site at www.asu.edu/xed.

UNDERGRADUATE DEGREE REQUIREMENTS

For detailed information on the degree requirements of a major in the College of Engineering and Applied Sciences, refer to that department's or school's individual description on the following pages.

UNIVERSITY GRADUATION REQUIREMENTS

In addition to department and school requirements, students must meet all university graduation requirements (see "University Graduation Requirements," page 81). A well-planned program of study enables students to meet all requirements in a timely fashion. Students are encouraged to consult with an academic advisor in planning a program to ensure that they comply with all necessary requirements.

General Studies Requirement

All students enrolled in a baccalaureate degree program must satisfy a university requirement of a minimum of 35 hours of approved course work in General Studies. General Studies courses are listed in the "General Studies Courses" table, page 88, in the course descriptions in this catalog or on the Web, in the *Schedule of Classes*, and in the *Summer Sessions Bulletin*. Consult with an advisor for an approved list of courses.

First-Year Composition Requirement

As a minimum, completion of ENG 101 and 102, or ENG 107 and 108, or ENG 105 with grades of "C" or higher is required for graduation from ASU in any baccalaureate program as described in "First-Year Composition Requirement," page 81. Any student whose written or spoken English in any course is unsatisfactory may be required by the appropriate director or department chair to take additional course work.

COLLEGE DEGREE REQUIREMENTS

Pass/Fail Grades

Students enrolled in the college do not receive degree credit for pass/fail courses taken at this institution. In addition, no course in this college is offered for pass/fail credit. Students requesting credit for pass/fail courses taken at another institution must file a Petition for Adjustment to Curriculum Requirements to the department of their major. Each request is judged on its particular merits.

Entry into Upper-Division Courses

Before enrolling in courses at the 300 level and above, students must be in good academic standing in professional program status in this college and have the approval of their advisors. A student who is not in good academic standing must secure approval from his or her advisor and the college's Student Academic Services. Students whose grades in 300-level courses are unsatisfactory may be required to retake one or more courses for which credit has previously been granted.

The departments and schools have certain additional requirements that must be met in addition to the above college requirements, and students should consult them for details.

Non-CEAS Students. Students who are not admissible to programs in this college and who enroll in another college at ASU may not register for any 300- or 400-level courses in this college unless they are required in their degree programs and the students have the proper course prerequisites.

Currency of Course Work

Courses taken more than five years before admission to degree programs in this college are not normally accepted for transfer credit at the option of the department in which the applicant wishes to enroll. Courses completed within the five years preceding admission are judged as to their applicability to the student's curriculum.

ACADEMIC STANDARDS

Probation. A student is expected to make satisfactory progress toward completion of degree requirements to continue enrollment in the college. Any one of the following conditions is considered unsatisfactory progress and results in the student being placed on probationary status:

1. a semester or summer session with a GPA less than or equal to 1.50;
2. two successive semesters with GPAs less than 2.00; or
3. an ASU cumulative GPA less than 2.00.

Students on probation are subject to disqualification if

1. they do not attain a semester GPA of 2.25;
2. their cumulative GPA is below 2.00 at the end of the probationary semester; or
3. they are placed on probation for two consecutive semesters.

Courses completed during the summer sessions may not be used to reevaluate a student's fall semester probationary status.

Students on academic probation are not allowed to register for more than 13 semester hours of course work. Probationary students may not register for the next semester without a special permit from an advisor in Student Academic Services. Special permits are not given until grades are recorded by the registrar for the current semester.

Disqualification. During a semester on academic probation, a student who fails to meet the retention standards specified above is disqualified. Students may request a review of their disqualification status by contacting the director of Student Academic Services in ECG 205. Any disqualified student who is accepted by another college at ASU may not register for courses in this college unless the courses are required for the new major. Disqualified students who do register for courses in this college may be withdrawn from these courses any time during that semester. Furthermore, students at the university who have been disqualified academically by this college are not eligible to enroll in summer session courses in this college until the disqualification period has expired and they have been reinstated.

Reinstatement. The college does not accept an application for reinstatement until the disqualified student has remained out of this college for at least a 12-month period. Merely

having remained in a disqualified status for this period of time does not, in itself, constitute a basis for reinstatement. Proof of ability to do satisfactory college work in the chosen discipline is required, for example, completing at least 15 semester hours of pertinent courses in the discipline at a community college with a GPA of 2.50 or higher, and a cumulative GPA of 2.50 or higher for all courses completed.

Student Academic Services. The College of Engineering and Applied Sciences maintains a unit to assist individual students in various matters. This office coordinates the work of the College Academic Standards Committee; administers the probation, disqualification, and readmission processes, student disciplinary actions, and grade grievances; and reviews and processes requests for medical and compassionate withdrawal. This office also administers the college's scholarship program. Additional information is available at www.eas.asu.edu/sas.

STUDENT RESPONSIBILITIES

Course Prerequisites. Students should consult the *Schedule of Classes* and the catalog for course prerequisites. Students who register for courses without the designated prerequisites may be withdrawn without the student's consent at any time before the final examination. Such withdrawal may be initiated by the instructor, the chair of the department offering the course, the director of Student Academic Services, or the dean of the college. In such cases, students will not receive monetary reimbursement. However, such withdrawal is considered to be unrestricted as described under "Grading System," page 74, and does not count against the number of restricted withdrawals allowed.

SPECIAL OPPORTUNITIES

Cooperative Education. The co-op program is a work-study plan of education that alternates periods of academic study with periods of employment in business, industry, or government. Students who choose this program ideally complete 12 months of employment and graduate with both the academic background and practical experience gained from working with professionals in a chosen field.

A student in the college is eligible to apply to the co-op program upon completion of 45 or more hours of classes required for the selected major. Transfer students are required to complete at least one semester at ASU before beginning work. All student applicants must have a GPA of at least 2.50 and the approval of an advisor and the dean of the college.

To maintain continuous student status in the university, each co-op student must be enrolled in ASE 399 Cooperative Work Experience for one semester hour during each work session. Such credit cannot be applied toward degree requirements. For more information, visit Student Academic Services in ECG 205, or call 480/965-1750, and visit the Career Services office in SSV 329, or call 480/965-2350.

Foundation Coalition. ASU is a member of the Foundation Coalition, a National Science Foundation-funded group of seven institutions of higher learning across the U.S. that is working to improve engineering education. Foundation Coalition programs are intended to

1. demonstrate and promote the interrelationships of subject matter within the curriculum;
2. improve the interpersonal skills of students and the understanding of concepts through the use of more teaming and cooperative learning environments;
3. increase the use of technology in the curriculum; and
4. assess and evaluate intended improvements.

Such changes address the desires of employers, increase the numbers of baccalaureate degrees earned by members of currently underrepresented groups, and promote curriculum improvement. Foundation Coalition programs are available to freshmen and sophomores in the School of Engineering and to juniors and seniors in Electrical Engineering and Industrial Engineering.

Foundation Coalition programs offer students a more hands-on, team-based, computer-intensive approach to the curriculum. The freshman programs provide an important opportunity for new students to get to know a small group of students, making a large university seem less overwhelming. The programs also involve more interactions with faculty and access to special tutors. All students get a team-based, computer-intensive education in ECE 100 Introduction to Engineering Design, and the Foundation Coalition program extends this experience to many more subjects and courses.

Freshmen Foundation Coalition programs offer both an integrated set of courses that include engineering, calculus, physics, and English in both the first and second semesters, and smaller course packages that include engineering, math, science, and English. In these packages, the same set of students take all of the courses in the package in high-tech, team-promoting classrooms while the faculty work together to deliver a unified set of courses. Sophomore programs involve courses in mathematics, mechanics, and electrical circuits.

Students interested in these programs should see their department advisor, visit the Foundation Coalition Office in ECG 303, call 480/965-5350, or access the Web site at www.eas.asu.edu/~asufc.

Minority Engineering Program. The staff of the Minority Engineering Program (MEP) is available to assist the academic and professional development of prospective, newly admitted, and continuing students through a variety of support services. In addition, advice on financial aid, scholarships, and employment is provided. For more information, visit the MEP director in ECG 145, or call 480/965-6882.

Women in Applied Sciences and Engineering Program. The Women in Applied Sciences and Engineering (WISE) Program hosts seminars and workshops, and provides outreach programs to high school and community college students to acquaint students with a variety of technical careers. The WISE center, in room ECG 145, is open for study groups, tutoring, and informal discussions. For more

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

information, call 480/965-6882, or access the Web site at www.eas.asu.edu/~wise.

Honor Societies. Students in the College of Engineering and Applied Sciences are encouraged to seek information concerning entry into those honor societies for which they may qualify. Membership in such organizations enhances the student's professional stature. The following honor societies are active within the college:

Alpha Eta Mu Beta—Bioengineering Honor Society
Alpha Pi Mu—Industrial Engineering Honor Society
Chi Epsilon—Civil Engineering Honor Society
Eta Kappa Nu—Electrical Engineering Honor Society
Omega Rho—Industrial Engineering Society
Pi Tau Sigma—Mechanical Engineering Honor Society
Sigma Gamma Tau—Aerospace Engineering Honor Society
Sigma Lambda Chi—Construction Honor Society
Tau Beta Pi—National Engineering Honor Society
Upsilon Pi Epsilon—National Computer Science Honor Society

Information on any of these organizations may be obtained from the respective department or school offices.

Honors Students. The College of Engineering and Applied Sciences participates in the programs of the Barrett Honors College, which provides enhanced educational experiences to academically superior undergraduate students. Participating students can major in any academic program. A description of the requirements and the opportunities offered can be found in "The Barrett Honors College," page 120.

Internships. A variety of internship programs exist within the college. Information on these programs can be obtained from the Engineering Internship Program coordinator in the office of the associate dean for Academic Affairs.

Scholarships. Information and applications for academic scholarships for continuing students may be obtained by contacting the college's Student Academic Services or the various department or school offices. Other scholarships may be available through the university Student Financial Assistance Office. For application and more information, access the Web site at www.eas.asu.edu/sas.

ROTC. Students pursuing a commission through either the Air Force or Army ROTC programs are required to take courses in the Department of Aerospace Studies or Department of Military Science. To preclude excessive overloads, these students should plan on at least one additional semester to complete degree requirements. Because of accreditation requirements, aerospace studies (AES) or military science (MIS) courses are not acceptable for degree credit in engineering as social and behavioral science or humanities and fine arts under General Studies. ROTC students must also meet all other degree requirements of this college.

GENERAL INFORMATION

Definition of Terms. The terms used in this college to describe offerings are defined below for purposes of clarity.

Program of Study. This broad term describes the complete array of courses included in the study leading to a degree.

Major. This term describes a specialized group of courses contained within the program of study. Example: program of study—engineering; major—Civil Engineering.

Area of Study (Technical Electives) or Concentration. Each of these terms describes a selection of courses within a major or among one or more majors. The number of technical electives varies from curriculum to curriculum. In several majors, the technical electives must be chosen from preselected groups. For this reason the choice of specific technical electives for an area of study should be made with the advice and counsel of an advisor. Example: major—Mechanical Engineering; area of study—thermosciences.

Del E. Webb School of Construction

construction.asu.edu
480/965-3615
SCOB 241

William W. Badger, Director

Professors: Badger, Mulligan

Associate Professors: Ariaratnam, Bashford, Chasey, Duffy, Ernzen, Kashiwagi, Sawhney, Weber, Wiezel

Assistant Professors: Fiori, Knutson

Visiting Eminent Scholars: Schexnayder, Schleifer

PURPOSE

Construction careers are so broadly diversified that no single curriculum prepares the student for universal entry into all fields. As an example, heavy construction contractors usually place more emphasis on technical and engineering science skills than do residential contractors/developers, who usually prefer a greater depth of knowledge in management and construction. To ensure a balanced understanding of the technical, professional, and philosophical standards that distinguish modern-day constructors, advisory groups representing leading associations of contractors and builders provide counsel in curriculum development. Construction has a common core of engineering science, management, and behavioral courses on which students may build defined concentrations to suit individual backgrounds, aptitudes, and objectives. These concentrations are not absolute but generally match major divisions of the construction industry.

DEGREES

Construction—B.S.

The faculty in the Del E. Webb School of Construction offer the B.S. degree in Construction. Four concentrations

are available: general building construction, heavy construction, residential construction, and specialty construction.

Each concentration is arranged to accent requisite technical skills and to develop management, leadership, and competitive qualities in the student. Prescribed are a combination of General Studies courses, technical courses basic to engineering and construction, and courses on a broad range of applied management subjects fundamental to the business of construction contracting.

Construction—M.S.

The faculty in the school also offer the M.S. degree in Construction. Details for this degree are found in the *Graduate Catalog.*

Professional Accreditation and Affiliations. The Del E. Webb School of Construction is a member of the Associated Schools of Construction, an organization dedicated to the development and advancement of construction education. The construction program is accredited by the American Council for Construction Education.

SPECIAL PROGRAMS

The Del E. Webb School of Construction maintains a cooperative agreement with community colleges within Arizona and also with selected out-of-state colleges and universities to structure courses that are directly transferable into the construction program at ASU.

Student Organizations. The school has a chapter of Sigma Lambda Chi, a national honor society that recognizes high academic achievement in accepted construction programs. The school is also host to the Associated General Contractors of America student chapter, the National Association of Home Builders student chapter, and the Construction Women's Alliance.

Scholarships. Apart from those given by the university, a number of scholarships from the construction industry are awarded to students registered in the construction program. The scholarships are awarded on the basis of academic achievement and participation in activities of the construction program.

ADMISSION

For information regarding requirements for admission, transfer, retention, qualification, and reinstatement, see "Undergraduate Admission," page 59; "Admission," page 200; and "College Degree Requirements," page 204. A preprofessional category is available for applicants deficient in regular admission requirements. Vocational and craft-oriented courses taught at the community colleges are not accepted for credit toward a bachelor's degree in Construction.

BASIC REQUIREMENTS

Students complete the following basic requirements before registering for advanced courses: (1) All first-semester, first-year courses and the university First-Year Composition requirement (see "University Graduation Requirements," page 81) must be completed by the time the student has accumulated 48 semester hours of program requirements, and (2) all second-semester, first-year courses must be completed by the time the student has completed 64 semester hours of program requirements. Transfer students are given a one-semester waiver. Participation in a summer field internship activity is required for all students between the second and third years of the program.

Any student not making satisfactory progress is permitted to register for only those courses required to correct any deficiencies.

DEGREE REQUIREMENTS

A minimum of 128 semester hours with at least 50 hours at the upper-division level is required for graduation in general building construction, heavy construction, residential construction, and specialty construction. Students in all concentrations are required to complete a construction core of science-based engineering, construction, and management courses.

GRADUATION REQUIREMENTS

A student must earn a grade of "C" or higher in the mathematics and physics courses listed in the program of study.

In addition to fulfilling school and major requirements, majors must satisfy the General Studies requirements as noted in "General Studies," page 85, and all university graduation requirements as noted in "University Graduation Requirements," page 81. Note that all three General Studies awareness areas are required. Consult an advisor for an approved list of courses.

SCHOOL COURSE REQUIREMENTS

The school requires that the General Studies requirement be satisfied in the following manner:

Humanities and Fine Arts/Social and Behavioral Sciences		
CON 101	Construction and Culture: A Built Environment *HU, G, H*	3
ECN 111	Macroeconomic Principles *SB*	3
ECN 112	Microeconomic Principles *SB*	3
HU/SB	and awareness area course as needed	3
HU/SB	(upper division) and awareness area course as needed	3
Total		15
Literacy and Critical Inquiry		
COM 225	Public Speaking *L*	3
CON 496	Construction Contract Administration *L*	3
Total		6
Natural Sciences		
PHY 111	General Physics *SQ*[1]	3
PHY 112	General Physics *SQ*[2]	3
PHY 113	General Physics Laboratory *SQ*[1]	1
PHY 114	General Physics Laboratory *SQ*[2]	1
Total		8

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Mathematical Studies
MAT 270 Calculus with Analytic Geometry I *MA* 4
STP 226 Elements of Statistics *CS* 3
Total 7

General Studies/school requirements total[3] 36

[1] Both PHY 111 and 113 must be taken to secure SQ credit.
[2] Both PHY 112 and 114 must be taken to secure SQ credit.
[3] Because of the school's requirement for MAT 270, the total semester hours exceed the General Studies requirement of 35.

Construction Major Requirements Common to *All* Concentrations

(Except as Noted)

ACC 230 Uses of Accounting Information I 3
or ACC 394 ST: Financial Analysis and Accounting for Small Businesses (3)*
CEE 340 Hydraulics and Hydrology 3
CON 221 Applied Engineering Mechanics: Statics 3
CON 243 Heavy Construction Equipment, Methods, and Materials 3
CON 244 Working Drawings Analysis 1
CON 251 Microcomputer Applications for Construction 3
CON 252 Building Construction Methods, Materials, and Equipment 3
CON 273 Electrical Construction Fundamentals 3
CON 296 Field Internship 0
CON 310 Testing of Materials for Construction 3
CON 323 Strength of Materials 3
CON 341 Surveying 3
CON 345 Mechanical Systems 3
CON 371 Construction Management and Safety 3
CON 383 Construction Estimating 3
CON 389 Construction Cost Accounting and Control *CS* 3
CON 424 Structural Design 3
CON 450 Soil Mechanics in Construction 3
CON 453 Construction Labor Management 3
CON 455 Construction Project Management 3
CON 463 Foundations 3
CON 495 Construction Planning and Scheduling *CS* 3
ECE 100 Introduction to Engineering Design *CS* 3
LES 305 Legal, Ethical, and Regulatory Issues in Business 3
or LES 306 Business Law (3) (ASU West)
or LES 380 Consumer Perspective of Business Law (3)
Physical science elective with lab 4

Total common to all concentrations 71

* ACC 394 ST: Financial Analysis and Accounting for Small Businesses is recommended.

Advisor-approved alternates/transfer credits for these courses may vary from the total required semester hours indicated. Such variances do not reduce the minimum of 128 semester hours required for the degree.

The course work for the first two years is the same for all concentrations.

First Semester
CON 101 Construction and Culture: A Built Environment *HU, G, H* 3
ECN 111 Macroeconomic Principles *SB* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
PHY 111 General Physics *SQ*[1] 3
PHY 113 General Physics Laboratory *SQ*[1] 1
Total 17

Second Semester
CON 244 Working Drawings Analysis 1
ECE 100 Introduction to Engineering Design *CS* 3
ECN 112 Microeconomic Principles *SB* 3
ENG 102 First-Year Composition 3
PHY 112 General Physics *SQ*[2] 3
PHY 114 General Physics Laboratory *SQ*[2] 1
HU elective with awareness area as needed 3
Total 17

Third Semester
CON 221 Applied Engineering Mechanics: Statics 3
CON 243 Heavy Construction Equipment, Methods, and Materials 3
CON 251 Microcomputer Applications for Construction 3
CON 273 Electrical Construction Fundamentals 3
STP 226 Elements of Statistics *CS* 3
Total 15

Fourth Semester
ACC 230 Uses of Accounting Information I 3
or ACC 394 ST: Financial Analysis and Accounting for Small Businesses[3] (3)
COM 225 Public Speaking *L* 3
CON 252 Building Construction Methods, Materials, and Equipment 3
CON 323 Strength of Materials 3
Physical science elective with lab 4
Total 16

[1] Both PHY 111 and 113 must be taken to secure SQ credit.
[2] Both PHY 112 and 114 must be taken to secure SQ credit.
[3] ACC 394 ST: Financial Analysis and Accounting for Small Businesses is recommended.

Concentration in General Building Construction

The general building construction concentration provides a foundation for students who wish to pursue careers as estimators, project managers, project engineers, and eventually, owners of firms engaged in the construction of industrial, commercial, and institutional structures. Educational focus is on building systems required for the mass development and production of large-scale projects. General building construction is addressed as an integrated process from conception through delivery of completed facilities to users.

Requirements
CON 472 Development Feasibility Reports *L* 3
CON 483 Advanced Building Estimating 3
PUP 432 Planning and Development Control Law 3
or PUP 433 Zoning Ordinances, Subdivision Regulations, and Building Codes (3)
REA 380 Real Estate Fundamentals 3
Upper-division technical elective 3
Total 15

Concentration in Heavy Construction

The heavy construction concentration prepares students for careers related to the public works discipline. Typical projects in which they are involved are highways, railroads, airports, power plants, rapid transit systems, process plants,

harbor and waterfront facilities, pipelines, dams, tunnels, bridges, canals, sewerage and water works, and mass earthwork.

Requirements

CON	344 Route Surveying	3
CON	486 Heavy Construction Estimating	3
Upper-division business electives		6
Upper-division technical elective		3
Total		15

Concentration in Residential Construction

The residential construction concentration prepares students for careers in the residential sector of the industry. This concentration covers the specific methods and processes during the planning, production, marketing, and business-related activities common to residential construction.

Requirements

CON	377 Residential Construction Production Procedures	3
CON	477 Residential Construction Business Practices	3
CON	484 Internship	3
MKT	382 Advertising/Marketing Communication	3
PUP	432 Planning and Development Control Law or PUP 433 Zoning Ordinances, Subdivision Regulations, and Building Codes (3)	3
Total		15

Concentration in Specialty Construction

The specialty construction concentration prepares students for careers with specialty constructors, such as mechanical and electrical construction firms. It emphasizes the construction process at the trade contractor level.

Requirements

CON	468 Mechanical and Electrical Estimating	3
CON	471 Mechanical and Electrical Project Management	3
CON	494 ST: Cleanroom Construction	3
Upper-division business electives		6
Total		15

CONSTRUCTION (CON)

CON 101 Construction and Culture: A Built Environment. (3)
fall and spring
Analyzes the cultural context of construction, emphasizing its centrality in the evolution and expansion of built environments as expressions of ethical and historical value systems. Lecture, speakers.
General Studies: HU, G, H

CON 221 Applied Engineering Mechanics: Statics. (3)
fall and spring
Vectors, forces and moments, force systems, equilibrium, analysis of basic structures and structural components, friction, centroids, and moments of inertia. Prerequisites: MAT 270; PHY 111, 113.

CON 243 Heavy Construction Equipment, Methods, and Materials. (3)
fall and spring
Emphasizes "Horizontal" construction. Fleet operations, maintenance programs, methods, and procedures to construct tunnels, roads, dams, and the excavation of buildings. Lab, field trips.

CON 244 Working Drawings Analysis. (1)
fall and spring
In-depth analysis of construction drawings (blueprint reading), interpreting symbols, dimensioning, projections, and general plan organization. Extensive workbook activity. Lecture, lab.

CON 251 Microcomputer Applications for Construction. (3)
fall and spring
Applies the microcomputer as a problem-solving tool for the constructor. Uses spreadsheets, information management, and multimedia software. Prerequisite: ECE 100.

CON 252 Building Construction Methods, Materials, and Equipment. (3)
fall and spring
Emphasizes "Vertical" construction. Methods, materials, codes, and equipment used in building construction corresponding to the 16 division "Master Format." Lecture, lab.

CON 273 Electrical Construction Fundamentals. (3)
fall and spring
Circuits and machinery. Power transmission and distribution, with emphasis on secondary distribution systems. Measurements and instrumentation. Lecture, field trips. Prerequisites: PHY 112, 114.

CON 296 Field Internship. (0)
summer
Participation as interns on construction projects to observe and experience the daily activities. Internship.

CON 310 Testing of Materials for Construction. (3)
fall and spring
Structural and behavioral characteristics, engineering properties, measurements, and application of construction materials. Not open to engineering students. Lecture, lab. Prerequisite: CON 323.

CON 323 Strength of Materials. (3)
fall and spring
Analyzes strength and rigidity of structural members in resisting applied forces. Stress, strain, shear, moment, deflections, combined stresses, connections, and moment distribution. Both U.S. and SI units of measurement. Prerequisite: CON 221.

CON 341 Surveying. (3)
fall, spring, summer
Theory and field work in construction and land surveys. Lecture, lab. Cross-listed as CEE 381. Credit is allowed for only CEE 381 or CON 341. Prerequisite: MAT 170.

CON 344 Route Surveying. (3)
spring
Simple, compound, and transition curves, including reconnaissance, preliminary, and location surveys. Calculation of earthwork. Dimensional control for construction projects. Lecture, lab. Prerequisites: CON 243, 341.

CON 345 Mechanical Systems. (3)
fall and spring
Design parameters and equipment related to heating and cooling systems for mechanical construction. Computer-aided calculations. Lecture, field trips. Prerequisites: CON 252; PHY 111, 113.

CON 371 Construction Management and Safety. (3)
fall and spring
Organization and management theory applied to the construction process. Leadership functions. Safety procedures and equipment. OSHA requirements for construction. Prerequisite: CON 252.

CON 377 Residential Construction Production Procedures. (3)
spring
Process used in residential construction. How a house is built: design, permits, scheduling, codes, contracting, site management, mechanical/electrical. Prerequisite: CON 252.

CON 383 Construction Estimating. (3)
fall and spring
Drawings and specifications. Methods and techniques used in construction estimating procedures. Introduces computer software used in industry. Lecture, project workshops. Prerequisites: a combination of CON 243 and 251 and 252 or only instructor approval. Pre- or corequisite: CON 244.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

CON 389 Construction Cost Accounting and Control. (3)
fall and spring
Nature of construction cost. Depreciation and tax theory and variable equipment costs. Cash flow theory, investment models, profitability, and analysis. Computer applications. Funding sources and arrangements. Builder's insurance. Prerequisites: ACC 230 (or 394 ST: Financial Analysis and Accounting for Small Businesses); CON 251.
General Studies: CS

CON 424 Structural Design. (3)
fall
Economic use of concrete, steel, and wood in building and engineered structures. Design of beams, columns, concrete formwork, and connections. Lecture, field trips. Prerequisite: CON 310.

CON 450 Soil Mechanics in Construction. (3)
fall and spring
Soil mechanics as applied to the construction field, including foundations, highways, retaining walls, and slope stability. Relationship between soil characteristics and geologic formations. Not open to engineering students. Lecture, lab. Prerequisite: CON 323.

CON 453 Construction Labor Management. (3)
fall and spring
Labor and management history, union, and open shop organization of building and construction workers; applicable laws and government regulations; goals, economic power, jurisdictional disputes, and grievance procedures. Lecture, lab. Prerequisites: CON 371; ECN 112.

CON 455 Construction Project Management. (3)
fall and spring
Study of methods for coordinating people, equipment, materials, money, and schedule to complete a project on time and within approved cost. Lecture, class projects, CPC exam. Fee. Prerequisite: CON 371. Pre- or corequisite: CON 495.

CON 463 Foundations. (3)
spring
Subsurface construction theory and practice for description, excavations, exploration, foundations, pavements, and slopes. Evaluation of specifications and plans of work. Lecture, recitation, field trips. Prerequisite: CON 450.

CON 468 Mechanical and Electrical Estimating. (3)
fall
Analysis and organization of performing a cost estimate for both mechanical and electrical construction projects. Computer usage. Prerequisites: a combination of CON 273 and 345 and 383 or only instructor approval.

CON 471 Mechanical and Electrical Project Management. (3)
spring
Specialty contracts and agreements, scheduling, material handling, labor unit analysis, and job costing for mechanical and electrical construction. Prerequisite: CON 371.

CON 472 Development Feasibility Reports. (3)
fall and spring
Integrates economic location theory, development cost data, market research data, and financial analysis into a feasibility report. Computer orientation. Prerequisite: REA 380.
General Studies: L

CON 477 Residential Construction Business Practices. (3)
fall
Topics addressed include development, marketing, financing, legal issues, and sales. Prerequisite: CON 377 or instructor approval.

CON 483 Advanced Building Estimating. (3)
fall and spring
Concepts of pricing and markup, development of historic costs, life cycle costing, change order and conceptual estimating, and emphasizing microcomputer methods. Prerequisite: CON 383.

CON 484 Internship. (1–12)
fall, spring, summer
Structured practical experience following a contract or plan, supervised by faculty and practitioners. May serve with industry participant or government agency. Prerequisite: school approval.

CON 486 Heavy Construction Estimating. (3)
fall
Methods analysis and cost estimation for construction of highways, bridges, tunnels, dams, and other engineering works. Lecture, field trips. Prerequisites: CON 344, 383.

CON 492 Honors Directed Study. (1–6)
selected semesters

CON 493 Honors Thesis. (1–6)
selected semesters

CON 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Cleanroom Construction. (3)
  fall

CON 495 Construction Planning and Scheduling. (3)
fall and spring
Various network methods of project scheduling, such as AOA, AON Pert, bar-charting, line-of-balance, and VPM techniques. Microcomputers used for scheduling, resource allocation, and time/cost analysis. Lecture, lab. Prerequisites: CON 383; STP 226. Pre- or corequisite: CON 389.
General Studies: CS

CON 496 Construction Contract Administration. (3)
fall and spring
Surveys administrative procedures of general and subcontractors. Studies documentation, claims, arbitration, litigation, bonding, insurance, and indemnification. Discusses ethical practices. Lecture, field trips. Prerequisites: COM 225 or ECE 300; senior standing.
General Studies: L

CON 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

School of Engineering

480/965-1726
ECG 105

Ronald J. Roedel, Director

PURPOSE

A large percentage of all engineering degree holders are found in leadership positions in a wide variety of industrial settings. Although an education in engineering is generally considered to be one of the best technical educations, it also provides an opportunity for the development of many additional attributes, including ethical and professional characteristics. In this era of rapid technological change, an engineering education serves society well as a truly liberal education. Society's needs in the decades ahead call for engineering contributions on a scale not previously experienced. The well-being of civilization as we know it may depend upon how effectively this resource is developed.

Students studying engineering at ASU are expected to acquire a thorough understanding of the fundamentals of mathematics and the sciences and their applications to the solution of problems in the various engineering fields. The program is designed to develop a balance between science and engineering and an understanding of the economic and

social consequences of engineering activity. The goals include the promotion of the general welfare of the engineering profession.

The courses offered are designed to meet the needs of the following students:

1. those who wish to pursue a career in engineering;
2. those who wish to do graduate work in engineering;
3. those who wish to have one or two years of training in mathematics, applied science, and engineering in preparation for some other technical career;
4. those who desire preengineering for the purpose of deciding which program to undertake or those who desire to transfer to another college or university; and
5. those who wish to take certain electives in engineering while pursuing another program in the university.

ADMISSION

For information regarding requirements for admission, transfer, retention, disqualification, and reinstatement, see "Undergraduate Admission," page 59; "Admission," page 200; "College Degree Requirements," page 204; and "Academic Standards," page 204.

Individuals who are beginning their initial college work in the School of Engineering should have completed certain secondary school units in addition to the minimum university admission requirements. Four units are required in mathematics; a course with trigonometry should be included. The laboratory sciences chosen must include at least one unit in physics and one unit in chemistry. Calculus, biology, and computer programming are also recommended. Students who do not meet the college's subject matter requirements may be required to complete additional university course work that may not apply toward an engineering degree. One or more of the courses—CHM 113 General Chemistry, CSE 180 Computer Literacy, CSE 181 Applied Problem Solving with Visual BASIC, MAT 170 Precalculus, and PHY 105 Basic Physics—may be required to satisfy omissions or deficiencies upon admission.

DEGREES

The Bachelor of Science in Engineering (B.S.E.) degree consists of three parts:

1. university requirements (e.g., General Studies, First-Year Composition);
2. an engineering core; and
3. a major.

The B.S. degree in Computer Science consists of two parts: (1) university requirements (e.g., General Studies, First-Year Composition); and (2) a major.

The courses identified for each of these parts are intended to meet requirements imposed by the university and by the professional accrediting agency, Accreditation Board for Engineering and Technology, Inc. (ABET), for programs in engineering and computing science, respectively.

In addition to First-Year Composition, the university requires, through the General Studies requirement, courses in literacy and critical inquiry, humanities and fine arts, social and behavioral sciences, mathematical studies, and natural sciences (see "General Studies," page 85). There are also requirements for historical awareness, global awareness, and cultural diversity in the United States. ABET imposes additional requirements, particularly in mathematics and the basic sciences and in the courses for the major.

The engineering core is an organized body of knowledge that serves as a foundation to engineering and to specialized studies in a particular engineering major.

The courses included in the engineering core are taught in such a manner that they serve as basic background material (1) for all engineering students who will be taking subsequent work in the same and related subject areas; and (2) for those students who may not desire to pursue additional studies in a particular subject area. Thus, subjects within the engineering core are taught with an integrity and quality appropriately relevant to the particular discipline but always with an attitude and concern for both engineering in general and for the particular major(s).

The majors available are of two types: (1) those associated with a particular department within the School of Engineering (for example, Electrical Engineering and Civil Engineering) and (2) those offered as concentrations in Engineering Special Studies (for example, premedical engineering). With the exception of the Computer Science major, all curricula are extensions beyond the engineering core and cover a wide variety of subject areas within each field. Some of the credits in the major are reserved for the student's use as an area of study. These credits are traditionally referred to as *technical electives.*

Majors and areas of study are offered by the seven departments:

Department of Chemical and Materials Engineering
Department of Civil and Environmental Engineering
Department of Computer Science and Engineering
Department of Electrical Engineering
Department of Industrial Engineering
Department of Mechanical and Aerospace Engineering
Harrington Department of Bioengineering

The major in Engineering Special Studies is administered by the Office of the Dean. Engineering Special Studies makes use of the general structure of the engineering curricula noted above and provides students with an opportunity for study in engineering concentrations not available in the traditional engineering curricula at ASU.

The first two years of study are concerned primarily with general education requirements, English proficiency, and the engineering core. The final two years of study are concerned with the engineering core and the major, with a considerable part of the time being spent on the major.

The semester-by-semester selection of courses may vary from one field to another, particularly at the upper-division level, and is determined by the student in consultation with

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

a faculty or professional advisor. An example of a typical full-time freshman-year schedule is shown below; depending on a particular student's circumstances, many other examples are possible.

Typical Freshman Year

CHM	114 General Chemistry for Engineers *SQ*	4
ECE	100 Introduction to Engineering Design *CS*	3
ECN	111 Macroeconomic Principles *SB*	3
	or ECN 112 Microeconomic Principles *SB* (3)	
ENG	101 First-Year Composition	3
ENG	102 First-Year Composition	3
MAT	270 Calculus with Analytic Geometry I *MA*	4
MAT	271 Calculus with Analytic Geometry II *MA*	4
PHY	121 University Physics I: Mechanics *SQ**	3
PHY	122 University Physics Laboratory I *SQ**	1
HU/SB and awareness area course		3
Total		31

* Both PHY 121 and 122 must be taken to secure SQ credit.

Well-prepared students who have no outside commitments can usually complete the program of study leading to an undergraduate degree in engineering in four years (eight semesters at 16 semester hours per semester). Many students, however, find it advantageous or necessary to devote more than four years to the undergraduate program by pursuing, in any semester, fewer courses than are regularly prescribed. Where omissions or deficiencies exist—e.g., in chemistry, computer programming, English, mathematics, and physics—the student must complete more than the minimum of 128 semester hours. Therefore, in cases of inadequate secondary preparation, poor health, or financial necessity requiring considerable time for outside work, the undergraduate program is extended beyond four years.

DEGREE REQUIREMENTS

The degree programs in engineering at ASU are intended to develop habits of quantitative thought having equal utility for both the practice of engineering and other professional fields. In response to the opportunities provided by changing technology, educational research, and industrial input, possible improvements of various aspects of these programs are routinely considered. It is the intent of the faculty that all students be appropriately prepared in the four areas described below.

1. *Oral and written English.* Communication skills are an essential component of an engineering education. All engineering students must complete the university First-Year Composition requirement (see "University Graduation Requirements," page 81), and the literacy and critical inquiry component (see "Five Core Areas," page 85) of the General Studies requirement, which involves two courses beyond First-Year Composition.
2. *Selected nonengineering topics.* This area ensures that the engineering student acquires a satisfactory level of basic knowledge in the humanities and fine arts, social and behavioral sciences, mathematical studies, and the natural sciences. Courses in these subjects give engineers an increased awareness of their social responsibilities, provide an understanding of related factors in the decision-making process, and also provide a foundation for the study of engineering. Required courses go toward fulfilling the General Studies requirement. Additional courses in mathematics and the basic sciences are selected to meet ABET requirements.

   Because of accreditation requirements, aerospace studies (AES) and military science (MIS) courses are not acceptable for engineering degree credit in fulfilling the humanities and fine arts and social and behavioral science portions of the General Studies requirement.
3. *Selected engineering topics.* This area involves courses in engineering science and engineering design. The courses further develop the foundation for the study of engineering and provide the base for specialized studies in a particular engineering discipline. The specific courses are included in the engineering core and in the major. While some departmental choices are allowed, all students are required to take ECE 100 Introduction to Engineering Design and ECE 300 Intermediate Engineering Design as part of the engineering core. These courses, together with other experiences in the engineering core and in the major, serve to integrate the study of design, the "process of devising a system, component, or process to meet desired needs" (ABET), throughout the engineering curricula.
4. *Specific engineering discipline.* This area provides a depth of understanding of a more definitive body of knowledge that is appropriate for a specific engineering discipline. Courses build upon the background provided by the earlier completed portions of the curriculum and include a major design experience as well as technical electives that may be selected by the student with the assistance of an advisor. The catalog material for the individual engineering majors describes specific departmental requirements.

COURSE REQUIREMENTS

A summary of the degree requirements is as follows:

First-Year Composition	6
General Studies/school requirements	56
Engineering core*	14–18
Major (including area of study or concentration)*	48–52
Minimum total	128

* The requirements for each of the majors offered are described in the department sections.

Specific course requirements for the B.S. and B.S.E. degrees follow.

First-Year Composition

Choose among the course combinations below 6

ENG 101 First-Year Composition (3)
ENG 102 First-Year Composition (3)

or

ENG 105 Advanced First-Year Composition (3)

Elective chosen with an advisor (3)
—or—
ENG 107 English for Foreign Students (3)
ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences[1]
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU and awareness area courses ..... 6 or 9
SB and awareness area course(s) ..... 3 or 6

Total 15

Literacy and Critical Inquiry
ECE 300 Intermediate Engineering Design *L* 3
ECE 400 Engineering Communications *L* 3
or approved department L course (3)

Total 6

Mathematical, Computation, and Quantitative Studies
ECE 100 Introduction to Engineering Design *CS* 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
Department mathematics elective 2

Total 20

Natural Sciences/Basic Sciences
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
PHY 121 University Physics I: Mechanics *SQ*[2] 3
PHY 122 University Physics Laboratory I *SQ*[2] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[3] 3
PHY 132 University Physics Laboratory II *SQ*[3] 1
Department basic science elective 3

Total 15

General Studies/school requirements total 56

[1] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU or SB requirements. Courses in the awareness areas of global, historical, and cultural diversity in the United States must also be represented in the program of study. One course must be upper-division.

[2] Both PHY 121 and 122 must be taken to secure SQ credit.

[3] Both PHY 131 and 132 must be taken to secure SQ credit.

Engineering Core Requirement

In addition to ECE 100 and 300, which also fulfill a portion of the university General Studies requirement, a minimum of five of the following eight courses are required. Courses selected are subject to departmental approval. See department requirements.

ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 214 Engineering Mechanics 4
ECE 313 Introduction to Deformable Solids 3
ECE 334 Electronic Circuits 4
ECE 340 Thermodynamics 3
or CHE 342 Applied Chemical Thermodynamics (4)
or MSE 430 Thermodynamics of Materials (3)
ECE 350 Structure and Properties of Materials 3
or ECE 351 Civil Engineering Materials (3)
or ECE 352 Properties of Electronic Materials (4)
Choose one microcomputer/microprocessor course below ..... 3 or 4
BME 470 Microcomputer Applications in Bioengineering (4)
CHE 461 Process Control *CS* (4)
CSE 225 Assembly Language Programming and Microprocessors (Motorola) (4)
or EEE 225 Assembly Language Programming and Microprocessors (Motorola) (4)
CSE 226 Assembly Language Programming and Microprocessors (Intel) (4)
or EEE 226 Assembly Language Programming and Microprocessors (Intel) (4)
IEE 463 Computer-Aided Manufacturing and Control *CS* (3)

GRADUATION REQUIREMENTS

To qualify for graduation from the School of Engineering, a student must have a minimum cumulative ASU GPA of 2.00 in addition to having a GPA of at least 2.00 for the courses in the major field.

PROFESSIONAL ACCREDITATION

The undergraduate programs in Aerospace Engineering, Bioengineering, Chemical Engineering, Civil Engineering, Computer Systems Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering are accredited by the Engineering Accreditation Commission of ABET, Baltimore, Maryland, 410/347-7700. The B.S. program in Computer Science is accredited by the Computer Science Accreditation Commission of ABET.

ANALYSIS AND SYSTEMS (ASE)

ASE 100 College Adjustment and Survival. (2)
fall and spring
Explores career goals and majors. Emphasizes organization and development of study skills, including time management, stress management, and use of the library.

ASE 194 Special Topics. (1–4)
fall
Topics may include the following:
- MEP Academic Success. (2)
- MEP Computer Basics. (1)

ASE 399 Cooperative Work Experience. (1)
fall, spring, summer
Work periods with industrial firms or government agencies alternated with full-time course work. Not open to students from other colleges. May be repeated for credit. Prerequisites: 45 hours completed in major with 2.50 GPA; dean approval.

ASE 490 Project in Design and Development. (2–3)
fall, spring, summer
Individual project in creative design and synthesis. May be repeated for credit. Prerequisite: senior standing.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ASE 496 Professional Seminar. (0)
fall and spring
Topics of interest to students in the engineering special and interdisciplinary studies.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ENGINEERING CORE (ECE)

ECE 100 Introduction to Engineering Design. (3)
fall and spring
Introduces engineering design; teaming; the profession of engineering; computer models in engineering; communication skills; quality and customer satisfaction. Prerequisites: high school computing and physics and algebra courses (or their equivalents).
General Studies: CS

ECE 194 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Introduction to Engineering Design I
- Introduction to Engineering Design II

ECE 200 Elements of Engineering Design. (3)
fall and spring
Advanced version of ECE 100 for students who transfer to ASU after completion of the stated prerequisites. Credit is allowed for only ECE 100 or 200. Lecture, lab. Prerequisites for engineering majors: ENG 101 (or 105); MAT 270; PHY 121, 122. Prerequisites for Construction majors: ENG 101 (or 105); MAT 270; PHY 111, 113. Pre- or corequisite for engineering majors: CHM 113 or 114 or 116.
General Studies: CS

ECE 201 Electrical Networks I. (4)
fall, spring, summer
Fundamental network theorems for dc and ac analysis. Utilization of SPICE. Design and measurement of linear analog electrical systems. Lecture, lab. Prerequisite: ECE 100 or 200. Pre- or corequisites: MAT 274 (or 275); PHY 131, 132.

ECE 210 Engineering Mechanics I: Statics. (3)
fall, spring, summer
Force systems, resultants, equilibrium, distributed forces, area moments, fluid statics, internal stresses, friction, energy criterion for equilibrium, and stability. Lecture, recitation. Prerequisites: ECE 100 or 194 (ST: Introduction to Engineering Design I and ST: Introduction to Engineering Design II) or 200; MAT 271 (or 291); PHY 121, 122.

ECE 212 Engineering Mechanics II: Dynamics. (3)
fall, spring, summer
Kinematics and kinetics of particles, translating and rotating coordinate systems, rigid body kinematics, dynamics of systems of particles and rigid bodies, and energy and momentum principles. Lecture, recitation. Prerequisites: ECE 210; MAT 274.

ECE 214 Engineering Mechanics. (4)
fall, spring, summer
Force systems, resultants, moments and equilibrium. Kinematics and kinetics of particles, systems of particles and rigid bodies. Energy and momentum principles. Lecture, recitation. Prerequisites: ECE 100 or 194 (ST: Introduction to Engineering Design I and ST: Introduction to Engineering Design II) or 200; MAT 274; PHY 121, 122.

ECE 300 Intermediate Engineering Design. (3)
fall, spring, summer
Engineering design process concentrating on increasing the ability to prepare well-written technical communication and to define problems and generate and evaluate ideas. Teaming skills enhanced. Prerequisites: ECE 100 or 194 (ST: Introduction to Engineering Design I and ST: Introduction to Engineering Design II) or 200; ENG 102 (or 105 or 108); at least two other engineering core courses.
General Studies: L

ECE 313 Introduction to Deformable Solids. (3)
fall, spring, summer
Equilibrium, strain-displacement relations, and stress-strain-temperature relations. Applications to force transmission and deformations in axial, torsional, and bending of bars. Combined loadings. Lecture, recitation. Prerequisites: ECE 210 (or 214); MAT 274.

ECE 334 Electronic Circuits. (4)
fall, spring, summer
Applies electric network theory to semiconductor circuits. Diodes/transistors/amplifiers/opamps/digital logic gates, and electronic instruments. Lecture, lab. Prerequisite: ECE 201.

ECE 340 Thermodynamics. (3)
fall, spring, summer
Work, heat, and energy transformations and relationships between properties; laws, concepts, and modes of analysis common to all applications of thermodynamics in engineering. Lecture, recitation. Prerequisites: CHM 114 (or 116); ECE 210 (or 214); PHY 131, 132. Pre- or corequisite: MAT 274.

ECE 350 Structure and Properties of Materials. (3)
fall, spring, summer
Basic concepts of material structure and its relation to properties. Application to engineering problems. Prerequisites: CHM 114 (or 116); PHY 121, 122.

ECE 351 Civil Engineering Materials. (3)
fall and spring
Structure and behavior of civil engineering materials. Laboratory investigations and test criteria. Lecture, lab. Prerequisite: ECE 313.

ECE 352 Properties of Electronic Materials. (4)
fall, spring, summer
Schrodinger's wave equation, potential barrier problems, bonds of crystals, the band theory of solids, semiconductors, superconductor dielectric, and magnetic properties. Prerequisites: CHM 114 (or 116); MAT 274 (or 275); PHY 241.

ECE 380 Probability and Statistics for Engineering Problem Solving. (3)
fall and spring
Applications-oriented course with computer-based experience using statistical software for formulating and solving engineering problems. 2 hours lecture, 2 hours lab. Prerequisite: MAT 271.
General Studies: CS

ECE 384 Numerical Methods for Engineers. (4)
fall and spring
Numerical methods and computational tools for selected problems in engineering. Prerequisites: ECE 100 or 194 (ST: Introduction to Engineering Design I and ST: Introduction to Engineering Design II) or 200; MAT 274; at least two other engineering core courses. Pre- or corequisite: MAT 272.

ECE 400 Engineering Communications. (3)
fall, spring, summer
Planning and preparing engineering publications and oral presentations, based on directed library research related to current engineering topics. Prerequisites: ENG 102 (or 105 or 108); completion of General Studies L requirement (or ECE 300); senior standing in an engineering major.
General Studies: L

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

SOCIETY, VALUES, AND TECHNOLOGY (STE)

STE 208 Patterns in Nature. (4)
fall and spring
Project-oriented science course with computer training to develop critical thinking and technical skills for student-oriented K–12 science lessons. Lecture, lab. Cross-listed as PHS 208. Credit is allowed for only PHS 208 or STE 208. Prerequisite: a college-level course in science or instructor approval.
General Studies: SQ

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Harrington Department of Bioengineering

www.eas.asu.edu/~bme
480/965-3028
ECG 334

Eric J. Guilbeau, Chair

Professors: Guilbeau, He, Towe

Associate Professors: Abbas, Garcia, Iasemidis, Jung, Massia, Pizziconi, Sweeney, Yamaguchi

Assistant Professors: Caplan, Muthuswamy, Panitch, Vernon

Senior Research Professional: Brandon

The faculty in the Harrington Department of Bioengineering offer the B.S.E. degree in Bioengineering. The major builds on a broad base of knowledge within the basic and mathematical sciences and the engineering core. The major offers graduates excellent career opportunities.

Faculty within the department also participate in the Engineering Special Studies program in premedical engineering, which is described separately in "Programs in Engineering Special Studies," page 255.

BIOENGINEERING—B.S.E.

Bioengineering (synonyms: biomedical engineering, medical engineering) is the discipline of engineering that applies principles and methods from engineering, the physical sciences, the life sciences, and the medical sciences to understand, define, and solve problems in medicine, physiology, and biology. The mission of the bioengineering program at ASU is to educate students to use engineering and scientific principles and methods to develop instrumentation, materials, diagnostic and therapeutic devices, artificial organs, or other equipment and technologies needed in medicine and biology and to discover new fundamental principles regarding the functioning and structure of living systems. The overall goal of the program is to produce high-quality graduates with a broad-based education in engineering and the life and natural sciences who are well prepared for further graduate study in bioengineering, a career in the medical device or biotechnology industries, a career in biomedical research, or entry into a medical or other health profession school.

The program's mission is achieved by having its faculty and graduate teachers fulfill the following objectives: to provide students with a strong foundation in mathematics, the physical and life sciences, and basic engineering; and to give students a balance of theoretical understanding and ability in order to apply modern techniques, skills, and tools for problem solving at the interface of engineering with the biological and medical sciences. Students demonstrate an ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and nonliving materials and systems. Students are able to design systems, devices, components, processes, and experiments with an understanding of manufacturing processes to meet real-world needs for solutions to problems in the biomedical device industries, medicine, and the life sciences. Students are able to communicate effectively as bioengineers in oral, written, computer-based, and graphical forms. Faculty seek to instill students with a sense of commitment to professionalism and ethical responsibility as bioengineers. Students are given opportunities to interact with and gain real-world experience with local and national medical device and technology industries, health-care organizations, educational institutions, and constituent populations. Faculty seek to develop within students an understanding of and positive approach toward continued lifelong learning of new technologies and relevant issues in the discipline of bioengineering.

Graduate degree programs in Bioengineering are offered at ASU at the master's and doctoral levels. For more information, consult the *Graduate Catalog*.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Bioengineering. A minimum of 50 upper-division semester hours is required. Students must attain a GPA of at least 2.00 for the courses in the major field.

GRADUATION REQUIREMENTS

In addition to fulfilling school and major requirements, students must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

COURSE REQUIREMENTS

The course work, in semester hours, for the undergraduate degree can be classified into the following categories:

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)

HU/SB and awareness area courses 12

Total 15

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Literacy and Critical Inquiry

BME	413	Biomedical Instrumentation *L*	3
BME	423	Biomedical Instrumentation Laboratory *L*	1
ECE	300	Intermediate Engineering Design *L*	3
Total			7

Natural Sciences/Basic Sciences

CHM	113	General Chemistry *SQ*	4
CHM	116	General Chemistry *SQ*	4
PHY	121	University Physics I: Mechanics *SQ*[1]	3
PHY	122	University Physics Laboratory I *SQ*[1]	1
PHY	131	University Physics II: Electricity and Magnetism *SQ*[2]	3
PHY	132	University Physics Laboratory II *SQ*[2]	1
Total			16

Mathematical Studies

ECE	100	Introduction to Engineering Design *CS*	3
ECE	384	Numerical Methods for Engineers	4
MAT	270	Calculus with Analytic Geometry I *MA*	4
MAT	271	Calculus with Analytic Geometry II *MA*	4
MAT	272	Calculus with Analytic Geometry III *MA*	4
MAT	274	Elementary Differential Equations *MA*	3
Total			22

General Studies/school requirements total 60

Engineering Core

ECE	201	Electrical Networks I	4
ECE	210	Engineering Mechanics I: Statics	3
ECE	334	Electronic Circuits	4
ECE	340	Thermodynamics	3
ECE	350	Structure and Properties of Materials	3
Total			17

Major

BIO	188	General Biology II *SQ*	4
BME	201	Introduction to Bioengineering *L*	3
BME	318	Biomaterials	3
BME	331	Biomedical Engineering Transport: Fluids	3
BME	334	Bioengineering Heat and Mass Transfer	3
BME	416	Biomechanics	3
BME	417	Biomedical Engineering Capstone Design I	3
BME	435	Physiology for Engineers	4
BME	470	Microcomputer Applications in Bioengineering	4
BME	490	Biomedical Engineering Capstone Design II	3
ECE	380	Probability and Statistics for Engineering Problem Solving *CS*	3
Technical electives			9
Minimum total			45

[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

The major BME courses require a grade of "C" or higher to advance in the program and to receive a baccalaureate degree.

Bioengineering Areas of Study

Technical electives should in general be selected from one of the following emphasis areas. Students can elect to emphasize biochemical engineering, bioelectrical engineering, biomaterials engineering, biomechanical engineering, biomedical imaging engineering, biosystems engineering, molecular and cellular bioengineering, or premedical engineering in their studies. A student may also, with prior approval of the department, select a general area of study or combination of courses that support a career in bioengineering not covered by the following areas.

Biochemical Engineering. This area is designed to strengthen the student's knowledge of chemistry and transport phenomena and is particularly well suited for students interested in biotechnology. Students should choose technical electives from the following:

BCH	361	Principles of Biochemistry or BCH 461 General Biochemistry (3)	3
BCH	462	General Biochemistry	3
CHE	475	Biochemical Engineering	3
CHE	476	Bioreaction Engineering	3
CHE	477	Bioseparation Processes	3
CHM	331	General Organic Chemistry	3
CHM	332	General Organic Chemistry	3
CHM	335	General Organic Chemistry Laboratory	1
CHM	336	General Organic Chemistry Laboratory	1
MIC	420	Immunology: Molecular and Cellular Foundations	3

Bioelectrical Engineering. This area is designed to strengthen the student's knowledge of electrical systems, electronics, and signal processing. Students considering a career in bioelectric phenomena, biocontrol systems, medical instrumentation, neural engineering, or electrophysiology should consider this area of study. Students should choose technical electives from the following:

BME	350	Signals and Systems for Bioengineers or EEE 303 Signals and Systems (3)	3
BME	419	Biocontrol Systems	3
EEE	302	Electrical Networks II	3
EEE	425	Digital Systems and Circuits or EEE 433 Analog Integrated Circuits (4)	4

Biomaterials Engineering. This area integrates the student's knowledge of materials science and engineering with biomaterials science and engineering concepts for the design of materials intended to be used for the development of medical and diagnostic devices. It emphasizes structure-property relationships of engineering materials (metals, polymers, ceramics, and composites) and biological materials, biomaterial-host response phenomena, technical and regulatory aspects of biomaterials testing and evaluation. Students interested in careers in the biomaterials, medical device, or biotechnology industries should consider this area of study. Students must take the following two courses:

MSE	353	Introduction to Materials Processing and Synthesis	3
MSE	355	Introduction to Materials Science and Engineering	3

Students should choose additional technical electives from the following:

BME	494	ST: Biopolymeric Drug Delivery	3
MSE	431	Corrosion and Corrosion Control	3
MSE	441	Analysis of Material Failures	3
MSE	470	Polymers and Composites	3
MSE	471	Introduction to Ceramics	3

Biomechanical Engineering. This area is designed to strengthen the student's knowledge of mechanics and control theory. Students interested in careers related to biomechanical analyses, the design of orthotic/prosthetic devices and orthopaedic implants, forensic biomechanics, and reha-

bilitation engineering should consider this area of study. While students may choose any combination of the following technical electives, it is recommended that courses be selected from one of three subareas: movement biomechanics, rehabilitation engineering, or orthopaedic biomechanics. The movement biomechanics area is designed to strengthen the student's knowledge of dynamics and control theory. Students interested in analyzing pathological movement disorders, sports techniques, and neuromuscular control should select courses from this area. Rehabilitation engineering emphasizes the design of highly functional products for people with disabilities. Biomechanical, electrical, and mechanical design procedures are used to develop new assistive devices, orthoses, and prostheses. The student primarily interested in the material properties of bones, cartilage, soft tissues, and the design of implants for tissue repair and replacement should select courses from the orthopaedic biomechanics area.

Recommended subarea selections of courses are as follows:

Movement Biomechanics

BME 350 Signals and Systems for Bioengineers 3
or EEE 303 Signals and Systems (3)
BME 419 Biocontrol Systems 3
ECE 212 Engineering Mechanics II: Dynamics 3
KIN 334 Functional Anatomy and Kinesiology 3
or KIN 414 Electromyographic Kinesiology *L* (3)

Rehabilitation Engineering

ECE 212 Engineering Mechanics II: Dynamics 3
IEE 437 Human Factors Engineering 3
or DSC 344 Human Factors in Design (3)
IND 354 Principles of Product Design 3
KIN 334 Functional Anatomy and Kinesiology 3
MAE 341 Mechanism Analysis and Design 3

Orthopaedic Biomechanics

ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
KIN 412 Biomechanics of the Skeletal System 3
MAE 404 Finite Elements in Engineering 3

Biomedical Imaging Engineering. This area is designed to strengthen the student's knowledge of radiation interactions, health physics, medical diagnostic imaging (MRI, PET, X-ray, CT), radiation protection, and nuclear instrumentation. Students considering careers in medical engineering or health physics should consider this area of study. Students should choose technical electives from the following or other departmental approved electives:

BME 350 Signals and Systems for Bioengineers 3
or EEE 303 Signals and Systems (3)
BME 494 ST: Scanning Probe Microscopy 3
EEE 460 Nuclear Concepts for the 21st Century 3
PHY 361 Introductory Modern Physics 3

Biosystems Engineering. This area is designed to strengthen the background of students interested in physiological systems modeling and analysis and design and evaluation of artificial organs and medical devices. Analyzing physiological systems and designing artificial organs require knowledge in integrating electrical, mechanical, transport, and thermofluid systems. Students considering careers in medical device industries, clinical engineering, or artificial organs should consider this area of study.

Students should choose technical electives from the following:

BME 350 Signals and Systems for Bioengineers 3
or BME 419 Biocontrol Systems (3)
BME 411 Biomedical Engineering I 3
BME 412 Biomedical Engineering II 3
BME 415 Biomedical Transport Processes 3
CHE 476 Bioreaction Engineering 3

Molecular and Cellular Bioengineering. This area is designed to strengthen and integrate the student's knowledge of molecular and cellular biology, biochemistry, and biomaterials science and engineering for the design of biomolecular- and cellular-based hybrid medical and diagnostic devices. It is particularly suited for students interested in pursuing graduate studies in molecular and cellular bioengineering and health-related biotechnologies.

Students are encouraged to choose the following courses:

BIO 353 Cell Biology 3
BME 494 ST: Biotechnology Laboratory Techniques 3
CHM 331 General Organic Chemistry 3

Students should choose additional or alternative technical electives from the following:

BCH 361 Principles of Biochemistry 3
or BCH 461 General Biochemistry (3)
BIO 340 General Genetics 4
or MBB 350 Applied Genetics (4)
or PLB 350 Applied Genetics (4)
BIO 343 Genetic Engineering and Society *L* 4
or MBB 343 Genetic Engineering and Society *L* (4)
BME 494 ST: Cell Biotechnology 3
BME 494 ST: Introduction to Molecular, Cellular, and Tissue Engineering 3
CHE 475 Biochemical Engineering 3
or CHE 476 Bioreaction Engineering (3)
or CHE 477 Bioseparation Processes (3)
CHM 335 General Organic Chemistry Laboratory 1

Premedical Engineering. This area is designed to meet the needs of students desiring entry into a medical, dental, or veterinary school. The course sequence provides an excellent background for advanced study leading to a career in research in the medical or life sciences. Technical electives must include the following:

CHM 331 General Organic Chemistry 3
CHM 332 General Organic Chemistry 3
CHM 335 General Organic Chemistry Laboratory 1
CHM 336 General Organic Chemistry Laboratory 1

Additional technical electives should be chosen from any of the course offerings listed for the other bioengineering areas of study listed. Note that, to fulfill medical school admission requirements, BIO 187 General Biology is required in addition to the degree requirements and cannot generally be used as a technical elective.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Bioengineering Program of Study
Typical Four-Year Sequence

First Year

First Semester

CHM	113	General Chemistry *SQ* 4
ECE	100	Introduction to Engineering Design *CS* 3
ENG	101	First-Year Composition 3
MAT	270	Calculus with Analytic Geometry I *MA* 4
Total		 14

Second Semester

CHM	116	General Chemistry *SQ* 4
ENG	102	First-Year Composition 3
MAT	271	Calculus with Analytic Geometry II *MA* 4
PHY	121	University Physics I: Mechanics *SQ*[1] 3
PHY	122	University Physics Laboratory I *SQ*[1] 1
Total		 15

Second Year

First Semester

BIO	188	General Biology II *SQ* 4
BME	201	Introduction to Bioengineering *L* 3
ECE	210	Engineering Mechanics I: Statics 3
MAT	272	Calculus with Analytic Geometry III *MA* 4
PHY	131	University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY	132	University Physics Laboratory II *SQ*[2] 1
Total		 18

Second Semester

ECE	201	Electrical Networks I 4
ECE	350	Structure and Properties of Materials 3
ECN	111	Macroeconomic Principles *SB* 3
		or ECN 112 Microeconomic Principles *SB* (3)
MAT	274	Elementary Differential Equations *MA* 3
HU/SB and awareness area course[3] 3		
Total		 16

Third Year

First Semester

BME	331	Biomedical Engineering Transport: Fluids 3
BME	435	Physiology for Engineers 4
ECE	300	Intermediate Engineering Design *L* 3
ECE	340	Thermodynamics 3
ECE	384	Numerical Methods for Engineers 4
Total		 17

Second Semester

BME	318	Biomaterials 3
BME	334	Bioengineering Heat and Mass Transfer 3
ECE	334	Electronic Circuits 4
ECE	380	Probability and Statistics for Engineering Problem Solving *CS* 3
HU/SB and awareness area course[3] 3		
Total		 16

Fourth Year

First Semester

BME	413	Biomedical Instrumentation *L*[4] 3
BME	416	Biomechanics 3
BME	417	Biomedical Engineering Capstone Design I 3
BME	423	Biomedical Instrumentation Laboratory *L*[4] 1
HU/SB and awareness area course[3] 3		
Technical elective(s) 3		
Total		 16

Second Semester

BME	470	Microcomputer Applications in Bioengineering 4
BME	490	Biomedical Engineering Capstone Design II 3
HU/SB and awareness area course[3] 3		
Technical electives 6		
Total		 16

Total degree requirements 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

[3] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU and SB requirements.

[4] Both BME 413 and 423 must be taken to secure *L* credit.

BIOENGINEERING (BME)

BME 201 Introduction to Bioengineering. (3)
fall and spring
Impact of bioengineering on society. Develops an awareness of the contributions of bioengineering to solve medical and biological problems. Prerequisite: ENG 101 or 102 or 105 or 108.
General Studies: L

BME 202 Global Awareness Within Biomedical Engineering Design. (3)
selected semesters
Introduction to ethical, legal, social, economic, and technical issues arising from the design and implementation of bioengineering technology. Lecture, critical discourse. Prerequisites: ECE 100; ECN 111 (or 112); ENG 102 (or 105).
General Studies: L/HU

BME 318 Biomaterials. (3)
spring
Material properties of natural and artificial biomaterials. Tissue and blood biocompatibility. Uses of materials to replace body parts. Prerequisite: ECE 350.

BME 331 Biomedical Engineering Transport: Fluids. (3)
fall
Transport phenomena with emphasis on biomedical engineering fluid systems. Prerequisites: MAT 274; PHY 131.

BME 334 Bioengineering Heat and Mass Transfer. (3)
spring
Applies the principles of heat and mass transfer phenomena to solution of problems in medicine and medical device design. Prerequisite: ECE 340. Prerequisite with a grade of "C" or higher: BME 331.

BME 350 Signals and Systems for Bioengineers. (3)
spring
Applies principles of calculus and ordinary differential equations to modeling and analysis of responses, signals, and signal transfers in biosystems. Prerequisites: ECE 201; MAT 272, 274.

BME 411 Biomedical Engineering I. (3)
once a year
Reviews diagnostic and prosthetic methods using engineering methodology. Introduces transport, metabolic, and autoregulatory processes in the human body. Prerequisite with a grade of "C" or higher: BME 334.

BME 412 Biomedical Engineering II. (3)
once a year
Reviews electrophysiology and nerve pacing applications. Introduces biomechanics and joint/limb replacement technology, cardiovascular and pulmonary fluid mechanics, and the application of mathematical modeling. Prerequisite: instructor approval.

BME 413 Biomedical Instrumentation. (3)
fall
Principles of medical instrumentation. Studies of medical diagnostic instruments and techniques for the measurement of physiologic vari-

ables in living systems. Prerequisites: ECE 300, 334. Prerequisite with a grade of "C" or higher: BME 435. Corequisite: BME 423.
General Studies: L (if credit also earned in BME 423)

BME 415 Biomedical Transport Processes. (3)
once a year
Principles of momentum, heat, and mass transport with applications to medical and biological systems and medical device design. Prerequisites: MAT 274; PHY 131.

BME 416 Biomechanics. (3)
fall
Mechanical properties of bone, muscle, and soft tissue. Static and dynamic analysis of human movement tasks such as locomotion. Prerequisite with a grade of "C" or higher: BME 318.

BME 417 Biomedical Engineering Capstone Design I. (3)
fall
Technical, regulatory, economic, legal, social, and ethical aspects of medical device systems engineering design. Lecture, field trips. Prerequisite: ECE 300. Prerequisites with a grade of "C" or higher: BME 318, 334.

BME 419 Biocontrol Systems. (3)
fall
Applies linear and nonlinear control systems techniques to analysis of neuromusculoskeletal, cardiovascular, thermal, and mass transfer systems of the body. Prerequisites: ECE 201; MAT 274.

BME 423 Biomedical Instrumentation Laboratory. (1)
fall
Laboratory experience with problems, concepts, and techniques of biomedical instrumentation in static and dynamic environments. Lab. Prerequisites: ECE 300, 334. Prerequisite with a grade of "C" or higher: BME 435. Corequisite: BME 413.
General Studies: L (if credit also earned in BME 413)

BME 435 Physiology for Engineers. (4)
fall
Physiology of the nervous, muscular, cardiovascular, endocrine, renal, and respiratory systems. Emphasizes use of quantitative methods in understanding physiological systems. Lecture, lab. Prerequisites: a combination of BIO 188 and CHM 116 and PHY 131 or only instructor approval.

BME 470 Microcomputer Applications in Bioengineering. (4)
spring
Uses microcomputers for real-time data collection, analysis, and control of experiments involving actual and simulated physiological systems. Lecture, lab. Prerequisites: ECE 100, 334. Prerequisite with a grade of "C" or higher: BME 435.

BME 490 Biomedical Engineering Capstone Design II. (1–5)
spring
Individual projects in medical systems or medical device design and development. Lecture, lab. Prerequisite with a grade of "C" or higher: BME 417.

BME 492 Honors Directed Study. (1–6)
selected semesters

BME 493 Honors Thesis. (1–6)
selected semesters

BME 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Biopolymeric Drug Delivery. (3)
- Biotechnology Laboratory Techniques. (3)
- Cell Biotechnology. (3)
- Introduction to Molecular, Cellular, and Tissue Engineering. (3)
- Scanning Probe Microscopy. (3)

BME 496 Professional Seminar. (1–3)
fall and spring
Professional and ethical aspects with a discussion of responsibilities. Lecture, field trips. Prerequisite: instructor approval.

BME 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Chemical and Materials Engineering

www.eas.asu.edu/~cme
480/965-3313
ECG 202

Subhash Mahajan, Chair

Regents' Professor: Mayer

Professors: Adams, Dey, Krause, Mahajan, Newman, Picraux, Raupp, Sieradzki

Associate Professors: Alford, Beaudoin, Beckman, Burrows, Rivera, Sierks, Van Schilfgaarde

Assistant Professors: Allen, Chawla, Dillner, Park, Razatos

The faculty in the Department of Chemical and Materials Engineering offer the B.S.E. degree in Chemical Engineering and in Materials Science and Engineering. Each of these majors builds on a broad base of knowledge within the basic and mathematical sciences and the engineering core. Each offers excellent career opportunities.

Chemical engineers design and operate processes that may include chemical change. They combine the science of chemistry with the discipline of engineering in order to solve complex problems in a wide variety of industries. Challenging job opportunities exist not only in the chemical and petroleum industries, but also in the plastics, electronics, computer, metals, space, food, drug, and health care industries. In these industries, chemical engineers practice in a wide variety of occupations including environmental control, surface treatments, energy and materials transformation, biomedical applications, fermentation, protein recovery, extractive metallurgy, and separations. In the environmental area, chemical engineers develop methods to reduce the pollution created in manufacturing processes, devise techniques to recover usable materials from wastes, design waste storage and treatment facilities, and design pollution control strategies.

Materials science and engineering uses fundamental knowledge in chemistry and physics to correlate relationships between the structure and processing of materials and their properties. Students educated in this discipline decide how to optimize existing materials or how to develop new

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

advanced materials and processing techniques. Students who major in materials science and engineering will find employment opportunities in a variety of industries and research facilities, which include aerospace, electronics, energy conversion, manufacturing, medical devices, semiconductors, and transportation.

CHEMICAL ENGINEERING—B.S.E.

Chemical engineers are generally concerned with transfer within and between liquid, gas, and solid phases and the chemical changes that may also occur. The engineers design and operate processes that accommodate such changes, including the chemical activation of materials. Typically this involves complex multicomponent systems wherein the interactions between species have to be considered and analyzed. The new challenge in chemical engineering is to apply the principles of fluid dynamics, mass transfer, solution thermodynamics, reaction kinetics, and separation techniques to technological endeavors such as pollution control within manufacturing and the environment, integrated circuit design, solid-state surface treatments, and materials processing.

Consequently, in addition to the chemical and petroleum industries, chemical engineers find challenging opportunities in the plastics, solid-state, electronics, computer, metals, space, food, drug, and health care industries, where they practice in a wide variety of occupations, such as environmental control, surface treatments, energy and materials transformations, biomedical applications, fermentation, protein recovery, extractive metallurgy, and separations. While a large percentage of the industrial positions are filled by graduates with bachelor's degrees, there are lucrative and creative opportunities in research and development for those who acquire postgraduate education.

Subspecializations have developed within the profession. However, the same broad body of knowledge is generally expected of all chemical engineers for maximum flexibility in industrial positions. The preparation for chemical engineering is accomplished by a blend of classroom instruction and laboratory experience.

The chemical engineering faculty are committed to fully developing the potential of our students by providing a unique learning environment that encourages the students to take responsibility for their education; exposes the students to a diversity of viewpoints and teaching/learning styles; prepares the students to work in teams to solve real-world, multi-disciplinary problems; and sets them on a path of lifelong learning. The faculty demand high quality work. They are fair, honest, courteous, and professional. They are sensitive to students' needs and dedicated to student success. They are interested in capitalizing on the nontraditional student demographics, including cultural background, age group, and the full- and part-time employed, to develop a vibrant and flexible education and research environment.

To achieve this commitment, the following program educational objectives were established by the chemical engineering faculty:

1. Graduates will have a strong foundation in mathematics, science, and engineering with a balance of theoretical understanding and ability to apply modern techniques, skills, and tools to solve real-world chemical engineering problems.
2. Graduates will have the skills and experience necessary to design component systems and processes for the manufacturing of chemical engineering products.
3. Graduates will have the skills and experience necessary to communicate effectively in oral, written, and graphical forms to various types of audiences.
4. Graduates will have the skills necessary to perform as engineers in a professional and ethical manner.
5. Graduates will have the skills and attitudes for continued life-long learning of new technologies and concepts.
6. Graduates will have opportunities to interact with local industries, educational institutions, and constituent populations.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Chemical Engineering. A minimum of 50 upper-division semester hours is required. Students must attain a GPA of at least 2.00 for the courses in the major field.

GRADUATION REQUIREMENTS

In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

COURSE REQUIREMENTS

The course work for the undergraduate degree can be classified into the following categories (in semester hours):

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU/SB and awareness area courses[1] 12

Total 15

Literacy and Critical Inquiry

CHE 462 Process Design *L* 3
ECE 300 Intermediate Engineering Design *L* 3

Total 6

Natural Sciences/Basic Sciences

CHM 113 General Chemistry *SQ* 4
CHM 116 General Chemistry *SQ* 4

CHM	331	General Organic Chemistry 3
CHM	335	General Organic Chemistry Laboratory 1
PHY	121	University Physics I: Mechanics *SQ*[2] 3
PHY	122	University Physics Laboratory I *SQ*[2] 1
PHY	131	University Physics II: Electricity and Magnetism *SQ*[3] . 3
Total		 19

Mathematical Studies

ECE	100	Introduction to Engineering Design *CS* 3
ECE	384	Numerical Methods for Engineers 4
MAT	270	Calculus with Analytic Geometry I *MA* 4
MAT	271	Calculus with Analytic Geometry II *MA* 4
MAT	272	Calculus with Analytic Geometry III *MA* 4
MAT	274	Elementary Differential Equations *MA* 3
Total		 22

General Studies/school requirements total 62

Engineering Core

CHE	311	Introduction to Chemical Processing 3
CHE	342	Applied Chemical Thermodynamics 4
CHE	461	Process Control *CS* 4
ECE	350	Structure and Properties of Materials 3
ECE Core elective		 3
Total		 17

Major

CHE	331	Transport Phenomena I: Fluids 3
CHE	334	Transport Phenomena II: Heat and Mass Transfer 4
CHE	352	Transport Laboratories 2
CHE	432	Principles of Chemical Engineering Design 2
CHE	433	Modern Separations 3
CHE	442	Chemical Reactor Design 3
CHE	451	Chemical Engineering Laboratory 2
CHM	332	General Organic Chemistry 3
ECE	380	Probability and Statistics for Engineering Problem Solving *CS* 3
Technical electives		 18
Total		 43

[1] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU or SB requirements.

[2] Both PHY 121 and 122 must be taken to secure SQ credit.

[3] Both PHY 131 and 132 must be taken to secure SQ credit.

Students should consult with their department academic advisors to ensure that all requirements are met.

The technical elective courses must be selected from upper-division courses with an advisor's approval and must include two three-semester-hour chemistry courses; a three-semester-hour natural science or materials course; and a three-semester-hour chemical engineering course.

To fulfill accreditation requirements and to prepare adequately for the advanced chemistry courses, Chemical Engineering majors are required to take the CHM 113 and 116 introductory chemistry sequence (CHM 117 and 118 are acceptable substitutes). Other freshman chemistry courses are *not acceptable,* and transfer students who have taken another chemistry course may be required to enroll in CHM 113 and 116.

Chemical Engineering Areas of Study

Students who wish to specialize may develop an area of interest through the use of technical electives and selective substitutions for required courses. Substitutions must be approved by the advisor and the Department Standards Committee and must be consistent with ABET accreditation criteria. No substitution of CHE 462 is allowed. The following are possible elective areas with suggested courses. A student may choose electives within the general department guidelines and does not have to select one of the areas listed.

Biochemical. Students wishing to prepare for a career in biotechnology, fermentation, food processing, pharmaceuticals, and other areas within biochemical engineering should select from the following:

Chemistry Electives

BCH	361	Principles of Biochemistry 3
		or BCH 461 General Biochemistry (3)
BCH	462	General Biochemistry 3

Technical Electives

CHE	475	Biochemical Engineering 3
CHE	476	Bioreaction Engineering 3
CHE	477	Bioseparation Processes 3
CHE	494	ST: Biotechnology Techniques 3

Biomedical. Students who are interested in biomedical engineering but wish to maintain a strong, broad chemical engineering base should select from the following:

Chemistry Electives

BCH	361	Principles of Biochemistry 3
		or BCH 461 General Biochemistry (3)
BCH	462	General Biochemistry 3

Technical Electives

BME	318	Biomaterials 3
BME	435	Physiology for Engineers 4

Environmental. Students interested in environmental engineering are encouraged to pursue a B.S.E. degree in Chemical Engineering with this area of study. Students interested in the management of hazardous wastes and air and water pollution should select from the following:

Chemistry Electives

BCH	361	Principles of Biochemistry 3
		or BCH 461 General Biochemistry (3)
CHM	302	Environmental Chemistry 3
CHM	481	Geochemistry 3
CHM	494	ST: Chemistry of Global Climate Change 3

Technical Electives

CEE	561	Physical-Chemical Treatment of Water and Waste 3
CEE	563	Environmental Chemistry Laboratory 3
CHE	474	Chemical Engineering Design for the Environment 3
CHE	478	Industrial Water Quality Engineering 3
CHE	479	Air Quality Control 3

Materials. Students interested in the development and production of new materials such as alloys, ceramics, composites, polymers, semiconductors, and superconductors should select from the following:

Chemistry Electives

CHM	345	Physical Chemistry I 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

CHM 346 Physical Chemistry II 3
CHM 453 Inorganic Chemistry 3
CHM 471 Solid-State Chemistry 3

Technical Electives
BME 318 Biomaterials 3
CHE 458 Semiconductor Material Processing 3
ECE 352 Properties of Electronic Materials 4
MSE 353 Introduction to Materials Processing and Synthesis 3
MSE 354 Experiments in Materials Synthesis and Processing 2
MSE 431 Corrosion and Corrosion Control 3
MSE 470 Polymers and Composites 3

Premedical. Students planning to attend medical school should select courses from those listed under the biomedical area. In addition, BIO 187, 188, and CHM 336 must be taken to satisfy medical-school requirements but are not counted toward the Chemical Engineering bachelor's degree.

Process Engineering. The engineering core and required chemical engineering courses serve as a suitable background for students intending to enter the traditional petrochemical and chemical process industries. Students can build on this background by selecting courses with the approval of their advisor. Examples of these courses are as follows:

CHE 474 Chemical Engineering Design for the Environment 3
CHE 478 Industrial Water Quality Engineering 3
CHE 479 Air Quality Control 3
CHE 494 ST: Advanced Process Control 3
CHE 528 Process Optimization Techniques 3
CHE 556 Separation Processes 3
CHE 563 Chemical Engineering Design 3
MAE 436 Combustion 3

Semiconductor Processing. Students interested in the development and manufacturing of semiconductor and other electronic devices should select from the following:

Chemistry Electives
CHM 345 Physical Chemistry I 3
CHM 346 Physical Chemistry II 3
CHM 453 Inorganic Chemistry 3
CHM 471 Solid-State Chemistry 3

Technical Electives
CHE 458 Semiconductor Material Processing 3
CHE 494 Special Topics 1–4
ECE 352 Properties of Electronic Materials 4
EEE 435 Microelectronics 3
EEE 436 Fundamentals of Solid-State Devices 3
EEE 439 Semiconductor Facilities and Cleanroom Practices 3
MSE 353 Introduction to Materials Processing and Synthesis 3
MSE 354 Experiments in Materials Synthesis and Processing 2

Chemical Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 113 General Chemistry *SQ* 4
ECE 100 Introduction to Engineering Design *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
Total 14

Second Semester
CHM 116 General Chemistry *SQ* 4
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
Total 15

Second Year

First Semester
CHE 311 Introduction to Chemical Processing 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
ECE core elective 3
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
MAT 274 Elementary Differential Equations *MA* 3
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
Total 18

Second Semester
CHE 331 Transport Phenomena I: Fluids 3
ECE 350 Structure and Properties of Materials 3
ECE 384 Numerical Methods for Engineers 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
HU/SB and awareness area course 3
Total 17

Third Year

First Semester
CHE 334 Transport Phenomena II: Heat and Mass Transfer 4
CHE 342 Applied Chemical Thermodynamics 4
CHM 331 General Organic Chemistry 3
CHM 335 General Organic Chemistry Laboratory 1
ECE 300 Intermediate Engineering Design *L* 3
Total 15

Second Semester
CHE 352 Transport Laboratories 2
CHE 433 Modern Separations 3
CHE 442 Chemical Reactor Design 3
CHM 332 General Organic Chemistry 3
HU/SB and awareness area course 3
Technical elective 3
Total 17

Fourth Year

First Semester
CHE 432 Principles of Chemical Engineering Design 2
CHE 451 Chemical Engineering Laboratory 2
CHE 461 Process Control *CS* 4
HU/SB and awareness area course 3
Technical electives 6
Total 17

Second Semester
CHE 462 Process Design *L* 3
HU/SB and awareness area course 3
Technical electives 9
Total 15

Total degree requirements 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

MATERIALS SCIENCE AND ENGINEERING—B.S.E.

Materials engineers create innovations that result in new and improved materials that help drive the cutting edge of new technologies in many industries. These include the auto, aerospace, electronics, semiconductor, materials production, and health professions. The space shuttle, lightweight cars, and today's fastest computers have all been developed using the latest materials technologies. In advancing today's technologies, materials engineers fulfill a wide range of job responsibilities that significantly impact other engineering disciplines and include

1. selecting the best material for a given application or developing innovative materials and processing techniques for new applications;
2. characterizing and analyzing failed products in order to redesign more reliable and robust engineering components; and
3. impacting technological advances in larger-scale projects through working in a team environment with other engineers from the chemical, electrical, mechanical, aerospace and other engineering disciplines.

The Materials Science and Engineering degree program at ASU has outstanding faculty who have national reputations in the areas of both structural and electronic materials. The faculty bring significant professional expertise to classroom teaching, which is complemented by enlightening experimental work in the program's contemporary, well-equipped laboratory facilities. This atmosphere promotes quality undergraduate research projects and senior design projects that frequently result in patents and technical publications. Examples of recent patent applications include an improved method for producing artificial Teflon arteries and an improved technique for testing steel in air bag containers. Such preparation and experiences give the programs's graduates an edge in seeking employment at the best companies or admission to the nation's leading graduate schools. The program's educational experience is also enhanced by numerous scholarships available to students ranging from entering freshman to final-year seniors.

The Materials Science and Engineering degree program is accredited by the national organization of Accreditation Board for Engineering and Technology, Inc. As such, it has an identifiable program mission, objectives, and outcomes, which reflect, encompass, and embody the unique educational development that a student experiences as he or she progresses through the program to graduation. The mission and objectives are described below.

The mission of the Materials Science and Engineering degree program is to provide a solid educational foundation in the application of the principles of science and engineering toward the design, utilization, and improvement of materials in engineering components and systems for the betterment of society. This mission, with the associated objectives and outcomes, also supports the mission and goals of ASU and the College of Engineering and Applied Sciences. To accomplish this mission, the program's graduates fulfill the following objectives: (1) graduates will have the strong educational foundation in materials science and engineering that promotes success in the broad range of career opportunities available in graduate school, industry, and government; and (2) graduates will have the personal skills and values that promote their success in the rapidly changing, culturally diverse workplace that reflects the needs of contemporary society.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Materials Science and Engineering. A minimum of 50 upper-division semester hours is required. Students must attain a GPA of at least 2.00 for the courses in the major field.

Graduation Requirements. In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

Course Requirements. The undergraduate curriculum requires that students take a series of interdisciplinary courses of fundamental importance to an understanding of all engineering materials. Following these are additional courses that may be taken as technical electives to develop an area of study. The courses for the undergraduate degree can be classified into the following categories (in semester hours):

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU, SB, and awareness area courses 12

Total 15

Literacy and Critical Inquiry

ECE 300 Intermediate Engineering Design *L* 3
MSE 482 Materials Engineering Design *L* 3

Total 6

Natural Sciences/Basic Sciences

CHM 113 General Chemistry *SQ* 4
CHM 116 General Chemistry *SQ* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Total 16

Mathematical Studies
ECE 100 Introduction to Engineering Design *CS* 3
MAT 242 Elementary Linear Algebra 2
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
Total 20

General Studies/school requirements total 57

Engineering Core
ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 313 Introduction to Deformable Solids 3
ECE 350 Structure and Properties of Materials 3
MSE 430 Thermodynamics of Materials 3
Total 16

Major
Select two of the following four courses[3] 6
CHM 325 Analytical Chemistry (3)
CHM 331 General Organic Chemistry (3)
CHM 341 Elementary Physical Chemistry (3)
PHY 361 Introductory Modern Physics (3)
Technical electives 12
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
MSE 111 Challenges in Materials Engineering 1
MSE 353 Introduction to Materials Processing and Synthesis 3
MSE 354 Experiments in Materials Synthesis and Processing 2
MSE 355 Introduction to Materials Science and Engineering 3
MSE 420 Physical Metallurgy 3
MSE 421 Physical Metallurgy Laboratory 1
MSE 440 Mechanical Properties of Solids 3
MSE 450 X-Ray and Electron Diffraction 3
MSE 470 Polymers and Composites 3
MSE 471 Introduction to Ceramics 3
MSE 490 Capstone Design Project 3
Total 49

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.
[3] To take CHM 341 Elementary Physical Chemistry, CHM 331 Organic Chemistry must be taken as the prerequisite.

Materials Science and Engineering Areas of Study

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Biomaterials. Students interested in the materials used in the body and other living systems to improve or replace body components should choose from the following technical electives:

BME 318 Biomaterials 3
BME 411 Biomedical Engineering I 3
BME 412 Biomedical Engineering II 3
BME 413 Biomedical Instrumentation *L*[*] 3
BME 416 Biomechanics 3

[*] Both BME 413 and 423 must be taken to secure L credit.

Ceramic Materials. Students who want to develop an understanding of the chemistry and processing that control the structure and properties of ceramics and their application should select from these technical electives:

CHM 331 General Organic Chemistry 3
CHM 332 General Organic Chemistry 3
CHM 471 Solid-State Chemistry 3
EEE 435 Microelectronics 3
EEE 436 Fundamentals of Solid-State Devices 3
EEE 439 Semiconductor Facilities and Cleanroom Practices 3

Energy Systems. Students interested in the materials used in energy conversion systems such as solar energy or nuclear energy should choose from the following technical electives:

MAE 441 Principles of Design 3
MAE 442 Mechanical Systems Design 4
MSE 431 Corrosion and Corrosion Control 3
MSE 441 Analysis of Material Failures 3

Integrated Circuit Materials. Students interested in the materials used in the semiconductor industry and in how they are processed to achieve the desired properties should choose from the following technical electives:

CHE 458 Semiconductor Material Processing 3
EEE 435 Microelectronics 3
EEE 436 Fundamentals of Solid-State Devices 3
EEE 439 Semiconductor Facilities and Cleanroom Practices 3

Manufacturing and Materials Processing. Students interested in the manufacturing and processing of materials for a broad base of applications should choose from the following technical electives:

CHE 458 Semiconductor Material Processing 3
IEE 300 Economic Analysis for Engineers 3
IEE 360 Manufacturing Processes 3
or MAE 351 Manufacturing Processes (3)
IEE 361 Manufacturing Processes Lab 1
IEE 368 Facilities Analysis and Design 3
IEE 369 Work Analysis and Design 3
IEE 431 Engineering Administration 3
IEE 437 Human Factors Engineering 3
IEE 461 Production Control 3
IEE 463 Computer-Aided Manufacturing Control *CS* 3
MAE 422 Mechanics of Materials 4
MAE 441 Principles of Design 3
MAE 442 Mechanical Systems Design 4
MAE 431 Corrosion and Corrosion Control 3
MSE 441 Analysis of Material Failures 3

Mechanical Metallurgy. Students interested in understanding the design, processing, and manufacturing of metals for structural applications, such as autos, airplanes, and buildings, should choose from the following technical electives:

MAE 415 Vibration Analysis 4
MAE 422 Mechanics of Materials 4
MAE 441 Principles of Design 3
MAE 442 Mechanical Systems Design 4

MSE 431 Corrosion and Corrosion Control 3
MSE 441 Principles of Design 3

Metallic Materials Systems. Students interested in building an understanding of the basis for the design and processing of metals and alloys should choose from the following technical electives:

MAE 351 Manufacturing Processes 3
MSE 431 Corrosion and Corrosion Control 3
MSE 441 Analysis of Material Failures 3

Polymers and Composites. Students who desire to build an understanding of the chemical and processing basis for the properties of polymers and their applications, including composite systems, should select from the following technical electives:

CHM 331 General Organic Chemistry 3
CHM 332 General Organic Chemistry 3
CHM 471 Solid-State Chemistry 3
MSE 441 Analysis of Material Failures 3

Materials Science and Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 113 General Chemistry *SQ* 4
ECE 100 Introduction to Engineering Design *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MSE 111 Challenges in Materials Engineering 1
Total 15

Second Semester
CHM 116 General Chemistry *SQ* 4
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
Total 15

Second Year

First Semester
ECE 210 Engineering Mechanics I: Statics 3
ECE 350 Structure and Properties of Materials 3
MAT 242 Elementary Linear Algebra 2
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Total 16

Second Semester
ECE 201 Electrical Networks I 4
ECE 313 Introduction to Deformable Solids 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
MAT 274 Elementary Differential Equations *MA* 3
Technical elective 3
Total 16

Third Year

First Semester
ECE 300 Intermediate Engineering Design *L* 3
ECN 111 Macroeconomic Principles *SB* 3
MSE 353 Introduction to Materials Processing and Synthesis 3
MSE 355 Introduction to Materials Science and Engineering 3
Advanced Science Course[3] 3
Total 15

Second Semester
MSE 354 Experiments in Materials Synthesis and Processing 2
MSE 420 Physical Metallurgy 3
MSE 421 Physical Metallurgy Laboratory 1
MSE 430 Thermodynamics of Materials 3
MSE 450 X-Ray and Electron Diffraction 3
HU/SB and awareness area courses[4] 3
Advanced Science Course[3] 3
Total 18

Fourth Year

First Semester
MSE 440 Mechanical Properties of Solids 3
MSE 470 Polymers and Composites 3
MSE 471 Introduction to Ceramics 3
MSE 482 Materials Engineering Design *L* 3
Technical electives 3
HU/SB and awareness area course[4] 3
Total 18

Second Semester
MSE 490 Capstone Design Project 3
HU/SB and awareness area course[4] 6
Technical elective 6
Total 15

Total degree requirements 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.
[3] To take CHM 341 Elementary Physical Chemistry, CHM 331 General Organic Chemistry must be taken as the prerequisite.
[4] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU and SB requirements.

GRADUATE STUDY

The faculty in the Department of Chemical and Materials Engineering also offer graduate programs leading to the M.S., M.S.E., and Ph.D. degrees. These programs provide a blend of classroom instruction and research. Many diverse topical and relevant research projects are available for thesis topics. Students interested in these programs should contact the department for up-to-date descriptive literature.

CHEMICAL ENGINEERING (CHE)

CHE 311 Introduction to Chemical Processing. (3)
fall
Applies chemical engineering analysis and problem solving to chemical processes material and energy balance methods and skills. Prerequisites: CHM 116; MAT 271.

L literacy and critical inquiry / MA mathematics / CS computer/statistics/quantitative applications / HU humanities and fine arts / SB social and behavioral sciences / SG natural science—general core courses / SQ natural science—quantitative / C cultural diversity in the United States / G global / H historical / See "General Studies," page 85.

CHE 331 Transport Phenomena I: Fluids. (3)
spring
Transport phenomena, with emphasis on fluid systems. Prerequisites: CHE 311; MAT 274.

CHE 334 Transport Phenomena II: Heat and Mass Transfer. (4)
fall
Applies heat and mass transport principles. Design of heat exchangers and continuous contactors. Prerequisite: CHE 331.

CHE 342 Applied Chemical Thermodynamics. (4)
fall
Applies conservation and accounting principles with nonideal property estimation techniques to model phase and chemical equilibrium processes. Lecture, recitation. Prerequisite: CHE 311. Pre- or corequisite: MAT 272.

CHE 352 Transport Laboratories. (2)
spring
Demonstrates transport phenomena principles with experiments in fluid flow, heat, and mass transfer. Prerequisite: ECE 300.

CHE 432 Principles of Chemical Engineering Design. (2)
fall
Multicomponent distillation, engineering economics, equipment sizing and costs, plant operation economics, and simulation and optimization techniques. Prerequisite: CHE 342.

CHE 433 Modern Separations. (3)
spring
Design of modern separation equipment in chemical engineering other than fractionation. Prerequisites: CHE 334, 342.

CHE 442 Chemical Reactor Design. (3)
spring
Applies kinetics to chemical reactor design. Prerequisite: CHE 342.

CHE 451 Chemical Engineering Laboratory. (2)
fall
Operation, control, and design of experimental and industrial process equipment; independent research projects. 6 hours lab. Prerequisites: CHE 352; ECE 384.

CHE 458 Semiconductor Material Processing. (3)
selected semesters
Introduces the processing and characterization of electronic materials for semiconductor applications. Prerequisite: CHE 342.

CHE 461 Process Control. (4)
fall
Process dynamics, instrumentation, and feedback applied to automatic process control. Lecture, lab.
General Studies: CS

CHE 462 Process Design. (3)
spring
Applies economic principles to optimize equipment selection and design; development and design of process systems. Prerequisites: CHE 432, 442.
General Studies: L

CHE 474 Chemical Engineering Design for the Environment. (3)
fall
Conflict of processing materials and preserving the natural resources. Teaches students to understand and value the environment and attempt to control our impact. Prerequisite: CHE 342.

CHE 475 Biochemical Engineering. (3)
selected semesters
Applies chemical engineering methods, mass transfer, thermodynamics, and transport phenomena to industrial biotechnology. Prerequisite: instructor approval.

CHE 476 Bioreaction Engineering. (3)
selected semesters
Principles of analysis and design of reactors for processing with cells and other biologically active materials; applications of reaction engineering in biotechnology. Prerequisite: instructor approval.

CHE 477 Bioseparation Processes. (3)
selected semesters
Principles of separation of biologically active chemicals; the application, scale-up, and design of separation processes in biotechnology. Prerequisite: instructor approval.

CHE 478 Industrial Water Quality Engineering. (3)
fall
Chemical treatment processing, quality criteria and control, system design, and water pollutants. Prerequisites: CHE 331; senior standing.

CHE 479 Air Quality Control. (3)
fall
Air pollutant control, effects, and origins. Chemical and physical processes, including combustion, control equipment design, dispersion, and sampling. Prerequisites: CHE 331; senior standing.

CHE 490 Chemical Engineering Projects. (1–5)
fall, spring, summer
Individual projects in chemical engineering operations and design. Prerequisite: instructor approval.

CHE 492 Honors Directed Study. (1–6)
selected semesters

CHE 493 Honors Thesis. (1–6)
selected semesters

CHE 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Advanced Process Control. (3)
- Biotechnology Techniques. (3)

CHE 496 Professional Seminar. (1–3)
fall and spring
Professional and ethical aspects with a discussion of responsibilities. Lecture, field trips. Prerequisite: instructor approval.

CHE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MATERIALS SCIENCE AND ENGINEERING (MSE)

MSE 111 Challenges in Materials Engineering. (1)
fall and spring
Introduces current issues and concepts of materials engineering, relationship between materials properties, application to engineering problems. Pre- or corequisite: ECE 100.

MSE 353 Introduction to Materials Processing and Synthesis. (3)
fall
Principles of materials structure and properties with emphasis on applications in bulk and thin film materials processing and synthesis. Prerequisites: CHM 116 and PHY 131 (or their equivalents).

MSE 354 Experiments in Materials Synthesis and Processing. (2)
spring
Small groups of students complete three experiments selected from a list. Each is supervised by a selected faculty member. Lab. Prerequisite: MSE 353 (or its equivalent).

MSE 355 Introduction to Materials Science and Engineering. (3)
fall
Elements of the structure of metals and alloys, measurement of mechanical properties, and optical metallography. Lecture, lab, field trips. Prerequisite: CHM 114 or 116.

MSE 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Computer and Experimental Methods in Materials. (3)

MSE 420 Physical Metallurgy. (3)
spring
Crystal structure and defects. Phase diagrams, metallography, solidification and casting, deformation, and annealing. Prerequisite: ECE 350.

MSE 421 Physical Metallurgy Laboratory. (1)
spring
Focuses on analysis of microstructure of metals and alloys and includes correlation with mechanical properties to some extent. Lab. Pre- or corequisite: MSE 420.

MSE 430 Thermodynamics of Materials. (3)
spring
Principles of statistical mechanics, statistical thermodynamics of single crystals, solutions, phase equilibrium, free energy of reactions, free electron theory, and thermodynamics of defects. Prerequisite: ECE 350.

MSE 431 Corrosion and Corrosion Control. (3)
spring in odd years
Introduces corrosion mechanisms and methods of preventing corrosion. Topics include: electrochemistry, polarization, corrosion rates, oxidation, coatings, and cathodic protection. Prerequisite: ECE 350.

MSE 440 Mechanical Properties of Solids. (3)
fall
Effects of environmental and microstructural variables of mechanical properties, including plastic deformation, fatigue, creep, brittle fracture, and internal friction. Prerequisite: ECE 350.

MSE 441 Analysis of Material Failures. (3)
spring in even years
Identifies types of failures. Analytical techniques. Fractography, SEM, nondestructive inspection, and metallography. Mechanical and electronic components. Prerequisite: ECE 350.

MSE 450 X-Ray and Electron Diffraction. (3)
spring
Fundamentals of x-ray diffraction, transmission electron microscopy, and scanning electron microscopy. Techniques for studying surfaces, internal microstructures, and fluorescence. Lecture, demonstrations. Prerequisite: ECE 350.

MSE 470 Polymers and Composites. (3)
fall
Relationship between chemistry, structure, and properties of engineering polymers. Design, properties, and behavior of fiber composite systems. Cross-listed as MAE 455. Credit is allowed for only MAE 455 or MSE 470. Prerequisites: ECE 313, 350.

MSE 471 Introduction to Ceramics. (3)
fall
Principles of structure and property relations in ceramic materials. Processing techniques. Applications in mechanical, electronic, and superconducting systems. Prerequisite: ECE 350.

MSE 482 Materials Engineering Design. (3)
fall
Principles of the design process. Feasibility and optimization. Manufacturing processes, materials selection, failure analysis, and economics. Prerequisites: ECE 300; ENG 101 (or 105 or 107); MSE 354, 355.
General Studies: L

MSE 490 Capstone Design Project. (1–3)
fall and spring
For small groups in fundamental or applied aspects of engineering materials; emphasizes experimental problems and design. Prerequisites: MSE 430, 440, 450.

MSE 492 Honors Directed Study. (1–6)
selected semesters

MSE 493 Honors Thesis. (1–6)
selected semesters

MSE 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Composite Materials. (3)
- Growth and Processing of Semiconductors. (3)
- Growth and Processing of Semiconductors Laboratory. (1)
- Nanomaterials: Synthesis and Evaluation. (3)
- Scanning Probe Microscopy. (3)
- Vacuum Systems Science and Engineering. (3)

MSE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Civil and Environmental Engineering

www.eas.asu.edu/~civil
480/965-3589
ECG 252

Sandra L. Houston, Chair

Professors: Fox, S. Houston, W. Houston, Mamlouk, Mays, Rajan, Singhal, Witczak

Associate Professors: Abbaszadegan, Fafitis, Hinks, Johnson, Mobasher, Westerhoff

Assistant Professors: Allen, Dillner, Kaloush, Muccino, Owusu-Antwi, Peccia, Zhu

The civil engineering profession includes analysis, planning, design, construction, and maintenance of many types of facilities for government, commerce, industry, and the public domain. These facilities include high-rise office towers, factories, schools, airports, tunnels and subway systems, dams, canals, and water purification and environmental protection facilities such as solid waste and wastewater treatment systems. Civil engineers are concerned with the impact of their projects on the public and the environment, and they attempt to coordinate the needs of society with technical and economic feasibility.

Career Opportunities in the Field. University graduates with the B.S.E. degree in Civil Engineering readily find employment. Civil engineers work in many different types of companies, from large corporations to small, private consulting firms, or in governmental agencies. A civil engineering background is an excellent foundation for jobs in management and public service. Civil engineering is one of the best engineering professions from the viewpoint of international travel opportunities or for eventually establishing one's own consulting business.

Uniqueness of the Program at ASU. The Department of Civil and Environmental Engineering offers a challenging program of study designed to provide the student with the resources and background to pursue a career in a wide range of specialty areas. Some of these areas are structural, geotechnical, environmental and water resources, transportation and materials engineering. The Civil Engineering program is fully accredited by ABET. With the program, students will be prepared for the Fundamentals of Engineering examination and professional registration.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

The Department of Civil and Environmental Engineering at ASU strongly believes in the development of programmatic objectives and outcomes, and a continuous quality improvement program. The four top-level learning objectives for the program deal with the ability graduates to

1. be technically competent,
2. be effective members of society,
3. communicate effectively, and
4. analyze and design civil engineering systems with due considerations to cost, environmental and construction factors.

Civil Engineering Areas of Study

Areas of study in the civil engineering curriculum are described below.

Environmental Engineering. This area of study includes the quality of air, water, and land resources; transport, use, and disposal of hazardous wastes; water and wastewater treatment; and water reuse.

Geotechnical/Geoenvironmental Engineering. This area of study includes the analysis and design of foundation systems, seepage control, earthdams and water resource structures, earthwork operations, fluid flow-through porous media, response of foundations and embankments to earthquakes, and solutions to environmental problems.

Structures/Materials Engineering. This area of study considers the planning, analysis and design of steel and concrete bridges, buildings, dams; special offshore and space structures; Portland cement concrete; composite materials; and structural retrofit of existing bridges.

Transportation/Materials Engineering. This area of study includes (1) transportation design and operation and (2) pavements and materials. Transportation design and operation cover geometric design of highways, traffic operations, and highway capacity and safety. Pavements and materials focus on pavement analysis and design, pavement maintenance and rehabilitation, pavement evaluation and management, characterization of highway materials, and durability of highway structures.

Water Resources Engineering. This area of study is concerned with surface and groundwater flow, planning and management of water supply, and water distribution system modeling.

The undergraduate program provides an excellent background for entry to graduate study in engineering.

UNDERGRADUATE OPPORTUNITIES IN CIVIL AND ENVIRONMENTAL ENGINEERING

Students majoring in Civil Engineering have three choices:

1. the major without a concentration;
2. the major with a concentration in construction engineering; and
3. the major with a concentration in environmental engineering.

Civil Engineering. The B.S.E. degree in Civil Engineering offers students a wide background on various areas of study within civil engineering. The degree provides basic principles of environmental, geotechnical/geoenvironmental, structural/materials, transportation/materials, and water resources engineering. Students have the option to select among a certain number of design and technical elective courses in their junior and senior years.

Civil Engineering with Construction Engineering Concentration. The B.S.E. degree in Civil Engineering with a construction engineering concentration offers students basic principles of civil engineering with the option to concentrate on construction engineering. The degree provides education based on the traditional engineering principles, construction materials and practice, quality control, and civil engineering project management.

Civil Engineering with Environmental Engineering Concentration. The B.S.E. degree in Civil Engineering with an environmental engineering concentration offers students basic principles of civil engineering with the option to concentrate on environmental engineering. The degree provides a multidisciplinary education based on the traditional engineering principles, chemistry, biology, and hydrogeology.

CIVIL ENGINEERING—B.S.E.

The B.S.E. degree in Civil Engineering requires a minimum of 128 semester hours of course work. A minimum of 50 upper-division semester hours is required. The minimum requirements are for a student who has successfully completed at least a year (each) of high school chemistry, physics, and computer programming along with precalculus, algebra, and trigonometry.

The B.S.E. degree program consists of the following categories:

First-Year Composition	6
General Studies/school requirements	55
Engineering core	18–19
Civil Engineering major	27
Design courses	6
Technical courses	15–16
Minimum requirement	128

First-Year Composition

Choose among the course combinations below 6

ENG 101 First-Year Composition (3)
ENG 102 First-Year Composition (3)

—or—

ENG 105 Advanced First-Year Composition (3)
Elective chosen with an advisor (3)

—or—

ENG 107 English for Foreign Students (3)
ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB (3)*
HU course(s) 6–9

SB courses 3

Minimum total 15

Literacy and Critical Inquiry
ECE 300 Intermediate Engineering Design *L* 3
CEE 486 Integrated Civil Engineering Design *L* 3

Total 6

Natural Sciences/Basic Sciences
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I: SQ[1] 1
PHY 131 University Physics II: Electricity and Magnetism SQ[2] 3
PHY 132 University Physics Laboratory II SQ[2] 1
Basic science elective 3

Total 15

Mathematical Studies
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
ECE 384 Numerical Methods for Engineers 4

Total 19

General Studies/school requirements total 55

Engineering Core
ECE 100 Introduction to Engineering Design *CS* 3
ECE 201 Electrical Networks I 4
or ECE 340 Thermodynamics (3)
ECE 210 Engineering Mechanics I: Statics 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 351 Civil Engineering Materials 3

Total 18–19

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

Civil Engineering Major

CEE 296 Civil Engineering Systems 4
CEE 321 Structural Analysis and Design 4
CEE 341 Fluid Mechanics for Civil Engineers 4
CEE 351 Geotechnical Engineering 4
CEE 361 Introduction to Environmental Engineering 4
CEE 372 Transportation Engineering 4
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3

Total 27

Design Courses for the Degree Without a Concentration

Six semester hours from the following list are required.

CEE 423 Structural Design 3
CEE 441 Water Resources Engineering 3
CEE 452 Foundations 3
CEE 466 Sanitary Systems Design 3
CEE 475 Highway Geometric Design 3

Technical Courses for the Degree Without a Concentration

From 15 to 16 semester hours are required. The design elective courses that have not been selected to satisfy the design electives requirement may be used as technical electives.

A maximum of seven hours may be selected from outside civil engineering, with an advisor's approval. Construction courses taken as technical electives may be selected from the following list: CON 383, 495, and 496. Students must select technical and design electives from at least three different CEE areas of study.

Environmental Engineering
CEE 362 Unit Operations in Environmental Engineering 3
CEE 466 Sanitary Systems Design 3
CEE 467 Environmental Microbiology 4
CHM 231 Elementary Organic Chemistry *SQ** 3

Geotechnical/Geoenvironmental Engineering
CEE 452 Foundations 3

Structures/Materials Engineering
CEE 322 Steel Structures 3
CEE 323 Concrete Structures 3
CEE 423 Structural Design 3
CEE 432 Matrix and Computer Applications in Structural Engineering 3

Transportation/Materials Engineering
CEE 381 Surveying 3
CEE 412 Pavement Analysis and Design 3
CEE 475 Highway Geometric Design 3
CEE 481 Civil Engineering Project Management 3
CEE 483 Highway Materials, Construction, and Quality 3

Water Resources Engineering
CEE 440 Engineering Hydrology 3
CEE 441 Water Resources Engineering 3

* Both CHM 231 and 235 must be taken to secure SQ credit.

Design Courses for the Degree with the Construction Engineering Concentration

CEE 322 Steel Structures 3
CEE 452 Foundations 3

Total 6

Technical Courses for the Degree with the Construction Engineering Concentration

CEE 323 Concrete Structures 3
CEE 381 Surveying 3
CEE 481 Civil Engineering Project Management 3
CEE 483 Highway Materials, Construction, and Quality 3
CON 496 Construction Contract Administration 3

Total 15

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Design Courses for the Degree with the Environmental Engineering Concentration

CEE	441	Water Resources Engineering 3
CEE	466	Sanitary Systems Design 3
Total		 6

Technical Courses for the Degree with the Environmental Engineering Concentration

BIO	320	Fundamentals of Ecology 3
		or BCH 361 Principles of Biochemistry (3)
		or CHM 302 Environmental Chemistry (3)
		or CHM 341 Elementary Physical Chemistry (3)
		or PUP 442 Environmental Planning (3)
		or PUP 475 Environmental Impact Assessment (3)
CEE	362	Unit Operations in Environmental Engineering 3
CEE	440	Engineering Hydrology 3
CEE	467	Environmental Microbiology 4
Technical elective*		 3
Total		 16

* This course is selected from the list of technical courses for the degree without a concentration.

Civil Engineering Program of Study
A Four-Year Sequence

First Year

First Semester

CHM	114	General Chemistry for Engineers *SQ* 4
		or CHM 116 General Chemistry *SQ* (4)
ECE	100	Introduction to Engineering Design *CS* 3
ENG	101	First-Year Composition 3
MAT	270	Calculus with Analytic Geometry I *MA* 4
Total		 14

Second Semester

CEE	296	Civil Engineering Systems 4
ECN	111	Macroeconomic Principles *SB* 3
		or ECN 112 Microeconomic Principles *SB* (3)
ENG	102	First-Year Composition 3
MAT	271	Calculus with Analytic Geometry II *MA* 4
PHY	121	University Physics I: Mechanics *SQ*[1] 3
PHY	122	University Physics Laboratory I *SQ*[1] 1
Total		 18

Second Year

First Semester

ECE	210	Engineering Mechanics I: Statics 3
MAT	272	Calculus with Analytic Geometry III *MA* 4
MAT	274	Elementary Differential Equations *MA* 3
PHY	131	University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY	132	University Physics Laboratory II *SQ*[2] 1
HU/SB and awareness area course[3]		 3
Total		 17

Second Semester

ECE	201	Electrical Networks I 4
		or ECE 340 Thermodynamics (3)
ECE	212	Engineering Mechanics II: Dynamics 3
ECE	313	Introduction to Deformable Solids 3
ECE	380	Probability and Statistics for Engineering Problem Solving *CS* 3
Basic science elective		 3
Total		 15–16

Third Year

First Semester

CEE	321	Structural Analysis and Design 4
CEE	341	Fluid Mechanics for Civil Engineers 4
ECE	300	Intermediate Engineering Design *L* 3
ECE	351	Civil Engineering Materials 3
ECE	384	Numerical Methods for Engineers 4
Total		 18

Second Semester

CEE	351	Geotechnical Engineering 4
CEE	361	Introduction to Environmental Engineering 4
CEE	372	Transportation Engineering 4
HU/SB and awareness area course[3]		 3
Total		 15

Fourth Year

First Semester

Design elective		 3
HU/SB and awareness area course[3]		 3
Technical electives		 9
Total		 15

Second Semester

CEE	486	Integrated Civil Engineering Design *L* 3
Design elective		 3
HU/SB and awareness area course[3]		 3
Technical electives		 6–7
Total		 15–16
Minimum total		 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

[3] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU or SB requirements. Students should consider the following list of electives to enhance communication and management skills: COM 100, 110, 320; CON 101; PUP 100, 200.

Construction Engineering Concentration
Program of Study
A Four-Year Sequence

First Year

First Semester

CHM	114	General Chemistry for Engineers *SQ* 4
		or CHM 116 General Chemistry *SQ* (4)
ECE	100	Introduction to Engineering Design *CS* 3
ENG	101	First-Year Composition 3
MAT	270	Calculus with Analytic Geometry I *MA* 4
Total		 14

Second Semester

CEE	296	Civil Engineering Systems 4
ECN	111	Macroeconomic Principles *SB* 3
		or ECN 112 Microeconomic Principles *SB* (3)
ENG	102	First-Year Composition 3
MAT	271	Calculus with Analytic Geometry II *MA* 4
PHY	121	University Physics I: Mechanics *SQ*[1] 3
PHY	122	University Physics Laboratory I *SQ*[1] 1
Total		 18

Second Year

First Semester

ECE 210 Engineering Mechanics I: Statics 3
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
HU/SB and awareness area course[3] 3
Total 17

Second Semester

ECE 201 Electrical Networks I 4
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
Basic science elective 3
Total 16

Third Year

First Semester

CEE 321 Structural Analysis and Design 4
CEE 341 Fluid Mechanics for Civil Engineers 4
ECE 300 Intermediate Engineering Design *L* 3
ECE 351 Civil Engineering Materials 3
ECE 384 Numerical Methods for Engineers 4
Total 18

Second Semester

CEE 351 Geotechnical Engineering 4
CEE 361 Introduction to Environmental Engineering 4
CEE 372 Transportation Engineering 4
HU/SB and awareness area course[3] 3
Total 15

Fourth Year

First Semester

CEE 322 Steel Structures 3
CEE 381 Surveying 3
CEE 452 Foundations 3
CEE 481 Civil Engineering Project Management 3
HU/SB and awareness area course[3] 3
Total 15

Second Semester

CEE 323 Concrete Structures 3
CEE 483 Highway Materials, Construction, and Quality 3
CEE 486 Integrated Civil Engineering Design *L* 3
CON 496 Construction Contract Administration *L* 3
HU/SB and awareness area course[3] 3
Total 15

Graduation requirement total 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

[3] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU or SB requirements. Students should consider the following list of electives to enhance communication and management skills: COM 100, 110, 320; CON 101; PUP 100, 200.

Environmental Engineering Concentration
Program of Study
A Four-Year Sequence

First Year

First Semester

CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
ECE 100 Introduction to Engineering Design *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
Total 14

Second Semester

CEE 296 Civil Engineering Systems 4
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
Total 18

Second Year

First Semester

ECE 210 Engineering Mechanics I: Statics 3
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
HU/SB and awareness area course[3] 3
Total 17

Second Semester

CHM 231 Elementary Organic Chemistry *SQ* 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 340 Thermodynamics 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
Total 15

Third Year

First Semester

CEE 321 Structural Analysis and Design 4
CEE 341 Fluid Mechanics for Civil Engineers 4
ECE 300 Intermediate Engineering Design *L* 3
ECE 351 Civil Engineering Materials 3
ECE 384 Numerical Methods for Engineers 4
Total 18

Second Semester

BIO 320 Fundamentals of Ecology 3
or BCH 361 Principles of Biochemistry (3)
or CHM 302 Environmental Chemistry (3)
or CHM 341 Elementary Physical Chemistry (3)
or PUP 442 Environmental Planning (3)
or PUP 475 Environmental Impact Assessment (3)
CEE 351 Geotechnical Engineering 4
CEE 361 Introduction to Environmental Engineering 4
CEE 372 Transportation Engineering 4

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

HU/SB and awareness area course[3]	3
Total	18

Fourth Year

First Semester

CEE 362 Unit Operations in Environmental Engineering	3
CEE 440 Engineering Hydrology	3
CEE 466 Sanitary Systems Design	3
CEE 467 Environmental Microbiology	4
HU/SB and awareness area course[3]	3
Total	16

Second Semester

CEE 441 Water Resources Engineering	3
CEE 486 Integrated Civil Engineering Design *L*	3
HU/SB and awareness area course[3]	3
Technical elective[4]	3
Total	12
Graduation requirement total	128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

[3] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU or SB requirements. Students should consider the following list of electives to enhance communication and management skills: COM 100, 110, 320; CON 101; PUP 100, 200.

[4] This course is selected from the list of technical courses for the degree without a concentration.

GRADUATION REQUIREMENTS

Each sequence of mathematics, engineering core, civil engineering major, and the combined design and technical courses must be completed with an average grade of "C" or higher. CEE courses, except CEE 296, may not be taken before the engineering core courses are completed. Design and technical courses may not be taken before the civil engineering major courses are completed. CEE 486 is taken in the last semester of course work.

A maximum of two graduate courses may be taken for undergraduate credit by students whose cumulative GPA is 3.00 or higher with the approval of the instructor, advisor, department chair, and the dean of the college.

In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

Concurrent Studies in Architecture and Civil Engineering

Qualified lower-division students interested in combining undergraduate studies in architecture and civil engineering may prepare for upper-division and graduate courses in both programs by taking courses to meet requirements for option B under the Architectural Studies major. See "Architectural Studies—B.S.D. Lower-Division Requirements Option A[1]," page 131.

GRADUATE STUDY

The Department of Civil and Environmental Engineering also offers graduate programs leading to the M.S., M.S.E., and Ph.D. degrees. These programs provide a blend of classroom instruction and research. Many topics and relevant research projects are available for thesis programs. Students interested in these programs should contact the department for up-to-date literature.

CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

CEE 296 Civil Engineering Systems. (4)
fall and spring
Introduces civil engineering. Problem solving, economics, description of civil engineering systems, design concepts, ethics, professional responsibilities, and computer graphics. Lecture, computer labs, field trips. Pre- or corequisite: ECE 100.

CEE 321 Structural Analysis and Design. (4)
fall and spring
Statically determinate and indeterminate structures (trusses, beams, and frames) by classical and matrix methods. Introduces structural design. Lecture, recitation. Prerequisites: ECE 212, 313. Pre- or corequisites: ECE 380, 384.

CEE 322 Steel Structures. (3)
fall
Behavior of structural components and systems. Design of steel members and connections. Load and resistance factor design methods. Lecture, recitation. Prerequisite: CEE 321.

CEE 323 Concrete Structures. (3)
spring
Behavior of concrete structures and the design of reinforced and prestressed concrete members, including footings. Partial design of concrete building system. Lecture, recitation. Prerequisite: CEE 321.

CEE 340 Hydraulics and Hydrology. (3)
fall and spring
Applies hydraulic engineering principles to flow of liquids in pipe systems and open channels; hydrostatics; characteristics of pumps and turbines. Introduces hydrology. Not open to engineering students. Lecture, lab. Prerequisite: CON 221.

CEE 341 Fluid Mechanics for Civil Engineers. (4)
fall and spring
Fundamental principles and methods of fluid mechanics forming the analytical basis for water resources engineering. Conduit and open channel flow. 3 hours lecture, 1 hour lab. Prerequisites: ECE 212, 313. Pre- or corequisites: ECE 380, 384.

CEE 351 Geotechnical Engineering. (4)
fall and spring
Index properties and engineering characteristics of soils. Compaction, permeability and seepage, compressibility and settlement, and shear strength. Lecture, lab. Prerequisites: ECE 212, 313. Pre- or corequisites: ECE 380, 384.

CEE 361 Introduction to Environmental Engineering. (4)
fall and spring
Concepts of air and water pollution; environmental regulation, risk assessment, chemistry, water quality modeling, water and wastewater treatment systems designs. Lecture, lab. Prerequisites: ECE 212, 313. Pre- or corequisites: ECE 380, 384.

CEE 362 Unit Operations in Environmental Engineering. (3)
spring
Design and operation of unit processes for water and wastewater treatment. Prerequisite: CEE 361.

CEE 372 Transportation Engineering. (4)
fall and spring
Highway, rail, water, and air transportation. Operational characteristics and traffic control devices of each transport mode. Impact on urban form. Prerequisites: ECE 212, 313. Pre- or corequisites: ECE 380, 384.

CEE 381 Surveying. (3)
fall, spring, summer
Theory and field work in construction and land surveys. Lecture, lab. Cross-listed as CON 341. Credit is allowed for only CEE 381 or CON 341. Prerequisite: MAT 170.

CEE 412 Pavement Analysis and Design. (3)
fall
Design of flexible and rigid pavements for highways and airports. Surface, base, and subgrade courses. Cost analysis and pavement selection. Credit is allowed for only CEE 412 or 511. Prerequisites: CEE 351; ECE 351.

CEE 423 Structural Design. (3)
fall
Analysis and design of reinforced concrete steel, masonry, and timber structures. Prerequisite: CEE 323. Pre- or corequisite: CEE 322.

CEE 432 Matrix and Computer Applications in Structural Engineering. (3)
spring
Matrix and computer applications to structural engineering and structural mechanics. Stiffness and flexibility methods, finite elements, and differences. Credit is allowed for only CEE 432 or 532. Prerequisite: CEE 321.

CEE 440 Engineering Hydrology. (3)
fall
Descriptive hydrology; hydrologic cycle, models, and systems. Rainrunoff models. Hydrologic design. Concepts, properties, and basic equations of groundwater flow. Prerequisite: CEE 341.

CEE 441 Water Resources Engineering. (3)
spring
Applies the principles of hydraulics and hydrology to the engineering of water resources projects; design and operation of water resources systems; water quality. Prerequisite: CEE 341.

CEE 452 Foundations. (3)
fall
Applies soil mechanics to foundation systems, bearing capacity, lateral earth pressure, and slope stability. Prerequisite: CEE 351.

CEE 466 Sanitary Systems Design. (3)
fall
Capacity, planning and design of water supply, domestic and storm drainage, and solid waste systems. Prerequisite: CEE 361.

CEE 467 Environmental Microbiology. (4)
fall
Overview of the microbiology of natural and human-impacted environment, microbial detection methodologies, waterborne disease outbreaks, risk assessment, and regulations. Lecture, lab. Prerequisite: CEE 361 or MIC 220.

CEE 474 Transportation Systems Engineering. (3)
fall
Introduces transportation systems and modeling, traffic characteristic analysis, traffic predictions, highway capacity, signal timing, transportation systems management, and transit. Prerequisites: CEE 372; ECE 384.

CEE 475 Highway Geometric Design. (3)
spring
Design of the visible elements of the roadway. Fundamental design controls with application to rural roads, at-grade intersections, freeways, and interchanges. Lecture, computer lab. Prerequisite: CEE 372.

CEE 481 Civil Engineering Project Management. (3)
once a year
Civil engineering project management and administration, planning and scheduling, cost estimating and bidding strategies, financial management, quality control and safety, and computer applications. Lecture, field trips. Prerequisites: CEE 321, 351, 372.

CEE 483 Highway Materials, Construction, and Quality. (3)
once a year
Properties of highway materials, including aggregates, asphalt concrete, and portland cement concrete; construction practice; material delivery, placement, and compaction; quality control. Lecture, field trips. Prerequisites: CEE 351, 372; ECE 351.

CEE 486 Integrated Civil Engineering Design. (3)
fall and spring
Requires completion of a civil engineering design in a simulated practicing engineering environment. Limited to undergraduates in their final semester. Lecture, team learning. Prerequisites: CEE 321, 341, 351, 361, 372.
General Studies: L

CEE 492 Honors Directed Study. (1–6)
selected semesters

CEE 493 Honors Thesis. (1–6)
selected semesters

CEE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Computer Science and Engineering

cse.asu.edu
480/965-3190
GWC 206

Sethuraman Panchanathan, Interim Chair

Professors: Baral, Colbourn, Collofello, Farin, Golshani, Kambhampati, Lee, Lewis, Nielson, Panchanathan, Tsai, J. Urban, S. Urban, Yau

Associate Professors: Bazzi, Bhattacharya, Dasgupta, Dietrich, Faltz, Gupta, Huey, Liu, Miller, O'Grady, Pheanis, Sen, Xue

Assistant Professors: Cam, Candan, Chatha, Davulcu, Gannod, Konjevod, Richa, Ryu, Sarjoughian, Sundaram, Syrotiuk, Wagner

Senior Lecturer: DeLibero

Lecturers: Boyd, Chen, Nakamura, Navabi, Turban

Computers have a significant impact on our daily lives, and this impact is likely to be even greater in the future as computer professionals continue to develop more powerful, smaller, faster, and less expensive computing systems. Computer science and computer engineering deal with the study, design, development, construction, and application of modern computing machinery. Other important topics include computing techniques and appropriate languages for general information processing; for scientific computation; for the recognition, storage, retrieval, and processing of data of all kinds; and for the automatic control and simulation of processes.

The curricula offered by the Department of Computer Science and Engineering prepare the student to be a participant in this rapidly changing area of technology by presenting in-depth treatments of the fundamentals of computer science and computer engineering. The department offers two undergraduate degrees: a B.S. degree in Computer

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Science and a B.S.E. degree in Computer Systems Engineering. The following are shared objectives of the degree programs:

1. Graduates will understand current trends in information technology and be able to apply their understanding in the distributed management of information.
2. Graduates can apply the underlying principles of computer science, including mathematical and physical sciences and engineering principles.
3. Graduates will know and be able to apply system development processes, using modern tools, from the component level to the system level.
4. Graduates also will have the skills required to communicate effectively in both technical and nontechnical settings, to work effectively in teams and in a multicultural environment, to work ethically and professionally, and continue to learn independently and grow intellectually.

The Computer Systems Engineering program has the specific objective that its graduates will have the technical expertise necessary to analyze requirements and to design and implement effective solutions to problems that require the integration of hardware and software. The Computer Science program has the specific objective that its graduates will have the technical expertise necessary to analyze requirements, design, and implement effective solutions using computer science for a broad range of problems. The department strives to maintain a modern learning environment that fosters excellence, cooperation, and scholarship for faculty, students, and staff.

ADMISSION REQUIREMENTS

The Preprofessional Program. Each student admitted to the Department of Computer Science and Engineering is designated a preprofessional student in either Computer Science or Computer Systems Engineering. The student follows the first- and second-year sequence of courses listed in the curriculum outline for his or her particular major. Included in the first- and second-year schedules are all emphasis courses:

CSE 120 Digital Design Fundamentals 3
CSE 200 Concepts of Computer Science *CS* 3
CSE 210 Object-Oriented Design and Data Structures *CS* 3
CSE 225 Assembly Language Programming and Microprocessors (Motorola) 4
or CSE 226 Assembly Language Programming and Microprocessors (Intel) (4)
CSE 240 Introduction to Programming Languages 3
Choose among the course combinations below 6
ENG 101 First-Year Composition (3)
ENG 102 First-Year Composition (3)
—or—
ENG 105 Advanced First-Year Composition (3)
HU/SB elective chosen with an advisor (3)
—or—
ENG 107 English for Foreign Students (3)
ENG 108 English for Foreign Students (3)
MAT 243 Discrete Mathematical Structures 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] . 3
PHY 132 University Physics Laboratory II *SQ*[2] 1

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

The Professional Program. Admission to the professional program is competitive and granted to those applicants demonstrating the highest promise for professional success in Computer Science and Engineering. The admissions committee considers overall transfer and ASU GPA numbers as well as the transfer and ASU GPA numbers in Computer Science and Engineering emphasis courses. All students seeking professional status must have completed or be in the process of completing all the emphasis courses and then follow the application procedure as described on the Computer Science and Engineering Web site. Completion of the specified courses does not guarantee admission to professional status. Only students who have been admitted to ASU are eligible to apply for the professional programs. Candidates are strongly encouraged to visit the Computer Science and Engineering Advising Center in GWC 302 before beginning the application process. All application materials can be found on the Web at cse.asu.edu.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is required for the B.S. degree in Computer Science and the B.S.E. degree in Computer Systems Engineering. A minimum of 50 upper-division semester hours is required. In addition to the requirement for a cumulative GPA of 2.00 or higher, all computer science and computer systems engineering students must obtain a minimum grade of "C" in all CSE courses used for degree credit. Students cannot take CSE courses for which they failed to earn a grade of "C" or better in the prerequisite course.

GRADUATION REQUIREMENTS

In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

DEGREES

Computer Science—B.S.

The faculty in the Department of Computer Science and Engineering offer a B.S. degree that prepares the student for a career in computer science. A student pursuing a B.S. degree must complete the First-Year Composition requirement, the General Studies requirement, department degree requirements, the computer science core courses, a senior-level breadth requirement in the major, technical electives, and unrestricted electives. For more information, visit the department in GWC 206, call 480/965-3190, or access the department's Web site at cse.asu.edu.

Software Engineering Concentration. Students pursuing the B.S. degree in Computer Science may choose to concen-

trate their studies on software engineering. The B.S. Degree in Computer Science with a concentration in software engineering provides recognition that the student has acquired in-depth knowledge and hands-on experience in software development and related subjects. This concentration requires the student to complete CSE 445, 460, 461, and 462 with a grade of "C" or higher in each.

The following table specifies departmental requirements for the B.S. degree in Computer Science.

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- HU/SB elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/Department Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

HU/SB electives 18

Literacy and Critical Inquiry

L elective 3

ECE 400 Engineering Communications *L* 3
or approved CSE L course (3)

Total 6

Natural Sciences/Basic Sciences

PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Science elective[3] 4

Total 12

Mathematical Studies

ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
MAT 243 Discrete Mathematical Structures 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 342 Linear Algebra 3

Total 21

General Studies/department requirement total 57

Computer Science Core

CSE 120 Digital Design Fundamentals 3
CSE 200 Concepts of Computer Science *CS* 3
CSE 210 Object-Oriented Design and Data Structures *CS* 3
CSE 225 Assembly Language Programming and Microprocessors (Motorola) 4
or CSE 226 Assembly Language Programming and Microprocessors (Intel) (4)
CSE 240 Introduction to Programming Languages 3
CSE 310 Data Structures and Algorithms 3
CSE 330 Computer Organization and Architecture 3
CSE 340 Principles of Programming Languages 3
CSE 355 Introduction to Theoretical Computer Science 3
CSE 360 Introduction to Software Engineering 3
CSE 430 Operating Systems 3

Total computer science core 34

400-level CSE computer science breadth requirement[4] 18
Technical electives[5] 6
Unrestricted electives 7

Total 31

Total degree requirements 128

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[1] Both PHY 121 and 122 must be taken to secure SQ credit.

[2] Both PHY 131 and 132 must be taken to secure SQ credit.

[3] Each student must complete a four-credit laboratory science course that meets major requirements in the discipline of the course selected and satisfies the SQ portion of the General Studies requirement. See an advisor for the approved listing.

[4] Students cannot count toward graduation more than six semester hours of independent study courses including but not limited to CSE 484, 492, 493, and 499.

[5] Each student must complete six hours of courses chosen from the computer science technical elective list and approved by the student's advisor. See an advisor for the approved listing.

Computer Science
Program of Study
Typical Four-Year Sequence

First Year

First Semester

CSE 200 Concepts of Computer Science *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
HU/SB and awareness area course[1] 3
Unrestricted elective 3

Total 16

Second Semester

CSE 120 Digital Design Fundamentals 3
CSE 210 Object-Oriented Design and Data Structures *CS* 3
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
Unrestricted elective 3

Total 16

Second Year

First Semester

CSE 240 Introduction to Programming Languages 3
MAT 243 Discrete Mathematical Structures 3
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[2] 3
PHY 122 University Physics Laboratory I *SQ*[2] 1
HU/SB and awareness area course[1] 3

Total 17

Second Semester

CSE 225 Assembly Language Programming and Microprocessors (Motorola) 4
or CSE 226 Assembly Language Programing and Microprocessors (Intel) (4)
MAT 342 Linear Algebra 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

PHY 131 University Physics II: Electricity and Magnetism *SQ*[3] 3
PHY 132 University Physics Laboratory II *SQ*[3] 1
HU/SB and awareness area course[1] 3
L elective 3
Total 17

Third Year

First Semester
CSE 310 Data Structures and Algorithms 3
CSE 330 Computer Organization and Architecture 3
CSE 360 Introduction to Software Engineering 3
HU/SB and awareness area course[1] 3
Laboratory Science *SQ*[4] 4
Total 16

Second Semester
CSE 340 Principles of Programming Languages 3
CSE 355 Introduction to Theoretical Computer Science 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
HU/SB and awareness area course[1] 3
Technical elective 3
Total 15

Fourth Year

First Semester
CSE 430 Operating Systems 3
ECE 400 Engineering Communications *L* 3
or approved CSE L course (3)
400-level CSE computer science breadth electives 9
Unrestricted elective 1
Total 16

Second Semester
400-level CSE computer science breadth electives 9
HU/SB and awareness area course[1] 3
Technical elective 3
Total 15

[1] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU and SB requirements.
[2] Both PHY 121 and 122 must be taken to secure SQ credit.
[3] Both PHY 131 and 132 must be taken to secure SQ credit.
[4] Each student must complete a four-credit laboratory science course that meets major requirements in the discipline of the course selected and satisfies the SQ portion of the General Studies requirement. See an advisor for the approved listing.

COMPUTER SYSTEMS ENGINEERING—B.S.E.

The Department of Computer Science and Engineering offers a B.S.E. degree that prepares the student for a career in computer systems engineering. This degree program provides training in both engineering and computer science. Qualified students in this program may apply to participate in an industrial internship program offered through the Embedded Systems and Internetworking Consortium. Students who participate in this internship program receive academic credit (CSE 484) that applies to the technical elective requirement of the B.S.E. degree in Computer Systems Engineering. The following table specifies departmental requirements for the B.S.E. degree in Computer Systems Engineering.

First-Year Composition
Choose among the course combinations below 6
ENG 101 First-Year Composition (3)
ENG 102 First-Year Composition (3)
—or—
ENG 105 Advanced First-Year Composition (3)
HU/SB elective chosen with an advisor (3)
—or—
ENG 107 English for Foreign Students (3)
ENG 108 English for Foreign Students (3)
Total 6

General Studies/Department Requirements

Humanities and Fine Arts/Social and Behavioral Sciences
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU and SB electives 12
Total 15

Literacy and Critical Inquiry
CSE 423 Microcomputer System Hardware *L* 3
or CSE 438 Systems Programming *L* (3)
ECE 300 Intermediate Engineering Design *L* 3
Total 6

Natural Sciences/Basic Sciences
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
PHY 361 Introductory Modern Physics 3
Total 15

Mathematical Studies
MAT 243 Discrete Mathematical Structures 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
MAT 342 Linear Algebra 3
Total 21

General Studies/department requirement total 57

Engineering Core
CSE 200 Concepts of Computer Science *CS* 3
CSE 225 Assembly Language Programming and Microprocessors (Motorola) 4
ECE 100 Introduction to Engineering Design *CS* 3
ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 334 Electronic Circuits 4
Total 21

Computer Science Core
CSE 120 Digital Design Fundamentals 3
CSE 210 Object-Oriented Design and Data Structures *CS* 3
CSE 240 Introduction to Programming Languages 3
CSE 310 Data Structures and Algorithms 3
CSE 330 Computer Organization and Architecture 3
CSE 340 Principles of Programming Languages 3
CSE 355 Introduction to Theoretical Computer Science 3

CSE 360 Introduction to Software Engineering 3
CSE 421 Microprocessor System Design I 4
CSE 422 Microprocessor System Design II 4
CSE 430 Operating Systems 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
Technical electives[3] 6
Total 44

Degree requirement total 128

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.
[3] Each student must complete six hours of courses chosen from the computer science technical elective list and approved by the student's advisor. See an advisor for the approved listing.

Computer Systems Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CSE 200 Concepts of Computer Science *CS* 3
ECE 100 Introduction to Engineering Design *CS* 3
or CSE 120 Digital Design Fundamentals (3)
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles (3)
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
Total 16

Second Semester
CHM 114 General Chemistry for Engineers *SQ* 4
CSE 120 Digital Design Fundamentals 3
or ECE 100 Introduction to Engineering Design *CS* (3)
CSE 210 Object-Oriented Design and Data Structures *CS* 3
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
Total 17

Second Year

First Semester
CSE 225 Assembly Language Programming and Microprocessors (Motorola) 4
MAT 243 Discrete Mathematical Structures 3
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
Total 15

Second Semester
CSE 240 Introduction to Programming Languages 3
ECE 210 Engineering Mechanics I: Statics 3
MAT 274 Elementary Differential Equations *MA* 3
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
HU/SB and awareness area course[3] 3
Total 16

Third Year

First Semester
CSE 310 Data Structures and Algorithms 3
CSE 330 Computer Organization and Architecture 3
CSE 360 Introduction to Software Engineering 3
ECE 300 Intermediate Engineering Design *L* 3
MAT 342 Linear Algebra 3
Total 15

Second Semester
CSE 340 Principles of Programming Languages 3
CSE 355 Introduction to Theoretical Computer Science 3
CSE 421 Microprocessor System Design I 4
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
HU/SB and awareness area course[3] 3
Total 16

Fourth Year

First Semester
CSE 422 Microprocessor System Design II 4
CSE 430 Operating Systems 3
ECE 201 Electrical Networks I 4
PHY 361 Introductory Modern Physics 3
HU/SB and awareness area course[3] 3
Total 17

Second Semester
CSE 423 Microcomputer System Hardware *L* 3
or CSE 438 Systems Programming *L* (3)
ECE 334 Electronic Circuits 4
HU/SB and awareness area course[3] 3
Technical electives 6
Total 16

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.
[3] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU and SB requirements.

COMPUTER SCIENCE AND ENGINEERING (CSE)

CSE 100 Principles of Programming with C++. (3)
fall, spring, summer
Principles of problem solving using C++, algorithm design, structured programming, fundamental algorithms and techniques, and computer systems concepts. Social and ethical responsibility. Lecture, lab. Prerequisite: MAT 170.
General Studies: CS

CSE 110 Principles of Programming with Java. (3)
fall, spring, summer
Concepts of problem solving using Java, algorithm design, structured programming, fundamental algorithms and techniques, and computer systems concepts. Social and ethical responsibility. Lecture, lab. Prerequisite: MAT 170.
General Studies: CS

CSE 120 Digital Design Fundamentals. (3)
fall, spring, summer
Number systems, conversion methods, binary and complement arithmetic, Boolean algebra, circuit minimization, ROMs, PLAs, flipflops, synchronous sequential circuits. Lecture, lab. Cross-listed as EEE 120. Credit is allowed for only CSE 120 or EEE 120. Prerequisite: computer literacy.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

CSE 180 Computer Literacy. (3)
fall, spring, summer
Introduces personal computer operations and their place in society. Problem-solving approaches using databases, spreadsheets, and word processing. May be taken for credit on either Windows or Macintosh, but not both. Lecture, demonstration. Prerequisite: nonmajor.
General Studies: CS

CSE 181 Applied Problem Solving with Visual BASIC. (3)
fall, spring, summer
Introduces systematic definition of problems, solution formulation, and method validation. Requires computer solution using Visual BASIC for projects. Lecture, lab. Prerequisites: MAT 117; nonmajor.
General Studies: CS

CSE 185 Internet and the World Wide Web. (3)
fall and spring
Fundamental Internet concepts, World Wide Web browsing, publishing, searching, advanced Internet productivity tools.

CSE 200 Concepts of Computer Science. (3)
fall, spring, summer
Overview of algorithms, languages, computing systems, theory. Problem solving by programming with a high-level language (Java or other). Lecture, lab. Prerequisite: CSE 100 or 110 or one year of high school programming with Java or C++ or PASCAL.
General Studies: CS

CSE 210 Object-Oriented Design and Data Structures. (3)
fall, spring, summer
Object-oriented design, static and dynamic data structures (strings, stacks, queues, binary trees), recursion, searching, and sorting. Professional responsibility. Prerequisite: CSE 200.
General Studies: CS

CSE 225 Assembly Language Programming and Microprocessors (Motorola). (4)
fall, spring, summer
Assembly language programming, including input/output programming and exception/interrupt handling. Register-level computer organization, I/O interfaces, assemblers, and linkers. Motorola-based assignments. Lecture, lab. Cross-listed as EEE 225. Credit is allowed for only CSE 225 or EEE 225. Prerequisites: CSE 100 (or 110 or 200); CSE 120 or EEE 120.

CSE 226 Assembly Language Programming and Microprocessors (Intel). (4)
fall and spring
CPU/memory/peripheral device interfaces and programming. System buses, interrupts, serial and parallel I/O, DMA, coprocessors. Intel-based assignments. Lecture, lab. Cross-listed as EEE 226. Credit is allowed for only CSE 226 or EEE 226. Prerequisites: CSE 100 (or 110 or 200); CSE 120 or EEE 120.

CSE 240 Introduction to Programming Languages. (3)
fall, spring, summer
Introduces the procedural (C++), applicative (LISP), and declarative (Prolog) languages. Lecture, lab. Prerequisite: CSE 210.

CSE 310 Data Structures and Algorithms. (3)
fall, spring, summer
Advanced data structures and algorithms, including stacks, queues, trees (B, B+, AVL), and graphs. Searching for graphs, hashing, external sorting. Lecture, lab. Prerequisites: CSE 210; MAT 243.

CSE 330 Computer Organization and Architecture. (3)
fall and spring
Instruction set architecture, processor performance and design; datapath, control (hardwired, microprogrammed), pipelining, input/output. Memory organization with cache, virtual memory. Prerequisite: CSE 225 (or 226) or EEE 225 (or 226).

CSE 340 Principles of Programming Languages. (3)
fall and spring
Formal syntactic and semantic descriptions, compilation and implementation issues, and theoretical foundations for several programming paradigms. Prerequisites: either CSE 225 (or 226) or EEE 225 (or 226) and both CSE 240 and 310.

CSE 355 Introduction to Theoretical Computer Science. (3)
fall and spring
Introduces formal language theory and automata, Turing machines, decidability/undecidability, recursive function theory, and complexity theory. Prerequisite: CSE 310.

CSE 360 Introduction to Software Engineering. (3)
fall, spring, summer
Software life cycle models; project management, team development environments and methodologies; software architectures; quality assurance and standards; legal, ethical issues. Prerequisites: CSE 210, 240.

CSE 408 Multimedia Information Systems. (3)
fall
Design, use, and applications of multimedia systems. Introduces acquisition, compression, storage, retrieval, and presentation of data from different media such as images, text, voice, and alphanumeric. Prerequisite: CSE 310.

CSE 412 Database Management. (3)
fall and spring
Introduces DBMS concepts. Data models and languages. Relational database theory. Database security/integrity and concurrency. Prerequisite: CSE 310.

CSE 420 Computer Architecture I. (3)
once a year
Computer architecture. Performance versus cost tradeoffs. Instruction set design. Basic processor implementation and pipelining. Prerequisite: CSE 330.

CSE 421 Microprocessor System Design I. (4)
fall and spring
Assembly language programming and logical hardware design of systems using 8-bit microprocessors and microcontrollers. Fundamental concepts of digital system design. Reliability and social, legal implications. Lecture, lab. Prerequisite: CSE 225 or EEE 225.

CSE 422 Microprocessor System Design II. (4)
fall and spring
Design of microcomputer systems using contemporary logic and microcomputer system components. Requires assembly language programming. Prerequisite: CSE 421.

CSE 423 Microcomputer System Hardware. (3)
once a year
Information and techniques presented in CSE 422 are used to develop the hardware design of a multiprocessor, multiprogramming, microprocessor-based system. Prerequisite: CSE 422.
General Studies: L

CSE 428 Computer-Aided Processes. (3)
selected semesters
Hardware and software considerations for computerized manufacturing systems. Specific concentration on automatic inspection, numerical control, robotics, and integrated manufacturing systems. Prerequisite: CSE 330.

CSE 430 Operating Systems. (3)
fall and spring
Operating system structure and services, processor scheduling, concurrent processes, synchronization techniques, memory management, virtual memory, input/output, storage management, and file systems. Prerequisites: CSE 330, 340.

CSE 432 Operating System Internals. (3)
fall
IPC, exception and interrupt processing, memory and thread management, user-level device drivers, and OS servers in a modern microkernel-based OS. Prerequisite: CSE 430.

CSE 434 Computer Networks. (3)
fall and spring
Cryptography fundamentals; data compression; error handling; flow control; multihop routing; network protocol algorithms; network reliability, timing, security; physical layer basics. Prerequisite: CSE 330.

CSE 438 Systems Programming. (3)
once a year
Design and implementation of systems programs, including text editors, file utilities, monitors, assemblers, relocating linking loaders, I/O handlers, and schedulers. Prerequisite: CSE 421 or instructor approval.
General Studies: L

CSE 440 Compiler Construction I. (3)
once a year
Introduces programming language implementation. Implementation strategies such as compilation, interpretation, and translation. Major

compilation phases such as lexical analysis, semantic analysis, optimization, and code generation. Prerequisites: CSE 340, 355.

CSE 445 Distributed Computing with Java and CORBA. (3)
fall and spring
Frameworks for distributed software components. Foundations of client-server computing and architectures for distributed object systems. Dynamic discovery and invocation. Lecture, projects. Prerequisite: CSE 360 or instructor approval.

CSE 446 Client-Server User Interfaces. (3)
spring
Client-server model and its use in creating and managing window interfaces. Toolkits and libraries, including X11, Microsoft Foundation Classes, and Java Abstract Window Toolkit. Lecture, projects. Prerequisite: CSE 310 or instructor approval.

CSE 450 Design and Analysis of Algorithms. (3)
fall and spring
Design and analysis of computer algorithms using analytical and empirical methods; complexity measures, design methodologies, and survey of important algorithms. Prerequisite: CSE 310.

CSE 457 Theory of Formal Languages. (3)
once a year
Theory of grammar, methods of syntactic analysis and specification, types of artificial languages, relationship between formal languages, and automata. Prerequisite: CSE 355.

CSE 459 Logic for Computing Scientists. (3)
selected semesters
Propositional logic, syntax and semantics, proof theory versus model theory, soundness, consistency and completeness, first order logic, logical theories, automated theorem proving, ground resolution, pattern matching unification and resolution, Dijkstras logic, proof obligations, and program proving. Prerequisite: CSE 355.

CSE 460 Software Analysis and Design. (3)
fall and spring
Requirements analysis and design; architecture and patterns; representations of software; formal methods; component-based development. Lecture, projects. Prerequisite: CSE 360.

CSE 461 Software Engineering Project I. (3)
fall and spring
First of two-course software team-development sequence. Planning, management, design, and implementation using object-oriented technology, CASE tools, CMM-level-5 guidelines. Lecture, lab, oral and written communications. Prerequisite: CSE 360.

CSE 462 Software Engineering Project II. (3)
fall and spring
Second of two-course software team-development sequence. Software evolution, maintenance, reengineering, reverse engineering, component-based development, and outsourcing. Lecture, lab, oral and written communications. Prerequisite: CSE 461.

CSE 470 Computer Graphics. (3)
fall and spring
Display devices, data structures, transformations, interactive graphics, 3-dimensional graphics, and hidden line problem. Prerequisites: CSE 310; MAT 342.

CSE 471 Introduction to Artificial Intelligence. (3)
fall and spring
State space search, heuristic search, games, knowledge representation techniques, expert systems, and automated reasoning. Prerequisites: CSE 240, 310.

CSE 473 Nonprocedural Programming Languages. (3)
selected semesters
Functional and logic programming using languages like Lucid and Prolog. Typical applications would be a Screen Editor and an Expert System. Prerequisite: CSE 355.

CSE 476 Introduction to Natural Language Processing. (3)
selected semesters
Principles of computational linguistics, formal syntax, and semantics, as applied to the design of software with natural (human) language I/O. Prerequisite: CSE 310 or instructor approval.

CSE 477 Introduction to Computer-Aided Geometric Design. (3)
once a year
Introduces parametric curves and surfaces, Bezier and B-spline interpolation, and approximation techniques. Prerequisites: CSE 210, 470; MAT 342.

CSE 484 Internship. (1–12)
selected semesters

CSE 492 Honors Directed Study. (1–6)
selected semesters

CSE 493 Honors Thesis. (1–6)
selected semesters

CSE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Electrical Engineering

www.eas.asu.edu/ee
480/965-3424
ENGRC 552

Stephen M. Goodnick, Chair

Regents' Professors: Balanis, Ferry, Heydt

Professors: Backus, Crouch, Goodnick, Gorur, Higgins, Hoppensteadt, Hui, Karady, Kiaei, Kozicki, Lai, Palais, Pan, Roedel, Schroder, Shen, Si, Spanias, Tao, Thornton, Y. Zhang

Associate Professors: Aberle, Allee, Bird, Chakrabarti, Cochran, Diaz, El-Sharawy, Greeneich, Grondin, Holbert, Karam, Kim, Morrell, Rodriguez, Skromme, Tsakalis, Tylavsky

Assistant Professors: Ayyanar, Duman, Joo, Papandreou-Suppappola, Reisslein, Tepedelenlioglu, Vasileska, J. Zhang

The professional activities of electrical engineers directly affect the everyday lives of most of the world's population. They are responsible for the design and development of radio and television transmitters and receivers, telephone networks and switching systems, computer systems, and electric power generation and distribution. Within the broad scope of these systems, the electrical engineer is concerned with a challenging and diverse array of design and development problems.

Electrical engineers design minuscule semiconductor integrated circuits that contain many thousands of elementary devices. These engineers design systems for automatically controlling mechanical devices and a variety of processes. These engineers are responsible for the design of

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

satellite communication links as well as patient monitoring systems for hospitals. The development of the microprocessor has expanded the opportunities for electrical engineers to improve the design of familiar products since these devices are now incorporated in automobiles, consumer and office products, entertainment systems, and a vast variety of test and measurement instruments and machine tools.

Students who earn a B.S.E. degree in Electrical Engineering will be involved in a variety of electrical and electronic problems in the course of their careers. To ensure the necessary breadth of knowledge, the Electrical Engineering curriculum includes basic (core) engineering courses and courses in networks and electronic circuits, electromagnetic fields and waves, microprocessors, communication and control systems, solid-state electronics, electrical power systems, and other specialty courses.

ELECTRICAL ENGINEERING—B.S.E.

The goal of the Electrical Engineering undergraduate program is to prepare the graduates for entry-level positions as electrical engineers for the broad range of opportunities available in industrial, commercial, and governmental organizations, and to prepare the graduates for continued learning experiences either in a formal graduate program or in continuing education applications.

This goal is achieved through a curriculum designed to accomplish five objectives:

1. We will maintain a modern curriculum, which adapts to changes in technology and society.
2. Our program will foster a diverse student population entering and successfully graduating, and our graduates will function well in a diverse work force.
3. Our graduates will be self-motivated, creative people who can succeed in environments where technical innovation is important.
4. Our graduates will be sought after by our constituent industries and respected graduate programs.
5. Our graduates will be technically competent.

The curriculum in Electrical Engineering builds upon the base provided by the engineering core. Beyond the engineering core, the curriculum includes a number of required electrical engineering and technical elective courses. Approved technical elective courses serve to provide students with an opportunity either to broaden their background in electrical engineering or to study, in greater depth, technical subjects in which they have special interests. Successful completion of the curriculum leaves the student prepared to embark on a career in electrical engineering or to pursue advanced education in graduate school.

The engineering design experience is structured around four backbone courses employing engineering teams: ECE 100 Introduction to Engineering Design (freshman year), ECE 300 Intermediate Engineering Design (junior year), EEE 488 Senior Design Laboratory I, and EEE 489 Senior Design Laboratory II. The integrated experience is strengthened with required courses: EEE 120 Digital Design Fundamentals, EEE 225 Assembly Language Programming and Microprocessors (Motorola), EEE 226 Assembly Language Programming and Microprocessors (Intel), EEE 303 Signals and Systems, and EEE 360 Energy Conversion and Transport. Students focus on design pertaining to specific electrical engineering areas in their senior technical electives before the culminating, capstone design experience in EEE 488 and EEE 489.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Electrical Engineering. A minimum of 50 upper-division semester hours is required.

GRADUATION REQUIREMENTS

A student must earn a grade of "C" or higher in the mathematics and physics courses listed in the program of study. Each mathematics and physics course in the program of study must be completed with a "C" or higher before enrolling in any course that requires that mathematics or physics course as a prerequisite. The student must also have an overall GPA of at least 2.00 for the following group of courses: CSE 100; ECE 201, 300, 334, 352; all courses with an EEE prefix; and all other courses used as technical electives.

In addition to fulfilling school and major requirements, students must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

COURSE REQUIREMENTS

The specific course requirements for the B.S.E. degree in Electrical Engineering follow.

First-Year Composition[1]

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective (requires departmental approval) (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU courses 6–9
SB course(s) 3–6
Minimum total 15

Literacy and Critical Inquiry

ECE 300 Intermediate Engineering Design *L* 3
EEE 488 Senior Design Laboratory I *L*[1] 2
EEE 489 Senior Design Laboratory II *L*[1] 2
Total 7

Natural Sciences/Basic Sciences

CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
PHY 121 University Physics I: Mechanics *SQ*[2, 3] 3
PHY 122 University Physics Laboratory I *SQ*[2, 3] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2, 4] 3

PHY 132 University Physics Laboratory II *SQ*[2, 4] 1
PHY 241 University Physics III[2] 3
Total 15

Mathematical Studies
ECE 100 Introduction to Engineering Design *CS* 3
MAT 270 Calculus with Analytic Geometry I *MA*[2] 4
MAT 271 Calculus with Analytic Geometry II *MA*[2] 4
MAT 272 Calculus with Analytic Geometry III *MA*[2] 4
MAT 274 Elementary Differential Equations *MA*[2] 3
or MAT 275 Modern Differential Equations *MA*[2] (3)
MAT 342 Linear Algebra[2] 3
MAT 362 Advanced Mathematics for Engineers and Scientists[2] 3
Total 24

General Studies/school requirements total 61

Engineering Core
ECE 201 Electrical Networks I 4
ECE 214 Engineering Mechanics 4
ECE 334 Electronic Circuits 4
ECE 352 Properties of Electronic Materials 4
EEE 225 Assembly Language Programming and Microprocessors (Motorola) 4
or EEE 226 Assembly Language Programming and Microprocessors (Intel) (4)
Total 20

[1] Both EEE 488 and 489 must be taken to secure L credit.
[2] A minimum grade of "C" is required.
[3] Both PHY 121 and 122 must be taken to secure SQ credit.
[4] Both PHY 131 and 132 must be taken to secure SQ credit.

Electrical Engineering Major

The following courses are required to fulfill the Electrical Engineering major:

CSE 100 Principles of Programming with C++ *CS** 3
EEE 120 Digital Design Fundamentals 3
EEE 302 Electrical Networks II 3
EEE 303 Signals and Systems 3
EEE 340 Electromagnetic Engineering I 4
EEE 350 Random Signal Analysis 3
EEE 360 Energy Conversion and Transport 4
Total 23

* CSE 110 Principles of Programming with Java (3) can be substituted for CSE 100 with Department of Electrical Engineering approval.

The program in Electrical Engineering requires a total of 18 semester hours of technical electives. With department approval, a maximum of two technical electives may be taken outside electrical engineering. Qualified students may choose from approved courses in business, engineering, mathematics, and the sciences at or above the 300-level, including graduate courses. Students must have a GPA of not less than 3.00 and approval of the dean to enroll in EEE graduate-level courses. To ensure breadth of knowledge, students *must* select courses from at least three of the following seven areas. In addition, to ensure depth, two courses must be taken in one area.

Communications and Signal Processing
EEE 407 Digital Signal Processing 4
EEE 455 Communication Systems 4
EEE 459 Communication Networks 3

Computer Engineering
CSE 330 Computer Organization and Architecture 3
CSE 420 Computer Architecture I 3
CSE 421 Microprocessor System Design I 4
CSE 422 Microprocessor System Design II 4

Controls
EEE 480 Feedback Systems 4
EEE 482 Introduction to State Space Methods 3

Electromagnetics
EEE 440 Electromagnetic Engineering II 4
EEE 443 Antennas for Wireless Communications 3
EEE 445 Microwaves 4
EEE 448 Fiber Optics 4

Electronic Circuits
EEE 405 Filter Design 3
EEE 425 Digital Systems and Circuits 4
EEE 433 Analog Integrated Circuits 4

Power Systems
EEE 460 Nuclear Concepts for the 21st Century 3
EEE 463 Electrical Power Plant 3
EEE 470 Electric Power Devices 3
EEE 471 Power System Analysis 3
EEE 473 Electrical Machinery 3

Solid-State Electronics
EEE 434 Quantum Mechanics for Engineers 3
EEE 435 Microelectronics 3
EEE 436 Fundamentals of Solid-State Devices 3
EEE 437 Optoelectronics 3
EEE 439 Semiconductor Facilities and Cleanroom Practices 3

Electrical Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
ECE 100 Introduction to Engineering Design[1] *CS* 3
or EEE 120 Digital Design Fundamentals (3)
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
Total 14

Second Semester
EEE 120 Digital Design Fundamentals[1] 3
or ECE 100 Introduction to Engineering Design *CS* (3)
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[2] 3
PHY 122 University Physics Laboratory I *SQ*[2] 1
Total 14

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Second Year

First Semester

CSE	100 Principles of Programming with C++ *CS*[3]	3
ECN	111 Macroeconomic Principles *SB*	3
	or ECN 112 Microeconomic Principles *SB* (3)	
MAT	272 Calculus with Analytic Geometry III *MA*	4
MAT	274 Elementary Differential Equations *MA*	3
	or Mat 275 Modern Differential Equations *MA* (3)	
PHY	131 University Physics II: Electricity and Magnetism *SQ*[4]	3
PHY	132 University Physics Laboratory II *SQ*[4]	1
Total		17

Second Semester

ECE	201 Electrical Networks I	4
EEE	225 Assembly Language Programming and Microprocessors (Motorola)	4
	or EEE 226 Assembly Language Programming and Microprocessors (Intel) (4)	
MAT	362 Advanced Mathematics for Engineers and Scientists	3
PHY	241 University Physics III	3
HU/SB and awareness area course[5]		3
Total		17

Third Year

First Semester

ECE	334 Electronic Circuits	4
EEE	302 Electrical Networks II	3
EEE	340 Electromagnetic Engineering I	4
MAT	342 Linear Algebra	3
HU/SB and awareness area course[5]		3
Total		17

Second Semester

ECE	300 Intermediate Engineering Design *L*	3
ECE	352 Properties of Electronic Materials	4
EEE	303 Signals and Systems	3
EEE	360 Energy Conversion and Transport	4
HU/SB and awareness area course[5]		3
Total		17

Fourth Year

First Semester

ECE	214 Engineering Mechanics	4
EEE	350 Random Signal Analysis	3
EEE	488 Senior Design Laboratory I *L*[6]	2
Technical electives		7
Total		16

Second Semester

EEE	489 Senior Design Laboratory II *L*[6]	2
HU/SB and awareness area course[5]		3
Technical electives		11
Total		16

[1] Both ECE 100 and 120 are required.

[2] Both PHY 121 and 122 must be taken to secure SQ credit.

[3] CSE 110 Principles of Programming with Java (3) can be substituted for CSE 100 with Department of Electrical Engineering approval.

[4] Both PHY 131 and 132 must be taken to secure SQ credit.

[5] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to satisfy HU or SB requirements.

[6] Both EEE 488 and 489 must be taken to secure L credit.

ELECTRICAL ENGINEERING (EEE)

EEE 120 Digital Design Fundamentals. (3)
fall, spring, summer
Number systems, conversion methods, binary and complement arithmetic, Boolean algebra, circuit minimization, ROMs, PLAs, flipflops, synchronous sequential circuits. Lecture, lab. Cross-listed as CSE 120. Credit is allowed for only CSE 120 or EEE 120. Prerequisite: computer literacy.

EEE 225 Assembly Language Programming and Microprocessors (Motorola). (4)
fall, spring, summer
Assembly language programming, including input/output programming and exception/interrupt handling. Register-level computer organization, I/O interfaces, assemblers, and linkers. Motorola-based assignments. Lecture, lab. Cross-listed as CSE 225. Credit is allowed for only CSE 225 or EEE 225. Prerequisites: CSE 100 (or 110 or 200); CSE 120 or EEE 120.

EEE 226 Assembly Language Programming and Microprocessors (Intel). (4)
fall and spring
CPU/memory/peripheral device interfaces and programming. System buses, interrupts, serial and parallel I/O, DMA, coprocessors. Intel-based assignments. Lecture, lab. Cross-listed as CSE 226. Credit is allowed for only CSE 226 or EEE 226. Prerequisites: CSE 100 (or 110 or 200); CSE 120 or EEE 120.

EEE 302 Electrical Networks II. (3)
fall, spring, summer
Analyzes linear and nonlinear networks. Analytical and numerical methods. Prerequisite: ECE 201. Pre- or corequisite: MAT 362.

EEE 303 Signals and Systems. (3)
fall, spring, summer
Introduces continuous and discrete time signal and system analysis, linear systems, Fourier, and z-transforms. Prerequisite: EEE 302. Pre- or corequisite: MAT 342.

EEE 340 Electromagnetic Engineering I. (4)
fall, spring, summer
Static and time varying vector fields; boundary value problems; dielectric and magnetic materials; Maxwell's equations; boundary conditions. Prerequisites: MAT 362; PHY 131, 132.

EEE 350 Random Signal Analysis. (3)
fall and spring
Probabilistic and statistical analysis as applied to electrical signals and systems. Pre- or corequisite: EEE 303.

EEE 360 Energy Conversion and Transport. (4)
fall and spring
Three-phase circuits. Energy supply systems. Magnetic circuit analysis, synchronous generators, transformers, induction and DC machines. Transmission line modeling and design. Lecture, lab. Prerequisite: EEE 302.

EEE 405 Filter Design. (3)
fall
Principles of active and passive analog filter design, frequency domain approximations, sensitivity and synthesis of filters. Prerequisite: EEE 303.

EEE 407 Digital Signal Processing. (4)
fall and spring
Time and frequency domain analysis, difference equations, z-transform, FIR and IIR digital filter design, discrete Fourier transform, FFT, and random sequences. Lecture, lab. Prerequisites: EEE 303; MAT 342.

EEE 425 Digital Systems and Circuits. (4)
fall and spring
Digital logic gate analysis and design. Propagation delay times, fan out, power dissipation, noise margins. Design of MOS and bipolar logic families, including NMOS, CMOS, standard and advanced TTL, ECL, and BiCMOS. Inverter, combinational and sequential logic circuit design, MOS memories, VLSI circuits. Computer simulations using PSPICE. Lecture, lab. Prerequisite: ECE 334.

EEE 433 Analog Integrated Circuits. (4)
spring
Analysis, design, and applications of modern analog circuits using integrated bipolar and field effect transistor technologies. Lecture, lab. Prerequisite: ECE 334.

EEE 434 Quantum Mechanics for Engineers. (3)
fall
Angular momentum, wave packets, Schroedinger wave equation, probability, problems in one dimension, principles of wave mechanics, scattering, tunneling, central forces, angular momentum, hydrogen atom, perturbation theory, variational techniques. Prerequisites: ECE 352; EEE 340.

EEE 435 Microelectronics. (3)
spring
Introduces basic CMOS processing and fabrication tools. Covers the fundamentals of thermal oxidation, CVD, implantation, diffusion, and process integration. Internet lecture, internet or on-campus lab. Fee. Pre- or corequisite: EEE 436.

EEE 436 Fundamentals of Solid-State Devices. (3)
fall and spring
Semiconductor fundamentals, pn junctions, metal-semiconductor contacts, metal-oxide-semiconductor capacitors and field-effect transistors, bipolar junction transistors. Prerequisite: ECE 352.

EEE 437 Optoelectronics. (3)
selected semesters
Basic operating principles of various types of optoelectronic devices which play important roles in commercial and communication electronics; light-emitting diodes, injection lasers, and photodetectors. Prerequisite: EEE 436.

EEE 439 Semiconductor Facilities and Cleanroom Practices. (3)
fall
Microcontamination, controlled environments, cleanroom layout and systems, modeling, codes and legislation, ultrapure water, production materials, personnel and operations, hazard management, advanced concepts. Prerequisite: EEE 435 or instructor approval.

EEE 440 Electromagnetic Engineering II. (4)
spring
Second half of an introductory course in electromagnetic theory and its application in electrical engineering. Analytical and numerical solution of boundary value problems. Advanced transmission lines; waveguides; antennas; radiation and scattering. Lecture, lab. Prerequisite: EEE 340.

EEE 443 Antennas for Wireless Communications. (3)
spring
Fundamental parameters; radiation integrals; wireless systems; wire, loop, and microstrip antennas; antenna arrays; smart antennas; ground effects; multipath. Prerequisite: EEE 340.

EEE 445 Microwaves. (4)
fall
Waveguides; circuit theory for waveguiding systems; microwave devices, systems, and energy sources; striplines and microstrips; impedance matching transformers; measurements. Lecture, lab. Prerequisite: EEE 340.

EEE 448 Fiber Optics. (4)
fall
Principles of fiber-optic communications. Lecture, lab. Prerequisites: EEE 303, 340.

EEE 455 Communication Systems. (4)
fall and spring
Signal analysis techniques applied to the operation of electrical communication systems. Introduction to and overview of modern digital and analog communications. Lecture, lab. Prerequisite: EEE 350.

EEE 459 Communication Networks. (3)
spring
Fundamentals of communication networks. Study of Seven-Layer OSI model. Focus on functionality and performance of protocols used in communication networks. Prerequisite: EEE 350.

EEE 460 Nuclear Concepts for the 21st Century. (3)
spring
Radiation interactions, damage, dose, and instrumentation. Cosmic rays, satellite effects; soft errors; transmutation doping. Fission reactors, nuclear power. TMI, Chernobyl. Radioactive waste. Prerequisite: PHY 241 or 361.

EEE 463 Electrical Power Plant. (3)
fall
Nuclear, fossil, and solar energy sources. Analysis and design of steam supply systems, electrical generating systems, and auxiliary systems. Power plant efficiency and operation. Prerequisites: ECE 201, 340 (or PHY 241).

EEE 470 Electric Power Devices. (3)
fall
Analyzes devices used for short circuit protection, including circuit breakers, relays, and current and voltage transducers. Protection against switching and lightning over voltages. Insulation coordination. Prerequisite: EEE 360.

EEE 471 Power System Analysis. (3)
spring
Review of transmission line parameter calculation. Zero sequence impedance, symmetrical components for fault analysis, short circuit calculation, review of power flow analysis, power system stability, and power system control concepts. Prerequisite: EEE 360.

EEE 473 Electrical Machinery. (3)
fall
Operating principles, constructional details, and design aspects of conventional DC and AC machines, transformers and machines used in computer disc drives, printers, wrist watches, and automobiles. Prerequisite: EEE 360.

EEE 480 Feedback Systems. (4)
fall and spring
Analysis and design of linear feedback systems. Frequency response and root locus techniques, series compensation, and state variable feedback. Lecture, lab. Prerequisite: EEE 303.

EEE 482 Introduction to State Space Methods. (3)
fall
Discrete and continuous systems in state space form controllability, stability, and pole placement. Observability and observers. Pre- or corequisite: EEE 480.

EEE 488 Senior Design Laboratory I. (2)
fall and spring
Capstone senior project. Design process: research, concept, feasibility, simulation, specifications, benchmarking, and proposal generation. Technical communications and team skills enrichment. Lecture, lab. Prerequisites: ECE 300, 334; EEE 303, 340; senior standing. Pre- or corequisite: ECE 352; EEE 360.
General Studies: L (if credit also earned in EEE 489)

EEE 489 Senior Design Laboratory II. (2)
fall and spring
Capstone senior project. Implement, evaluate, and document EEE 488 design. Social, economic, and safety considerations. Technical communications and team skills enrichment. Lecture, lab. Prerequisite: EEE 488 in the immediately preceding semester.
General Studies: L (if credit also earned in EEE 488)

EEE 492 Honors Directed Study. (1–6)
selected semesters

EEE 493 Honors Thesis. (1–6)
selected semesters

EEE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Department of Industrial Engineering

www.eas.asu.edu/~imse
480/965-3185
GWC 502

Gary L. Hogg, Chair

Professors: Cochran, Dooley, Henderson, Hogg, Hubele, Montgomery, Runger, Shunk, Wolfe, Ye

Associate Professors: Anderson-Rowland, Carlyle, Fowler, Mackulak, Moor, Mou, Roberts, Villalobos

Assistant Professors: Gel, Kulahci, Wu

Lecturer: Borror

The industrial engineer (IE) provides leadership for American organizations in reestablishing competitiveness in the global marketplace through system integration and productivity improvement. No challenge can be greater than improving productivity, which is the application of knowledge and skills to provide improved goods and services to enhance the quality of life, both on and off the job. This improvement must be achieved without waste of physical and human resources while maintaining environmental balance. Industrial engineers are the "productivity people" who provide the necessary leadership and skills to integrate technology. This gives IEs a wide range of interests and responsibilities.

As in other engineering fields, industrial engineering is concerned with solving problems through the application of scientific and practical knowledge. What sets industrial engineering apart from other engineering disciplines is its broader scope. An IE relates to the total picture of productivity looking at the "big picture" of what makes society perform best—the right combination of human resources, natural resources, synthetic structures, and equipment. An IE bridges the gap between management and operations, dealing with and motivating people as well as determining what tools should be used and how they should be used.

An IE deals with people as well as things. In fact, industrial engineering is often called the "people-oriented profession." It is a primary function of the IE to integrate people and technology-oriented systems. Therefore, IEs are active in the fields of ergonomics and human factors.

To be competitive in this global economy, it is essential to emphasize and continually improve the quality of goods and services. Industrial engineering is the only engineering discipline offering course work in designing and implementing quality assurance systems.

The IE's skills are applicable to every kind of organization. IEs learn how to approach, think about, and solve productivity and integration problems regardless of their settings. IEs work in manufacturing facilities, banks, hospitals, government, transportation, construction, and social services. Within this wide variety of organizations, IEs get involved in projects such as designing and implementing quality control systems, independent work groups, the work flow in a medical laboratory, real-time production control systems, computer-based management information systems, and manufacturing operating systems, to name a few. A unique feature of most industrial engineering assignments is that they involve interdisciplinary teams. For example, the IE might be the leader of a team consisting of electrical and mechanical engineers, accountants, computer scientists, and planners. This IE program gives the student the skills necessary to direct these teams. These skills include team building, brainstorming, group dynamics, and interpersonal relationships.

IEs have a sound background in technology integration, management theory and application, engineering economics and cost analysis. IEs are well equipped to deal with problems never seen before, making them prime candidates for promotion through the management career path, especially in high-tech organizations. In fact, more than half of all practicing IEs are in management positions. This area of expertise has placed the IE in the leadership role in the establishment of a new field of activity called "management of technology."

Industrial engineers are well trained in the development and use of analytical tools, and their most distinctive skill is in the area of model building. IEs must quickly learn and understand the problems of their clients. In this context, good people skills and good analytic skills are essential. This industrial engineering program offers both.

INDUSTRIAL ENGINEERING—B.S.E.

The curriculum in Industrial Engineering builds upon mathematics, computer programming, and the engineering core. Beyond this foundation, the curriculum includes a number of required IE core courses, IE electives, and study area electives, enabling each student to focus on a specific career objective.

By successfully completing this curriculum, the student is prepared to embark on a career in industrial engineering or to pursue advanced education in graduate school.

The career-focused study-areas are as follows:

1. *Industrial and Management Systems.* For a broad traditional IE career in the design and analysis of manufacturing and service systems.
2. *Information and Telecommunication Systems.* For a career in the application of integrated computer and telecommunication systems to manufacturing and service systems analysis and design.
3. *Global Industrial Engineering Leadership.* For a career in global manufacturing and service organizations.
4. *High-Tech Manufacturing.* For a career in the design and analysis of integrated manufacturing systems.
5. *Preprofessional and Service Systems.* For a career in law, medicine or public service or careers in the design and analysis of health care, agribusiness, banking/financial, and government/public-administration systems.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Industrial Engineering. A minimum of 50 upper-division hours is required. Students must attain a GPA of at least 2.00 for the courses in the major field.

GRADUATION REQUIREMENTS

In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81. For information concerning admission, degree, course, and graduation requirements for the School of Engineering, see "Degree Requirements," page 212, and subsequent sections.

COURSE REQUIREMENTS

Students take 59 semester hours of university English proficiency and general studies course work, 19 hours of engineering core, 36 hours of industrial engineering courses, two hours of industrial engineering electives, and 12 hours of career-focused study area electives. Each study area has an associated list of recommended General Studies, IE electives, and study area courses. The course work for the undergraduate degree can be classified into the following categories:

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 112 Microeconomic Principles *SB* 3
or ECN 111 Macroeconomic Principles *SB* (3)
HU courses 6–9
SB course(s) 3–6

Minimum total 15

Literacy and Critical Inquiry

ECE 300 Intermediate Engineering Design *L* 3
IEE 490 Project in Design and Development *L* 3

Total 6

Natural Sciences/Basic Sciences

CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Basic science elective 3

Total 15

Mathematical Studies

MAT 242 Elementary Linear Algebra 2
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3

Total 17

General Studies/school requirements total 53

Engineering Core

ECE 100 Introduction to Engineering Design *CS* 3
ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 350 Structure and Properties of Materials 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3

Total 19

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

Industrial Engineering Major

The following courses are required:

CSE 100 Principles of Programming with C++ *CS* 3
or CSE 110 Principles of Programming with Java (3)
CSE 200 Concepts of Computer Science *CS* 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
IEE 294 ST: Industrial Engineering Applications Seminar 2
IEE 300 Economic Analysis for Engineers 3
IEE 360 Manufacturing Processes 3
IEE 368 Facilities Analysis and Design 3
IEE 374 Quality Control *CS* 3
IEE 461 Production Control 3
IEE 475 Simulating Stochastic Systems *CS* 3
IEE 476 Operations Research Techniques/Applications *CS* 4
IEE 485 Engineering Statistics *CS* 3

Total 36

Industrial Engineering Electives Area

Students select two semester hours of industrial engineering electives. IEE 361 Manufacturing Processes Lab is highly recommended. For course information, see the list of recommended courses in the department advising office.

Career-Focused Study Area Electives

Students select a minimum of 12 semester hours from the following recommended electives in one of the five career-focused study areas.

Industrial and Management Systems

IEE 305 Information Systems Engineering *CS* 3
IEE 431 Engineering Administration 3
Any approved engineering or business elective 3
Any approved engineering elective 3

Information and Telecommunication Systems

CSE 210 Object-Oriented Design and Data Structures *CS* 3
CSE 240 Introduction to Programming Languages 3
IEE 305 Information Systems Engineering *CS* 3
IEE 494 ST: Information Systems Development Tools 3

Global Industrial Engineering Leadership

ECN 306 Survey of International Economics *SB, G* 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

IBS 300 Principles of International Business *G* 3
IBS 400 Cultural Factors in International Business *C, G* 3
Any approved international business electives 3

High-Tech Manufacturing[1]
ECE 352 Properties of Electronic Materials 4
EEE 435 Microelectronics 3
EEE 436 Fundamentals of Solid-State Devices 3
MSE 355 Introduction to Materials Science and Engineering 3
MSE 441 Analysis of Materials Failures 3
MSE 470 Polymers and Composites 3

Preprofessional and Service Systems[1, 2]
Focus area courses 12

[1] Certain focus areas may require more than 12 semester hours due to class prerequisites.

[2] A student desiring a focus area other than those listed is invited to create his or her own that concentrates on a professional service area. The student is expected to formulate a set of four courses (12 semester hours) that supports his or her career option. The student needs to submit a petition to the department that explains and supports the focus and the courses selected. The associate chair for undergraduate studies must approve the petition before the student begins study in the focus area. For more information, see the IE academic advisor.

Industrial Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ*[1]
ECE 100 Introduction to Engineering Design *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
HU/SB elective[2] 3
Total 17

Second Semester
ECN 112 Microeconomic Principles *SB* 3
or ECN 111 Macroeconomic Principles *SB* (3)
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[3] 3
PHY 122 University Physics Laboratory I *SQ*[3] 1
HU/SB elective[2] 3
Total 17

Second Year

First Semester
CSE 100 Principles of Programming with C++ *CS* 3
or CSE 110 Principles of Programming with Java *CS* (3)
IEE 300 Economic Analysis for Engineers 3
MAT 242 Elementary Linear Algebra 2
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 131 University Physics II: Electricity and Magnetism *SQ*[4] 3
PHY 132 University Physics Laboratory II *SQ*[4] 1
Total 16

Second Semester
CSE 200 Concepts of Computer Science *CS* 3
ECE 350 Structure and Properties of Materials 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
IEE 294 ST: Industrial Engineering Applications Seminar 2
MAT 274 Elementary Differential Equations *MA* 3
Basic science elective[5] 3
Total 17

Third Year

First Semester
ECE 210 Engineering Mechanics I: Statics 3
IEE 360 Manufacturing Processes 3
IEE 368 Facilities Analysis and Design 3
IEE 374 Quality Control *CS* 3
IEE 485 Engineering Statistics *CS* 3
Industrial Engineering elective 2
Total 17

Second Semester
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 300 Intermediate Engineering Design *L* 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3
IEE 476 Operations Research Techniques/Applications *CS* 4
Study area elective 3
Total 16

Fourth Year

First Semester
ECE 201 Electrical Networks I 4
IEE 461 Production Control 3
IEE 475 Simulating Stochastic Systems *CS* 3
HU/SB elective[2] 3
Study area elective 3
Total 16

Second Semester
IEE 490 Project in Design and Development 3
HU/SB elective[2] 3
Study area electives 6
Total 12

[1] Students who have taken no high school chemistry should take CHM 113 and 116.

[2] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to satisfy HU or SB requirements.

[3] Both PHY 121 and 122 must be taken to secure SQ credit.

[4] Both PHY 131 and 132 must be taken to secure SQ credit.

[5] This elective must be an earth science or life science course; if physics or chemistry, the course must be of a more advanced level than CHM 114 or 116 or PHY 131.

INDUSTRIAL ENGINEERING (IEE)

IEE 294 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Industrial Engineering Applications Seminar. (2)

IEE 300 Economic Analysis for Engineers. (3)
fall, spring, summer
Economic evaluation of alternatives for engineering decisions, emphasizing the time value of money. Prerequisites: ECE 100; MAT 270.

IEE 305 Information Systems Engineering. (3)
fall
Overview of computer and information systems applications. Topics include client/server; distributed computing; networks; process modeling; e-commerce; enterprise applications; internet. Prerequisite: CSE 200.
General Studies: CS

IEE 360 Manufacturing Processes. (3)
fall and spring
Production technique and equipment. Casting and molding, forming, machining, joining and assembly, computer-integrated manufacturing, rapid prototyping, and electronics manufacturing. Cross-listed as MAE 351. Credit is allowed for only IEE 360 or MAE 351. Prerequisite: ECE 350.

IEE 361 Manufacturing Processes Lab. (1)
fall and spring
Series of labs designed to illustrate concepts presented in IEE 360 on production technique and equipment. Corequisite: IEE 360 or MAE 351.

IEE 368 Facilities Analysis and Design. (3)
fall
Planning analysis and design of methods of the tangible physical assets of the firm. Emphasizes facilities location, materials handling, automation, computer integration, and utilization of financial resources. Applications in diverse fields. Lecture, lab. Prerequisite: IEE 300.

IEE 369 Work Analysis and Design. (3)
spring
Planning analysis and design of methods of accomplishing work. Emphasizes human factors, work planning, methods analysis and design, and work measurement. Applications in diverse fields. Lecture, lab. Prerequisite: IEE 300.

IEE 374 Quality Control. (3)
fall
Control charting and other statistical process control techniques. Organization and managerial aspects of quality assurance, plus acceptance sampling plans. Prerequisite: ECE 380.
General Studies: CS

IEE 394 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Introduction to Manufacturing Engineering (Intel). (3)

IEE 431 Engineering Administration. (3)
fall and summer
Introduces quantitative and qualitative approaches to management functions, engineering administration, organizational analysis, decision making, and communication. Credit is allowed for only IEE 431 or 541. Prerequisite: senior standing.

IEE 437 Human Factors Engineering. (3)
fall
Study of the human psychological and physiological factors that underlie the design of equipment and the interaction between people and machines. Credit is allowed for only IEE 437 or 547.

IEE 461 Production Control. (3)
fall
Techniques for the planning, control, and evaluation of production systems. Project management, forecasting, inventory control, scheduling, enterprise requirements planning. Prerequisites: CSE 100; IEE 476, 485.

IEE 463 Computer-Aided Manufacturing and Control. (3)
spring
Computer control in manufacturing, CIM, NC, logic controllers, group technology, process planning, and robotics. Credit is allowed for only IEE 463 or 543. Prerequisite: IEE 360 or MAE 351.
General Studies: CS

IEE 475 Simulating Stochastic Systems. (3)
fall and spring
Analyzes stochastic systems using basic queuing networks and discrete event simulation. Basic network modeling, shared resources, routing, assembly logic. Credit is allowed for only IEE 475 or 545. Prerequisite: CSE 200.
General Studies: CS

IEE 476 Operations Research Techniques/Applications. (4)
fall and spring
Industrial systems applications with operations research techniques. Resource allocation, product mix, production, shipping, task assignment, market share, machine repair, customer service. Credit is allowed for only IEE 476 or 546. Prerequisite: CSE 200.
General Studies: CS

IEE 485 Engineering Statistics. (3)
fall, spring, summer
Designing statistical studies for solutions to engineering problems. Methods include regression, design and analysis of experiments, and other statistical topics. Credit is allowed for only IEE 485 or 500. Prerequisite: ECE 380.
General Studies: CS

IEE 490 Project in Design and Development. (3)
fall and spring
Individual or team capstone project in creative design and synthesis. Prerequisites: ECE 300; IEE 461, 475.
General Studies: L

IEE 492 Honors Directed Study. (1–6)
selected semesters

IEE 493 Honors Thesis. (1–6)
selected semesters

IEE 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Information Systems Development Tools. (3)

IEE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Mechanical and Aerospace Engineering

www.eas.asu.edu/~mae
480/965-3291
ECG 346

Robert E. Peck, Chair

Professors: Boyer, Chattopadhyay, Davidson, Fernando, Jankowski, Krajcinovic, Liu, Mignolet, Peck, Reed, Roy, Saric, Shah, Sieradzki, Squires, Tseng, Wie, Yao

Associate Professors: Chen, Kuo, Lee, McNeill, Phelan, Rankin, Van Schilfgaarde, Wells

Assistant Professors: Calhoun, Mikellides, Peralta, Sugar

The Department of Mechanical and Aerospace Engineering is the administrative home for two undergraduate majors: Aerospace Engineering and Mechanical Engineering. Consistent with the department's mission to provide the best possible education to its students, a department goal is to attract and retain—from the metropolitan community, the state, and the country—outstanding and diverse students

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

and to give each the opportunity to become competent in contemporary subjects that bear on an engineering career. This goal is achieved through a curriculum designed to accomplish the following four objectives:

1. *Technical Competency.* Graduates are able to model and predict the behavior of engineering systems by applying the fundamental principles from mathematics, physics, and chemistry and by using modern computational and experimental tools.
2. *Product Realization Ability.* Graduates are able to design components or systems at the conceptual and embodiment design level including the issues of production, manufacturability, and cost.
3. *Communication Skills.* Graduates can present and document effectively, using both oral and written communication, their work and ideas to a diverse audience.
4. *Professionalism.* Graduates are prepared for modern engineering practice by working in teams, keeping technologically abreast, and having an understanding of related ethical, environmental, and societal issues.

The Aerospace Engineering major provides students an education in technological areas critical to the design and development of aerospace vehicles and systems. Aerospace Engineering graduates are typically employed in aerospace industries or at government laboratories (e.g., NASA). The Mechanical Engineering major is perhaps one of the most broadly applicable programs in engineering, providing education for a wide variety of employment opportunities.

The two majors can serve as entry points to immediate professional employment or to graduate study. The emphasis in all fields is on the development of fundamental knowledge that will have long-lasting utility in a rapidly changing technical society.

AEROSPACE ENGINEERING—B.S.E.

The goal of the Aerospace Engineering program is to provide students with an education in technological areas critical to the design and development of aerospace vehicles and systems. The program emphasizes aeronautical engineering with topics in required courses covering aerodynamics, aerospace materials, aerospace structures, propulsion, flight mechanics, aircraft performance, and stability and control. Astronautic topics such as orbital mechanics, attitude dynamics, spacecraft control, and rocket propulsion are also covered in required courses.

Design is integrated throughout the curriculum beginning with ECE 100 Introduction to Engineering Design and followed later by ECE 300 Intermediate Engineering Design, both of which focus on basic design theory as well as professional practice. These required courses are followed by topic-specific design content in aerospace engineering courses in the junior and senior years. The senior capstone design course integrates design and analysis topics from the earlier courses and completes the required design sequence. This sequence includes a minimum of one-half year of required design. In addition, many of the aerospace technical electives have design content.

Laboratory experience is provided in the areas of aerodynamics, aerospace structures, and vibrations. Laboratory facilities include four major wind tunnels, an integrated mechanical-testing laboratory, a controls laboratory, and a vibrations laboratory.

DEGREE REQUIREMENTS

A minimum of 128 semester hours of course work is necessary for the B.S.E. degree in Aerospace Engineering, including a minimum of 50 upper-division semester hours. All students must satisfy the university First-Year Composition Requirement and General Studies requirement. The College of Engineering and Applied Sciences does not permit the use of pass/fail classes as part of a degree program, and at the option of the department, courses taken more than five years before admission to the programs are normally not accepted for transfer credit.

GRADUATION REQUIREMENTS

A student must earn a grade of "C" or higher in all lower-division mathematics, physics, and chemistry courses. A student must attain a minimum GPA of 2.00 in the engineering core, in the major, and overall. The department may require additional or remedial course work for those students who have demonstrated a trend toward academic difficulties.

COURSE REQUIREMENTS

The specific course requirements for the B.S.E. degree in Aerospace Engineering are as follows:

First-Year Composition[1]

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Approved elective (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements[2]

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU courses 6–9
SB course(s) 3–6
Minimum total 15

Literacy and Critical Inquiry

ECE 300 Intermediate Engineering Design *L* 3
MAE 468 Aerospace Systems Design *L* 3
Total 6

Natural Sciences/Basic Sciences

CHM 114 General Chemistry for Engineers *SQ*[1] 4
or CHM 116 General Chemistry *SQ*[1] (4)
PHY 121 University Physics I: Mechanics *SQ*[1, 3] 3
PHY 122 University Physics Laboratory I *SQ*[1, 3] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[1, 4] 3

PHY 132 University Physics Laboratory II *SQ*[1, 4] 1
PHY 361 Introductory Modern Physics 3
Total 15

Mathematical Studies
MAT 242 Elementary Linear Algebra [1] 2
MAT 270 Calculus with Analytic Geometry I *MA*[1] 4
MAT 271 Calculus with Analytic Geometry II *MA*[1] 4
MAT 272 Calculus with Analytic Geometry III *MA*[1] 4
MAT 274 Elementary Differential Equations *MA*[1] 3
Total 17

General Studies school requirements total 53

Engineering Core[5]
ECE 100 Introduction to Engineering Design *CS* 3
ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 340 Thermodynamics 3
ECE 350 Structure and Properties of Materials 3
Total 22

Aerospace Engineering Major[6]
ECE 384 Numerical Methods for Engineers 4
MAE 101 Introduction to Aerospace Engineering 2
MAE 317 Dynamic Systems and Control 3
MAE 319 Measurements and Data Analysis 3
MAE 361 Aerodynamics I 3
MAE 413 Aircraft Performance, Stability, and Control 3
MAE 415 Vibration Analysis 4
MAE 425 Aerospace Structures 4
MAE 444 Fundamentals of Aerospace Design 3
MAE 460 Gas Dynamics 3
MAE 462 Space Vehicle Dynamics and Control 3
MAE 463 Propulsion 3
MAE 464 Aerospace Laboratory 3
Design technical elective (Select at least one.) 3
MAE 426 Design of Aerospace Structures (3)
MAE 465 Rocket Propulsion (3)
MAE 466 Rotary Wing Aerodynamics and Performance (3)
MAE 467 Aircraft Performance (3)
MAE 469 Projects in Astronautics or Aeronautics (3)
Technical elective(s) 3
Total 47

Total for the program 128

[1] A minimum grade of "C" or higher is required.

[2] The General Studies requirement is divided into five core and three awareness areas. A student must include within his or her program at least two courses that cover the three awareness areas. It is recommended that students consult an academic advisor to ensure the completion of the Humanities and Fine Arts (HU), Social and Behavior Sciences (SB), and awareness areas (C, G, H).

[3] Both PHY 121 and 122 must be taken to secure SQ credit.

[4] Both PHY 131 and 132 must be taken to secure SQ credit.

[5] A "C" average is required for engineering core classes and ECE 300.

[6] A "C" average or higher is required for all classes listed under the major plus MAE 468.

Aerospace Engineering Areas of Study

The technical elective(s) may be selected from among any of the courses on the following list. A student may, with prior approval of the advisor and department chair, select a course not listed that would support a specific career objective. Graduate-level courses are permitted provided the student has at least a 3.00 GPA and approval of the instructor, advisor, and the college dean.

IEE 300 Economic Analysis for Engineers 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3
IEE 485 Engineering Statistics *CS* 3
MAE 341 Mechanism Analysis and Design 3
MAE 351 Manufacturing Processes 3
MAE 372 Fluid Mechanics 3
MAE 388 Heat Transfer 3
MAE 404 Finite Elements in Engineering 3
MAE 406 CAD/CAM Applications in MAE 4
MAE 417 Control System Design 3
MAE 434 Internal Combustion Engines 3
MAE 435 Turbomachinery 3
MAE 447 Robotics and Its Influence on Design 3
MAE 455 Polymers and Composites 3
MAE 461 Aerodynamics II 3
MAE 471 Computational Fluid Dynamics 3
MAT 421 Applied Computational Methods *CS* 3
MAT 423 Numerical Analysis I *CS* 3
MAT 425 Numerical Analysis II *CS* 3
MSE 440 Mechanical Properties of Solids 3
MSE 441 Analysis of Material Failures 3

TYPICAL FOUR-YEAR SEQUENCE

The first two years are usually devoted to the General Studies and engineering core requirements. A typical schedule is given below.

Aerospace Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
ECE 100 Introduction to Engineering Design *CS* 3
or HU/SB elective[1]
ENG 101 First-Year Composition 3
MAE 101 Introduction to Aerospace Engineering 2
MAT 270 Calculus with Analytic Geometry I *MA* 4
Total 16

Second Semester
ENG 102 First-Year Composition 3
MAT 242 Elementary Linear Algebra 2
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[2] 3
PHY 122 University Physics Laboratory I *SQ*[2] 1
HU/SB and awareness area course[1] 3
or ECE 100 Introduction to Engineering Design *CS* (3)
Total 16

Second Year

First Semester
ECE 210 Engineering Mechanics I: Statics 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ECE	350	Structure and Properties of Materials	3
MAT	272	Calculus with Analytic Geometry III *MA*	4
MAT	274	Elementary Differential Equations *MA*	3
PHY	131	University Physics II: Electricity and Magnetism *SQ*[3]	3
PHY	132	University Physics Laboratory II *SQ*[3]	1
Total			17

Second Semester

ECE	201	Electrical Networks I	4
ECE	212	Engineering Mechanics II: Dynamics	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics	3
ECE	384	Numerical Methods for Engineers	4
Total			17

Third Year

First Semester

ECE	300	Intermediate Engineering Design *L*	3
MAE	317	Dynamic Systems and Control	3
MAE	319	Measurements and Data Analysis	3
MAE	361	Aerodynamics I	3
MAE	425	Aerospace Structures	4
Total			16

Second Semester

MAE	413	Aircraft Performance, Stability, and Control	3
MAE	444	Fundamentals of Aerospace Design	3
MAE	460	Gas Dynamics	3
PHY	361	Introductory Modern Physics	3
HU/SB and awareness area course[1]			3
Total			15

Fourth Year

First Semester

MAE	415	Vibration Analysis	4
MAE	462	Space Vehicle Dynamics and Control	3
MAE	463	Propulsion	3
MAE	464	Aerospace Laboratory	3
HU/SB and awareness area course[1]			3
Total			16

Second Semester

MAE	468	Aerospace Systems Design *L*	3
HU/SB and awareness area courses[1]			6
Required design technical elective			3
Technical elective			3
Total			15

[1] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to satisfy HU or SB requirements.

[2] Both PHY 121 and 122 must be taken to secure SQ credit.

[3] Both PHY 131 and 132 must be taken to secure SQ credit.

MECHANICAL ENGINEERING —B.S.E.

Mechanical engineering is a creative discipline that draws upon a number of basic sciences to design the devices, machines, processes, and systems that involve mechanical work and its conversion from and into other forms. It includes the conversion of thermal, chemical, and nuclear energy into mechanical energy through various engines and power plants; the transport of energy via devices such as heat exchangers, pipelines, gears, and linkages; and the use of energy to perform a variety of tasks for the benefit of society, such as in transportation vehicles of all types, manufacturing tools and equipment, and household appliances. Furthermore, since all hardware products must be constructed of solid materials and because most products contain parts that transmit forces, mechanical engineering is involved in the structural integrity and materials selection for almost every product on the market.

Mechanical engineers are employed in virtually every kind of industry. They are involved in seeking new knowledge through research, in generating creative design and development, and in the production, control, management, and sales of the devices and systems needed by society. Therefore, a major strength of a mechanical engineering education is the flexibility it provides in future employment opportunities for its graduates.

The undergraduate curriculum includes the study of the principles governing the use of energy; the principles of design, instruments and control devices; and the application of these studies to the creative solution of practical, modern problems.

Design is integrated throughout the curriculum, beginning with ECE 100 Introduction to Engineering Design and followed later by ECE 300 Intermediate Engineering Design, both of which focus on basic design theory as well as professional practice. These required courses are followed by topic specific design content in mechanical engineering courses in the junior and senior years. The senior capstone design course combines the design topics from the earlier courses and completes the required design sequence. In addition, many of the mechanical technical electives have design content.

Laboratory experience is provided in the areas of thermo-fluid systems, mechanics of materials, and controls. Laboratory facilities include a thermal systems laboratory, an integrated mechanical-testing laboratory, a controls laboratory, and a manufacturing laboratory.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Mechanical Engineering, including a minimum of 50 upper-division semester hours. All students must satisfy the university First-Year Composition requirement and General Studies requirement. The College of Engineering and Applied Sciences does not permit the use of pass/fail classes as part of a degree program, and at the option of the department, courses taken more than five years before admission to the programs are normally not accepted for transfer credit.

GRADUATION REQUIREMENTS

A student must earn a grade of "C" or higher in all lower-division mathematics, physics, and chemistry courses. A student must attain a minimum GPA of 2.00 in the engineering core, in the major, and overall. The department may require additional or remedial course work for those students who have demonstrated a trend toward academic difficulties.

COURSE REQUIREMENTS

The specific course requirements for B.S.E. degree in Mechanical Engineering are as follows:

First-Year Composition[1]

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Approved elective (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements[2]

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
HU courses 6–9
SB course(s) 3–6

Minimum total 15

Literacy and Critical Inquiry

ECE 300 Intermediate Engineering Design *L* 3
MAE 468 Aerospace Systems Design *L* 3

Total 6

Natural Sciences/Basic Sciences

CHM 114 General Chemistry for Engineers *SQ*[1] 4
or CHM 116 General Chemistry *SQ*[1] (4)
PHY 121 University Physics I: Mechanics *SQ*[1, 3] 3
PHY 122 University Physics Laboratory I *SQ*[1, 3] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[1, 4] 3
PHY 132 University Physics Laboratory II *SQ*[1, 4] 1
PHY 361 Introductory Modern Physics 3

Total 15

Mathematical Studies

MAT 242 Elementary Linear Algebra[1] 2
MAT 270 Calculus with Analytic Geometry I *MA*[1] 4
MAT 271 Calculus with Analytic Geometry II *MA*[1] 4
MAT 272 Calculus with Analytic Geometry III *MA*[1] 4
MAT 274 Elementary Differential Equations *MA*[1] 3

Total 17

General Studies school requirements total 53

Engineering Core[5]

ECE 100 Introduction to Engineering Design *CS* 3
ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 340 Thermodynamics 3
ECE 350 Structure and Properties of Materials 3

Total 22

Mechanical Engineering Major[6]

ECE 384 Numerical Methods for Engineers 4
MAE 317 Dynamic Systems and Control 3
MAE 319 Measurements and Data Analysis 3
MAE 371 Fluid Mechanics 3
MAE 388 Heat Transfer 3
MAE 422 Mechanics of Materials 4
MAE 441 Principles of Design 3
MAE 443 Engineering Design 3
MAE 491 Experimental Mechanical Engineering 3
Mechanical Systems Design (select one) 3–4
- MAE 341 Mechanism Analysis and Design (3)
- MAE 442 Mechanical Systems Design (4)
- MAE 447 Robotics and Its Influence on Design (3)

Thermal Systems Design(select one) 3
- MAE 382 Thermodynamics (3)
- MAE 433 Air Conditioning and Refrigeration (3)
- MAE 434 Internal Combustion Engines (3)
- MAE 435 Turbomachinery (3)
- MAE 446 Thermal Systems Design (3)

Areas of Study (technical electives) 11–12

Total 47

Total for the program 128

[1] A minimum grade of "C" or higher is required.

[2] The General Studies requirement is divided into five core and three awareness areas. A student must include within his or her program at least two courses that cover the three awareness areas. It is recommended that students consult an academic advisor to ensure completion of the Humanities and Fine Arts (HU), Social and Behavioral Sciences (SB), and awareness areas (C, G, H).

[3] Both PHY 121 and 122 must be taken to secure SQ credit.

[4] Both PHY 131 and 132 must be taken to secure SQ credit.

[5] A "C" average is required for engineering core classes and ECE 300.

[6] A "C" average or higher is required for all classes listed under the major plus MAE 490.

Mechanical Engineering Areas of Study. Technical electives may be selected from among any of the following courses. The courses are grouped to assist a student in identifying areas of specialization. Students preferring a broader technical background may choose courses from different areas. Generally no more than two technical elective courses from outside the department area are allowed. Furthermore, only one project course may be used for a technical elective. Graduate-level classes may be used provided the student's GPA is at least 3.00 and the student has permission from the course instructor, department advisor, and College of Engineering and Applied Sciences dean. Credit for courses not on the list requires prior approval of the student's advisor and department.

Aerospace

MAE 413 Aircraft Performance, Stability, and Control 3
MAE 415 Vibration Analysis 4
MAE 426 Design of Aerospace Structures 3
MAE 455 Polymers and Composites 3
MAE 460 Gas Dynamics 3
MAE 461 Aerodynamics II 3
MAE 463 Propulsion 3
MAE 465 Rocket Propulsion 3
MAE 466 Rotary Wing Aerodynamics and Performance 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MAE 467 Aircraft Performance 3
MAE 469 Projects in Astronautics or Aeronautics 3

Biomechanical
BME 411 Biomedical Engineering I 3
BME 412 Biomedical Engineering II 3
BME 416 Biomechanics 3
BME 419 Biocontrol Systems 3
EEE 302 Electrical Networks II 3
EEE 434 Quantum Mechanics for Engineers 3

Computer Methods
CSE 310 Data Structures and Algorithms 3
CSE 422 Microprocessor System Design II 4
CSE 428 Computer-Aided Processes 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3
IEE 475 Simulating Stochastic Systems *CS* 3
IEE 485 Engineering Statistics *CS* 3
MAE 404 Finite Elements in Engineering 3
MAE 406 CAD/CAM Applications in MAE 4
MAE 471 Computational Fluid Dynamics 3
MAT 421 Applied Computational Methods *CS* 3
MAT 423 Numerical Analysis I *CS* 3
MAT 425 Numerical Analysis II *CS* 3

Control and Dynamic Systems
CSE 428 Computer-Aided Processes 3
EEE 360 Energy Conversion and Transport 4
EEE 480 Feedback Systems 4
EEE 482 Introduction to State Space Methods 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3
MAE 413 Aircraft Performance, Stability, and Control 3
MAE 417 Control System Design 3
MAE 462 Space Vehicle Dynamics and Control 3
MAE 467 Aircraft Performance 3

Design
MAE 341 Mechanism Analysis and Design 3
MAE 351 Manufacturing Processes 3
MAE 404 Finite Elements in Engineering 3
MAE 406 CAD/CAM Applications in MAE 4
MAE 413 Aircraft Performance, Stability, and Control 3
MAE 417 Control System Design 3
MAE 434 Internal Combustion Engines 3
MAE 435 Turbomachinery 3
MAE 442 Mechanical Systems Design 4
MAE 446 Thermal Systems Design 3
MAE 447 Robotics and Its Influence on Design 3
MAE 462 Space Vehicle Dynamics and Control 3
MAE 467 Aircraft Performance 3

Energy Systems
EEE 360 Energy Conversion and Transport 4
MAE 372 Fluid Mechanics 3
MAE 382 Thermodynamics 3
MAE 434 Internal Combustion Engines 3
MAE 435 Turbomachinery 3
MAE 436 Combustion 3
MAE 446 Thermal Systems Design 3

Engineering Mechanics
MAE 341 Mechanism Analysis and Design 3
MAE 402 Introduction to Continuum Mechanics 3
MAE 404 Finite Elements in Engineering 3
MAE 413 Aircraft Performance, Stability, and Control 3
MAE 415 Vibration Analysis 4
MAE 426 Design of Aerospace Structures 3
MAE 442 Mechanical Systems Design 4
MAE 460 Gas Dynamics 3
MAE 461 Aerodynamics II 3
MAE 471 Computational Fluid Dynamics 3
MAT 421 Applied Computational Methods *CS* 3
MAT 423 Numerical Analysis I *CS* 3
MSE 440 Mechanical Properties of Solids 3

Manufacturing
CSE 428 Computer-Aided Processes 3
IEE 300 Economic Analysis for Engineers 3
IEE 374 Quality Control *CS* 3
IEE 461 Production Control 3
IEE 463 Computer-Aided Manufacturing and Control *CS* 3
MAE 341 Mechanism Analysis and Design 3
MAE 351 Manufacturing Processes 3
MAE 404 Finite Elements in Engineering 3
MAE 442 Mechanical Systems Design 4
MAE 447 Robotics and Its Influence on Design 3
MAE 455 Polymers and Composites 3
MSE 355 Introduction to Materials Science and Engineering 3
MSE 420 Physical Metallurgy 3
MSE 431 Corrosion and Corrosion Control 3
MSE 440 Mechanical Properties of Solids 3

Stress Analysis, Failure Prevention, and Materials
MAE 341 Mechanism Analysis and Design 3
MAE 404 Finite Elements in Engineering 3
MAE 426 Design of Aerospace Structures 3
MAE 447 Robotics and Its Influence on Design 3
MAE 455 Polymers and Composites 3
MSE 355 Introduction to Materials Science and Engineering 3
MSE 420 Physical Metallurgy 3
MSE 431 Corrosion and Corrosion Control 3
MSE 440 Mechanical Properties of Solids 3
MSE 450 X-Ray and Electron Diffraction 3

Thermosciences
MAE 372 Fluid Mechanics 3
MAE 382 Thermodynamics 3
MAE 433 Air Conditioning and Refrigeration 3
MAE 434 Internal Combustion Engines 3
MAE 435 Turbomachinery 3
MAE 436 Combustion 3
MAE 446 Thermal Systems Design 3
MAE 460 Gas Dynamics 3
MAE 463 Propulsion 3
MAE 471 Computational Fluid Dynamics 3

TYPICAL FOUR-YEAR SEQUENCE

The first two years are usually devoted to the General Studies and engineering core requirements. A typical schedule is given below.

Mechanical Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester
CHM 114 General Chemistry for Engineers *SQ* 4
or CHM 116 General Chemistry *SQ* (4)
ECE 100 Introduction to Engineering Design *CS* 3
or HU/SB elective[1]
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
HU/SB and awareness area course[1] 3
Total 17

Second Semester
ENG 102 First-Year Composition 3

MAT 242 Elementary Linear Algebra 2
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[2] 3
PHY 122 University Physics Laboratory I *SQ*[2] 1
HU/SB and awareness area course[1] 3
or ECE 100 Introduction to Engineering Design *CS* (3)

Total 16

Second Year

First Semester
ECE 210 Engineering Mechanics I: Statics 3
ECE 350 Structure and Properties of Materials 3
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3
PHY 131 University Physics II: Electricity and Magnetism *SQ*[3] 3
PHY 132 University Physics Laboratory II *SQ*[3] 1

Total 17

Second Semester
ECE 201 Electrical Networks I 4
ECE 212 Engineering Mechanics II: Dynamics 3
ECE 313 Introduction to Deformable Solids 3
ECE 340 Thermodynamics 3
ECE 384 Numerical Methods for Engineers 4

Total 17

Third Year

First Semester
ECE 300 Intermediate Engineering Design *L* 3
MAE 317 Dynamic Systems and Control 3
MAE 319 Measurements and Data Analysis 3
MAE 371 Fluid Mechanics 3
MAE 422 Mechanics of Materials 4

Total 16

Second Semester
MAE 388 Heat Transfer 3
MAE 441 Principles of Design 3
HU/SB and awareness area courses[1] 3
Technical elective 6

Total 15

Fourth Year

First Semester
MAE 491 Experimental Mechanical Engineering 3
PHY 361 Introductory Modern Physics 3
HU/SB and awareness area course[1] 3
Technical electives 6

Total 15

Second Semester
MAE 443 Engineering Design 3
MAE 490 Projects in Design and Development *L* 3
HU/SB and awareness area course[1] 3
Technical electives 6

Total 15

[1] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to satisfy HU or SB requirements.

[2] Both PHY 121 and 122 must be taken to secure SQ credit.

[3] Both PHY 131 and 132 must be taken to secure SQ credit.

MECHANICAL AND AEROSPACE ENGINEERING (MAE)

MAE 101 Introduction to Aerospace Engineering. (2)
fall and spring
Careers in aerospace engineering, problem solving, computer usage in aerospace engineering, contemporary issues of the aerospace industry, the aerospace engineering curriculum. Pre- or corequisite: ECE 100.

MAE 317 Dynamic Systems and Control. (3)
fall and spring
Modeling and representations of dynamic physical systems, including transfer functions, block diagrams, and state equations. Transient response. Principles of feedback control and linear system analysis, including root locus and frequency response. Prerequisite: ECE 212. Pre- or corequisite: ECE 384.

MAE 319 Measurements and Data Analysis. (3)
fall and spring
Theory of measurement systems, sensors, digital data acquisition, signal processing and statistical analysis. Computer simulations and real-time experiments designed to illustrate these topics. Lecture, lab. Prerequisite: ECE 201. Pre- or corequisite: MAE 317.

MAE 341 Mechanism Analysis and Design. (3)
once a year
Positions, velocities, and accelerations of machine parts; cams, gears, flexible connectors, and rolling contact; introduces synthesis. Prerequisite: ECE 212.

MAE 351 Manufacturing Processes. (3)
fall and spring
Production technique and equipment. Casting and molding, forming, machining, joining and assembly, computer-integrated manufacturing, rapid prototyping, and electronics manufacturing. Cross-listed as IEE 360. Credit is allowed for only IEE 360 or MAE 351. Prerequisite: ECE 350.

MAE 361 Aerodynamics I. (3)
once a year
Fluid statics, conservation principles, stream function, velocity potential, vorticity, inviscid flow, Kutta-Joukowski, thin-airfoil theory, and panel methods. Prerequisites: ECE 212, 340.

MAE 371 Fluid Mechanics. (3)
fall and spring
Introductory concepts of fluid motions; fluid statics; control volume forms of basic principles; viscous internal flows. Prerequisites: ECE 212, 340.

MAE 372 Fluid Mechanics. (3)
once a year
Applies basic principles of fluid mechanics to problems in viscous and compressible flow. Prerequisites: ECE 384; MAE 361 (or 371).

MAE 382 Thermodynamics. (3)
once a year
Applied thermodynamics; gas mixtures, psychrometrics, property relationships, power and refrigeration cycles, and reactive systems. Prerequisite: ECE 340.

MAE 388 Heat Transfer. (3)
fall and spring
Steady and unsteady heat conduction, including numerical solutions; thermal boundary layer concepts and applications to free and forced convection. Thermal radiation concepts. Prerequisites: ECE 384; MAE 361 (or 371).

MAE 402 Introduction to Continuum Mechanics. (3)
once a year
Applies the principles of continuum mechanics to such fields as flow-in porous media, biomechanics, electromagnetic continua, and magneto-fluid mechanics. Prerequisites: ECE 313; MAE 361 (or 371); MAT 242 (or 342).

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MAE 404 Finite Elements in Engineering. (3)
once a year
Introduces ideas and methodology of finite element analysis. Applications to solid mechanics, heat transfer, fluid mechanics, and vibrations. Prerequisites: ECE 313; MAT 242 (or 342).

MAE 406 CAD/CAM Applications in MAE. (4)
once a year
Solution of engineering problems with the aid of state-of-the-art software tools in solid modeling, engineering analysis, and manufacturing; selection of modeling parameters; reliability tests on software. 3 hours lecture, 3 hours lab. Prerequisites: ECE 384; MAE 422, 441 (or 444).

MAE 413 Aircraft Performance, Stability, and Control. (3)
spring
Aircraft performance, cruise, climbing and turning flights, energy maneuverability, 6 DOF equations for aircraft, aerodynamic stability derivatives, flight stability/control. Prerequisites: MAE 317, 361.

MAE 415 Vibration Analysis. (4)
fall
Free and forced response of single and multiple degree of freedom systems, continuous systems; applications in mechanical and aerospace systems numerical methods. Lecture, lab. Prerequisites: ECE 212; MAE 319, 422 (or 425); MAT 242 (or 342).

MAE 417 Control System Design. (3)
once a year
Tools and methods of control system design and compensation, including simulation, response optimization, frequency domain techniques, state variable feedback, and sensitivity analysis. Introduces nonlinear and discrete time systems. Prerequisite: MAE 317.

MAE 422 Mechanics of Materials. (4)
fall and spring
Failure theories, energy methods, finite element methods, plates, torsion of noncircular members, unsymmetrical bending, shear center, and beam column. Lecture, lab. Prerequisites: ECE 313; MAT 242 (or 342). Pre- or corequisite: ECE 384.

MAE 425 Aerospace Structures. (4)
fall
Stability, energy methods, finite element methods, torsion, unsymmetrical bending and torsion of multicelled structures, design of aerospace structures. Lecture, lab. Prerequisites: ECE 313; MAT 242 (or 342).

MAE 426 Design of Aerospace Structures. (3)
once a year
Flight vehicle loads, design of semimonocoque structures, local buckling and crippling, fatigue, aerospace materials, composites, joints, and finite element applications. Prerequisite: MAE 422 or 425.

MAE 433 Air Conditioning and Refrigeration. (3)
once a year
Air conditioning processes; environmental control; heating and cooling loads; psychrometry; refrigeration cycles. Prerequisite: MAE 388 or MET 432 or instructor approval.

MAE 434 Internal Combustion Engines. (3)
once a year
Performance characteristics, combustion, carburetion and fuel-injection, and the cooling and control of internal combustion engines. Computer modeling. Lab. Prerequisite: MAE 388.

MAE 435 Turbomachinery. (3)
once a year
Design and performance of turbomachines, including steam, gas and hydraulic turbines, centrifugal pumps, compressors, fans, and blowers. Pre- or corequisite: MAE 361 or 371.

MAE 436 Combustion. (3)
once a year
Thermochemical and reaction rate processes; combustion of gaseous and condensed-phase fuels. Applications to propulsion and heating systems. Pollutant formation. Prerequisite: MAE 388.

MAE 441 Principles of Design. (3)
fall and spring
Conceptual and embodiment design of mechanical elements; form synthesis; material selection, failure modes, manufacturability tolerances, common mechanisms, and machine elements. Lecture, lab (project). Prerequisites: ECE 300, 350. Pre- or corequisites: MAE 319, 422 (or 425).

MAE 442 Mechanical Systems Design. (4)
spring
Applies design principles and techniques to the synthesis, modeling, and optimization of mechanical, electromechanical, and hydraulic systems. Lecture, lab. Prerequisites: MAE 317, 441 (or 444).

MAE 443 Engineering Design. (3)
fall and spring
Group projects to design engineering components and systems. Problem definition ideation, modeling, and analysis; emphasizes decision making and documentation activities. 6 hours lab. Prerequisite: MAE 441.

MAE 444 Fundamentals of Aerospace Design. (3)
spring
Design theory and design tools applied to aerospace engineering. Engineering drawings, solid modeling, RFP's, Federal Aviation Regulations and military specifications, aircraft sizing, rapid prototyping. Lab, projects. Prerequisites: ECE 300, 350; MAE 319, 361, 425. Pre- or corequisite: MAE 413.

MAE 446 Thermal Systems Design. (3)
once a year
Applies engineering principles and techniques to the modeling and analysis of thermal systems and components. Presents and demonstrates optimization techniques and their use. Prerequisite: ECE 300; MAE 388.

MAE 447 Robotics and Its Influence on Design. (3)
once a year
Robot applications, configurations, singular positions, and work space; modes of control; vision; programming exercises; design of parts for assembly. Prerequisite: MAE 317.

MAE 455 Polymers and Composites. (3)
fall
Relationship between chemistry, structure, and properties of engineering polymers. Design, properties, and behavior of fiber composite systems. Cross-listed as MSE 470. Credit is allowed for only MAE 455 or MSE 470. Prerequisites: ECE 313, 350.

MAE 460 Gas Dynamics. (3)
spring
Compressible flow at subsonic and supersonic speeds; duct flow; normal and oblique shocks, perturbation theory, and wind tunnel design. Prerequisites: ECE 384; MAE 361 (or 371).

MAE 461 Aerodynamics II. (3)
once a year
Transonic/hypersonic flows, wing theory, Navier-Stokes, laminar/turbulent shear flows, pressure drop in tubes, separation, drag, viscous/inviscid interaction, and wing design. Prerequisite: MAE 460.

MAE 462 Space Vehicle Dynamics and Control. (3)
fall
Attitude dynamics and control, launch vehicles, orbital mechanics, orbital transfer/rendezvous, space mission design, space structures, spacecraft control systems design. Prerequisite: MAE 317.

MAE 463 Propulsion. (3)
fall
Fundamentals of gas-turbine engines and design of components. Principles and design of rocket propulsion and alternative devices. Lecture, design projects. Prerequisites: ECE 384; MAE 382 (or 460).

MAE 464 Aerospace Laboratory. (3)
fall
Aerodynamic flow parameters; flow over airfoils and bodies of revolution; flow visualization; computer-aided data acquisition and processing; boundary layer theory. 1 hour lecture, 4 hours lab. Prerequisites: ECE 384; MAE 319, 460.

MAE 465 Rocket Propulsion. (3)
once a year
Rocket flight performance; nozzle design; combustion of liquid and solid propellants; component design; advanced propulsion systems; interplanetary missions; testing. Prerequisite: MAE 382 or 460.

MAE 466 Rotary Wing Aerodynamics and Performance. (3)
once a year
Introduces helicopter and propeller analysis techniques. Momentum, blade-element, and vortex methods. Hover and forward flight. Ground effect, autorotation, and compressibility effects. Prerequisites: both ECE 384 and MAE 361 or only instructor approval.

MAE 467 Aircraft Performance. (3)
once a year
Integrates aerodynamic and propulsive forces into aircraft performance design. Estimation of drag parameters for design. Engine, airfoil selection. Conceptual design methodology. Lecture, design projects. Prerequisite: MAE 361 or 371. Pre- or corequisite: MAE 444.

MAE 468 Aerospace Systems Design. (3)
fall and spring
Group projects related to aerospace vehicle design, working from mission definition and continuing through preliminary design. Prerequisites: MAE 413, 444. Pre- or corequisite: MAE 463.
General Studies: L

MAE 469 Projects in Astronautics or Aeronautics. (3)
fall and spring
Various multidisciplinary team projects available each semester. Projects include design of high-speed rotocraft autonomous vehicles, liquid-fueled rockets, microaerial vehicles, satellites. Prerequisite: instructor approval.

MAE 471 Computational Fluid Dynamics. (3)
once a year
Numerical solutions for selected problems in fluid mechanics. Prerequisites: ECE 384; MAE 361 (or 371).

MAE 490 Projects in Design and Development. (3)
fall and spring
Capstone projects in fundamental or applied aspects of engineering. Prerequisite: MAE 441. Pre- or corequisite: MAE 491.
General Studies: L

MAE 491 Experimental Mechanical Engineering. (3)
fall and spring
Experimental and analytical studies of phenomena and performance of fluid flow, heat transfer, thermodynamics, refrigeration, and mechanical power systems. 6 hours lab. Prerequisites: MAE 319, 388.

MAE 492 Honors Directed Study. (1–6)
selected semesters

MAE 493 Honors Thesis. (1–6)
selected semesters

MAE 498 Pro-Seminar. (1–3)
selected semesters
Special topics for advanced students. Applies the engineering disciplines to design and analysis of modern technical devices and systems. Prerequisite: instructor approval.

MAE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Programs in Engineering Special Studies

480/965-1726
ECG 104

Ronald J. Roedel, Director

The major of Engineering Special Studies accommodates students whose educational objectives require more intensity of concentration on a particular subject or more curricular flexibility within an engineering discipline than the traditional departmental majors generally permit. The major is a School of Engineering program. Unlike the departmental major areas, however, there is not a separate faculty. The faculty teaching and advising in these programs are from the various departments within the School of Engineering.

For many students, engineering studies form the basis of preparation for professional engineering work where proficiency in the application of science and the physical and social technologies is brought to bear on problems of a large scope. The necessary breadth that these students seek often is not obtainable in traditional engineering fields. Rather, specially designed programs of course work that merge the required principles and approaches drawn from all fields of engineering and other pertinent disciplines are desired.

The B.S.E. degree in Engineering Special Studies is designed primarily for students intending to pursue engineering careers at a professional level in industry or graduate studies.

ENGINEERING SPECIAL STUDIES—B.S.E.

Premedical Engineering. In recent decades, the interrelation between engineering and medicine has become vigorous and exciting. Rapidly expanding technology dictates that engineering will continue to become increasingly involved in all branches of medicine. As this develops, so will the need for physicians trained in the engineering sciences—medical men and women with a knowledge of computer technology, transport phenomena, biomechanics, bioelectric phenomena, operations research, and cybernetics. This concentration is of special interest to students who desire entry into a medical college and who have medical interests in research, aerospace and undersea medicine, artificial organs, prostheses, biomedical engineering, or biophysics. Since both engineering and medicine have as their goal the well-being of humans, this program is compatible with any field of medical endeavor. This program is administered with the Harrington Department of Bioengineering.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

DEGREE REQUIREMENTS

A minimum of 128 semester hours is necessary for the B.S.E. degree in Engineering Special Studies with a concentration in Premedical Engineering. A minimum of 50 upper-division hours is required. Students must attain a GPA of at least 2.00 for the courses in the major field.

GRADUATION REQUIREMENTS

In addition to fulfilling school and major requirements, majors must satisfy all university graduation requirements. See "University Graduation Requirements," page 81.

Note: To fulfill medical school admission requirements, BIO 187 General Biology is required in addition to the degree requirements and is best taken in summer session before the Medical College Admission Test.

COURSE REQUIREMENTS

The course work for the undergraduate degree can be classified into the following categories (in semester hours):

First-Year Composition

Choose among the course combinations below 6
- ENG 101 First-Year Composition (3)
- ENG 102 First-Year Composition (3)

—or—

- ENG 105 Advanced First-Year Composition (3)
- Elective chosen with an advisor (3)

—or—

- ENG 107 English for Foreign Students (3)
- ENG 108 English for Foreign Students (3)

Total 6

General Studies/School Requirements

Humanities and Fine Arts/Social and Behavioral Sciences

ECN 111 Macroeconomic Principles *SB*[1] 3
or ECN 112 Microeconomic Principles *SB*[1] (3)
HU/SB and awareness area courses[2] 12

Total 15

Literacy and Critical Inquiry

BME 413 Biomedical Instrumentation *L*[3] 3
BME 423 Biomedical Instrumentation Laboratory *L*[3] 1
ECE 300 Intermediate Engineering Design *L* 3

Total 7

Natural Sciences

PHY 121 University Physics I: Mechanics *SQ*[4] 3
PHY 122 University Physics Laboratory I *SQ*[4] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[5] 3
PHY 132 University Physics Laboratory II *SQ*[5] 1

Total 8

Mathematical Studies

ECE 100 Introduction to Engineering Design *CS* 3
ECE 384 Numerical Methods for Engineers 4
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 274 Elementary Differential Equations *MA* 3

Total 22

General Studies/school requirements total 52

Engineering Core

ECE 201 Electrical Networks I 4
ECE 210 Engineering Mechanics I: Statics 3
ECE 334 Electronic Circuits 4
ECE 340 Thermodynamics 3
ECE 350 Structure and Properties of Materials 3

Total 17

Engineering Special Studies Program Major—Premedical Engineering Concentration

BIO 188 General Biology II *SQ* 4
BME 201 Introduction to Bioengineering *L* 3
BME 318 Biomaterials 3
BME 331 Biomedical Engineering Transport: Fluids 3
BME 334 Bioengineering Heat and Mass Transfer 3
BME 416 Biomechanics 3
BME 417 Biomedical Engineering Capstone Design I 3
BME 435 Physiology for Engineers 4
BME 470 Microcomputer Applications in Bioengineering 4
BME 490 Biomedical Engineering Capstone Design II 3
CHM 113 General Chemistry *SQ* 4
CHM 116 General Chemistry *SQ* 4
CHM 331 General Organic Chemistry 3
CHM 332 General Organic Chemistry 3
CHM 335 General Organic Chemistry Laboratory 1
CHM 336 General Organic Chemistry Laboratory 1
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
Technical elective 1

Total 53

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[1] ECN 111 or 112 must be included to fulfill the HU and SB requirements.

[2] Engineering students may not use aerospace studies (AES) or military science (MIS) courses to fulfill HU and SB requirements.

[3] Both BME 413 and 423 must be taken to secure L credit.

[4] Both PHY 121 and 122 must be taken to secure SQ credit.

[5] Both PHY 131 and 132 must be taken to secure SQ credit.

Premedical Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester

CHM 113 General Chemistry *SQ* 4
ECE 100 Introduction to Engineering Design *CS* 3
ENG 101 First-Year Composition 3
MAT 270 Calculus with Analytic Geometry I *MA* 4

Total 14

Second Semester

CHM 116 General Chemistry *SQ* 4
ENG 102 First-Year Composition 3
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1

Total 15

Second Year

First Semester

BIO 188 General Biology II *SQ* 4
BME 201 Introduction to Bioengineering *L* 3
ECE 210 Engineering Mechanics I: Statics 3
MAT 272 Calculus with Analytic Geometry III *MA* 4

PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1

Total 18

Second Semester

CHM 331 General Organic Chemistry 3
CHM 335 General Organic Chemistry Laboratory 1
ECE 201 Electrical Networks I 4
ECE 350 Structure and Properties of Materials 3
ECN 111 Macroeconomic Principles *SB* 3
or ECN 112 Microeconomic Principles *SB* (3)
MAT 274 Elementary Differential Equations *MA* 3

Total 17

Third Year

First Semester

BME 331 Biomedical Engineering Transport: Fluids 3
BME 435 Physiology for Engineers 4
ECE 300 Intermediate Engineering Design *L* 3
ECE 340 Thermodynamics 3
ECE 384 Numerical Methods for Engineers 4

Total 17

Second Semester

BME 318 Biomaterials 3
BME 334 Bioengineering Heat and Mass Transfer 3
CHM 332 General Organic Chemistry 3
CHM 336 General Organic Chemistry Laboratory 1
ECE 334 Electronic Circuits 4
HU/SB and awareness area course[3] 3

Total 17

Fourth Year

First Semester

BME 413 Biomedical Instrumentation *L*[4] 3
BME 416 Biomechanics 3
BME 417 Biomedical Engineering Capstone Design I 3
BME 423 Biomedical Instrumentation Laboratory *L*[4] 1
HU/SB and awareness area courses[3] 6

Total 16

Second Semester

BME 470 Microcomputer Applications in Bioengineering 4
BME 490 Biomedical Engineering Capstone Design II 3
ECE 380 Probability and Statistics for Engineering Problem Solving *CS* 3
HU/SB and awareness area course[3] 3
Technical elective 1

Total 14

Total degree requirements 128

1 Both PHY 121 and 122 must be taken to secure SQ credit.
2 Both PHY 131 and 132 must be taken to secure SQ credit.
3 Engineering students may not use aerospace studies (AES) or military science (MIS) courses to satisfy HU or SB requirements.
4 Both BME 413 and 423 must be taken to secure L credit.

San Pablo is ASU Main's newest residence hall. Tim Trumble photo

The Katherine K. Herberger College of Fine Arts

herbergercollege.asu.edu **J. Robert Wills, Ph.D., Dean**

School of Art 263
Department of Dance 277
School of Music 282
Department of Theatre 296

PURPOSE

The Katherine K. Herberger College of Fine Arts at ASU provides both preprofessional and professional education in the arts disciplines and an opportunity for nonmajors to become culturally literate through participation and involvement in the creative and performing arts.

The college, through its programs in art, dance, music, and theatre, reflects a wide range of challenges facing the contemporary artist and scholar. The arts, as an integral part of the curriculum, offer the student a rewarding educational experience balanced and strengthened by studies in related fine arts areas, the humanities, social sciences, and the natural sciences.

In addition to professional curricula offered in each department and school, the college provides courses designed to meet the specific educational needs of students pursuing majors in other colleges throughout the university. The cultural life of the university community is further enriched by study opportunities offered at off-campus sites. The Herberger College of Fine Arts also offers community audiences many hours of cultural enjoyment through a myriad of concerts, art exhibitions, music and dance concerts, dramatic productions, operas, lectures, and seminars.

ORGANIZATION

The college houses the School of Art, the Department of Dance, the School of Music, and the Department of Theatre. An average of 2,600 students per semester enroll as majors in various degree programs offered through these units. The college also includes the ASU Art Museum and the Institute for Studies in the Arts.

ADMISSION

Students meeting the university requirements for admission may matriculate in the Herberger College of Fine Arts. Separate admission procedures and approvals are required for some programs within the college. Students must contact specific departments or schools for details.

Transfer of Community College Credits. The university standards for evaluation of transfer credit are listed under "Transfer Credit," page 62. Transfer students are encouraged to contact their department or school or the Herberger College of Fine Arts Undergraduate Student Academic Services (GHALL 127) to ensure a smooth transition to the Herberger College of Fine Arts. Credits transferred from any accredited junior or community college may be accepted up to a maximum of 64 semester hours. (A community college student planning to transfer at the end of his or her first or second year should plan to take community college courses that meet the requirements of the ASU curriculum selected. Students attending Arizona community colleges are permitted to follow the degree requirements specified in the ASU *General Catalog* in effect at the time they began their community college work, providing their college attendance has been continuous.)

Courses transferred from community colleges are not accepted as upper-division credit at ASU. Arizona students are urged to refer to the *Course Applicability System* for transferability of specific courses from Arizona community colleges. In choosing courses at a community college, students should be aware that a minimum of 45 hours of work taken at the university must be upper-division credits. While attending a community college, it is suggested that students select courses similar to ASU General Studies lower-division courses in the major field.

For optimal course selection, access the ASU Transfer Guides on the Web at www.asu.edu/provost/articulation.

General Transfer Credit. Direct transfer of courses from other accredited institutions to the Herberger College of Fine Arts are subject to (1) the existence of parallel and equal courses in the college's curriculum and (2) departmental or school evaluation of studio courses with respect to performance standards. Every candidate for the bachelor's degree must earn a minimum of 30 semester hours in resident credit at ASU. Transfer students enrolled in the college must complete a minimum of 15 semester hours of resident credit in the major as approved by the faculty.

ADVISING

Advising is handled as a decentralized activity within the college. To offer personalized attention, each academic unit establishes its own graduation advising procedures. Students are encouraged to make appointments through the central office of their department or school.

Baccalaureate Degrees

The three baccalaureate degrees differ in curricula with respect to the amount of specialization permitted in the

Herberger College of Fine Arts Baccalaureate Degrees and Majors

Major	Degree	Concentration	Administered By
Art	B.A.	Art history, digital art, museum studies, studio art	School of Art
	B.F.A.	Art education, ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, sculpture	School of Art
Dance	B.F.A.	Choreography, dance education, dance studies, performance	Department of Dance
Music	B.A.	—	School of Music
Music Education*	B.M.	Choral-general, instrumental, string	School of Music
Music Therapy*	B.M.	—	School of Music
Performance	B.M.	Guitar, jazz, keyboard, music theatre, orchestral instrument, piano accompanying, voice	School of Music
Theatre	B.A.	Acting, scenography	Department of Theatre
Theory and Composition	B.M.	Composition, theory	School of Music

* This major requires more than 120 semester hours to complete.

major field. The B.A. degree provides a broad, scholarly, humanistic program, while the other two programs place greater emphasis upon the major field. See the "Herberger College of Fine Arts Baccalaureate Degrees and Majors" table, on this page, for more information.

The university General Studies curriculum plays an integral role within the educational mission of the university and as such constitutes an important component of all undergraduate degrees in the Herberger College of Fine Arts. See "General Studies," page 85, for more information.

In cooperation with the College of Education a K–12 endorsement for teacher certification is available in the disciplines of art, dance, and music for students preparing for a teaching career in the public schools. Students should, with the advice and counsel of their arts education advisors, fulfill the requirements for the appropriate area of specialization under the Bachelor of Fine Arts or Bachelor of Music degrees. In addition, a student wishing to be admitted to the Initial Teacher Certification (ITC) program in the College of Education (leading to teaching certification) must consult with an advisor from the Office of Student Services in the College of Education before making application for the ITC. Students must have completed 56 hours with a minimum GPA of 2.50 and also have submitted scores from either the Pre-Professional Skills Test (PPST) or the ACT. Further details on admission requirements and procedures for the ITC can be found under "Teacher Education," page 181.

Minors

The Herberger College of Fine Arts provides an opportunity for students majoring in other disciplines to sustain their interest in the arts through a structured program of required courses and electives leading to a minor. The minor is not intended as a substitute for professional work in the arts, but as a complement to various liberal arts and preprofessional curricula.

Minors are offered in Art History, Dance, Music, and Theatre. The total number of semester hours required for a minor ranges from 18 to 23. Students should contact the relevant academic unit for specific requirements and guidelines regarding the minor.

Graduate Degrees

Master's programs range from 30 to 60 semester hours, depending upon the degree chosen. Doctoral programs vary in scope and curricula. See the "Herberger College of Fine Arts Graduate Degrees and Majors," page 260, for more information. See the *Graduate Catalog* for specific requirements.

UNIVERSITY GRADUATION REQUIREMENTS

In addition to fulfilling college and major requirements, students must meet all university graduation requirements. For more information, see "University Graduation Requirements," page 81.

GENERAL STUDIES REQUIREMENT

All students enrolled in a baccalaureate degree program must satisfy a university requirement of a minimum of 35 semester hours of approved course work in General Studies, as described under "General Studies," page 85. Note that all three General Studies awareness areas are required. Consult with an advisor for an approved list of courses. General Studies courses are listed in the "General Studies" table, page 88, in the course descriptions, in the *Schedule of Classes,* and in the *Summer Sessions Bulletin.*

Courses in the major or in a related field area may not be used to satisfy both the major and core area portions of the General Studies requirement. Concurrent listings in the literacy areas, numeracy (computer applications) areas, and awareness areas are an exception. Students are encouraged to consult with an academic advisor to ensure that they comply with all necessary requirements.

COLLEGE DEGREE REQUIREMENTS

The Herberger College of Fine Arts degree requirements supplement the General Studies requirement. Descriptions

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Herberger College of Fine Arts Graduate Degrees and Majors

Major	Degree	Concentration	Administered By
Art	M.A.	Art education, art history	School of Art
	M.F.A.	Ceramics, drawing, fibers, intermedia, metals, painting, photographic studies, photography, printmaking, sculpture, wood	School of Art
Composition	M.M.	—	School of Music
Creative Writing	M.F.A.[1]	—	Creative Writing Committee
Curriculum and Instruction	Ph.D.[2]	Art education	School of Art
Dance	M.F.A.	—	Department of Dance
History and Theory of Art[3]	Ph.D.	—	School of Art
Music	M.A.	Ethnomusicology, music history and literature, music theory	School of Music
	D.M.A.	Conducting, music composition, music education, performance	School of Music
Music Education	M.M.	Choral music, general music, instrumental music, jazz studies	School of Music
Performance	M.M.	Music theatre/opera musical direction, music theatre/opera performance, performance, performance pedagogy, piano accompanying	School of Music
Theatre	M.A.	—	Department of Theatre
	M.F.A.	Performance, scenography, theatre for youth	Department of Theatre
	Ph.D.	Theatre for youth	Department of Theatre

[1] This program is administered by the Graduate College.

[2] This program is administered in collaboration with the College of Education and the Graduate College.

[3] This major is jointly offered with the University of Arizona.

of additional required courses follow. Students are encouraged to consult with an academic advisor to ensure that they comply with all necessary requirements.

Fine arts majors must take at least six semester hours of fine arts course work in areas outside of the major school or department. These courses may be in art, dance, music, or theatre. A student may concurrently fulfill this requirement and the humanities and fine arts portion of the General Studies requirement by selecting approved courses as indicated in the *Schedule of Classes*. This requirement may also be met by taking *any* Herberger College of Fine Arts course outside of the student's major.

All B.A. degrees require the equivalent of 16 semester hours in one foreign language except for the B.A. degrees in Theatre and Art with a concentration in studio art. Foreign language study is strongly recommended but not required for these degree programs. Course work may be selected in any language and must follow the sequence of language courses 101, 102, 201, and 202. This requirement may be fulfilled at the secondary school level or by examination. If acquired in secondary school, two years of instruction in one foreign language is considered the equivalent of one year of college instruction. Transfer students are placed in language study at the level above completed work.

Candidates for the B.M. degree in Performance with a concentration in voice have specific foreign language requirements, which are stated in the degree requirements. There is no foreign language requirement for other concentrations of the B.F.A. or B.M. degrees.

ACADEMIC STANDARDS AND RETENTION

Good Standing. Students in the Herberger College of Fine Arts are considered in good standing for the purpose of retention if they maintain a cumulative GPA of 2.00 or higher in all courses taken at ASU. However, to gain admission into certain undergraduate degree programs in the college, students must maintain a minimum GPA within their major and/or a minimum cumulative GPA. These minimum GPAs vary according to the given program.

Probation. Any student who does not maintain good standing is placed on academic probation. A student on academic probation is required to observe any limitations or rules the college may impose as a condition for retention.

Disqualification. A student who is on probation becomes disqualified if (1) the student has not returned to good standing or (2) the student has not met the required semester GPA.

Disqualification is exercised at the discretion of the college and becomes effective on the first day of the fall or spring semester following college action. A disqualified student is notified by the Office of the Registrar and/or the dean of the college and is not allowed to register for a fall or spring semester at the university until reinstated. A student who is disqualified may not attend as a nondegree student.

Reinstatement. Students seeking reinstatement after disqualification should contact the Herberger College of Fine Arts Student Services Office regarding procedures and guidance for returning to good standing. When reinstatement

includes readmission, application must be made to the Readmissions Section of the Office of the Registrar.

All academic discipline action is the function of the Herberger College of Fine Arts Student Services Office, GHALL 127, under the direction of the assistant dean of the college. Students having academic problems should call this office for advising at 480/965-4495.

MAJOR REQUIREMENTS

The minimum requirement for a baccalaureate degree is the completion of 120 semester hours with a minimum cumulative GPA of 2.00. Of these 120 semester hours, at least 45 must be selected from upper-division courses.

Several professional programs within the college require additional semester hours for graduation and a higher cumulative GPA of their majors. To be acceptable as degree credit, all course work in the major discipline must show an earned grade of "C" (2.00) or higher.

In addition to the general information given below, consult the school and departmental sections that follow for specific degree requirements.

Bachelor of Arts (B.A.) Degree. The B.A. degree requires from 45 to 69 semester hours for the major. Depending on the major, 18 to 24 hours must be selected from upper-division (300- or 400-level) courses. The semester-hour requirements in the major are distributed between a field of specialization (30 to 53 hours) and one or more related fields (an additional 15 hours). The exact content of the major is selected by a student in consultation with an advisor under rules and regulations of the department or school concerned. A successful entrance audition is also required for admission to the B.A. degree in Music program.

Bachelor of Fine Arts (B.F.A.) Degree. The B.F.A. degree requires 52 to 79 semester hours for the major. At least 30 of these hours, depending on the major, must be selected from upper-division (300- or 400-level) courses. The curriculum for the major is designed as preprofessional study. Auditions and/or interviews are required for admission to the B.F.A. degree program in Dance. Consult these departments for specific information.

Bachelor of Music (B.M.) Degree. The B.M. degree requires 79 semester hours for the major. The required number of upper-division (300- or 400-level) courses is dependent upon the area of specialization. The curriculum is designed to provide a broad yet concentrated preparation with a choice of specialization among various areas. See the "Herberger College of Fine Arts Baccalaureate Degrees and Majors" table, page 259, for available majors and concentrations. An entering undergraduate music student, regardless of the area of specialization, must pass an entrance audition in his or her primary performing medium (voice or instrument).

Academic Standards. The terms of disqualification, reinstatement, and appeals are consistent with those set forth by the university under "Retention and Academic Standards," page 78. In addition, a student disqualified in any program is normally not eligible for reinstatement for two semesters.

SPECIAL PROGRAMS

Working closely with faculty, visiting scholars, and artists-in-residence, students in all fields of the college participate in dynamic, innovative programs. Students receive a great deal of individual attention to their creative work and artistic development.

School of Art. The School of Art is one of the largest programs of its kind in the country. The faculty are nationally recognized and the programs offer students diverse educational opportunities in studio art, art history, and art educaton. Some of the unique offerings include bookmaking and papermaking, digital art, film, neon, video, computer animation, and foundry. In addition, internships are available in galleries and museums throughout the Phoenix area. The Children's Art Workshop is an on-campus program taught by students in art education for school-age children in the metropolitan area. Northlight, Harry Wood, and Step galleries host exhibitions organized and curated by students. Visiting artists and guest lecturers enrich the basic curriculum. Graduates of the School of Art have been accepted to top graduate schools and many are in leadership positions in art, education, and industry.

Department of Dance. The department's strengths include choreography and performance, dance science and somatic, educational outreach and methodology, media and technology, as well as contemporary directions. Prominent and renowned faculty and guest artists create repertory for dance majors and for the Dance Arizona Repertory Theatre (DART), the repertory and community partnership company. Through instructional curriculum, workshop intensives, guest residencies, strong performance programs, professional internships and apprenticeships, students are exposed and trained to meet the demands of professional preparations. An environment that encourages creative collaboration, interdisciplinary views, and community awareness is central to the mission of the department.

School of Music. Ranked among the top programs in the United States, the School of Music offers a broad scope of degree options for the study of performance, music education, music therapy, composition, theory, history and literature, jazz, music theatre, ethnomusicology, pedagogy, accompanying, and conducting. This wide spectrum of areas is supported by special programs and facilities that enrich the opportunities for professional training and musical growth. Music education and pedagogy are supplemented by the Piano and Guitar Preparatory Programs, the Music for Tots series, special classes for certification in Orff and Kodály methods, and the publication on campus of a major research journal. Performance opportunities are enhanced by a wide variety of ensembles, including such groups as Mexican marimba, African drumming, and mariachi. Voice students may pursue training in opera or in Broadway musicals. Composition students work in the Electronic Music Studio, and all benefit from the Electronic

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Classroom, a state-of-the-art computer facility. A variety of community partnerships, including a gang intervention program, stem from the music therapy area. The scope and variety of the School of Music's programs are made possible by the wide range of expertise of the faculty, who are performers, teachers, conductors, composers, and scholars recognized both nationally and internationally.

Department of Theatre. The Department of Theatre's B.A. degree features a broad liberal arts education, which cultivates in the student the ability to understand human behavior and values in societies of the past and present, an essential element in the creation of and response to theatre. Special strengths of the department include internationally acclaimed programs in theatre for youth; an outstanding playwriting area that infuses each specialization with new script work; multicultural courses; an acting concentration that allows work with nationally acclaimed directors and acting coaches; and a nationally recognized scenography concentration that provides for further specialization in costume, lighting, scene design, and theatre technology.

Production is at the core of ASU theatre and the quality of the faculty, student body, and facilities often attracts professionals to ASU. The department recently premiered productions by four Pulitzer prize-winning playwrights. Four to six subscription series plays are produced annually in the 496-seat Galvin Playhouse and the smaller Lyceum Theatre. An additional eight to 15 student-directed shows are presented.

Theatre-for-youth artists, students, and scholars are attracted to ASU by the opportunities to work on national K–12 theatre curricula and research projects, theatre tours to area schools, and opportunities to teach on and off campus. The Child Drama Special Collection in Hayden Library, which includes rare books, plays, and personal and national association archives, is the most complete and extensive collection of its kind in the English-speaking world and also contributes to the international recognition of the theatre-for-youth faculty.

ASU EXTENDED CAMPUS

The College of Extended Education was created in 1990 to extend the resources of ASU throughout Maricopa County, the state, and the region. The College of Extended Education is a university-wide college that oversees the ASU Extended Campus and forms partnerships with other ASU colleges, and the Katherine K. Herberger College of Fine Arts to meet the instructional and informational needs of a diverse community.

The ASU Extended Campus goes beyond the boundaries of the university's three physical campuses to provide access to quality academic credit for working adults through flexible schedules; a vast network of off-campus sites; classes scheduled days, evenings, and weekends; and innovative delivery technologies including television, the Internet, and Independent Learning.

For more information, see "ASU Extended Campus," page 671, or access the Web site at www.asu.edu/xed.

GENERAL INFORMATION

Undergraduate Credit for Graduate Courses. To enable interested students to benefit as much as possible from their undergraduate studies, the Graduate College and the Herberger College of Fine Arts extend to seniors with a GPA of at least 2.50 the privilege of taking 500-level graduate courses for undergraduate credit. Students requesting to take 500-level graduate courses must have the approval of the instructor of the class and their academic advisor.

Preprofessional Programs. Students preparing for admission to professional graduate schools should obtain information regarding admission requirements by writing directly to the schools in which they are interested.

Courses. The academic units within the Herberger College of Fine Arts may use the CFA prefix for course offerings that cross disciplinary boundaries.

COLLEGE OF FINE ARTS (CFA)

CFA 194 Special Topics. (1–4)
fall
Topics may include the following:
- Academic Balance for the Fine Arts Major. (1)

CFA 422 Concepts in Collaborative Multimedia. (3)
spring
Designed to bring students from different disciplines throughout the Herberger College of Fine Arts to experience the collaboration process in creating art. Lab, studio.

CFA 484 Internship. (1–12)
fall and spring

CFA 494 Special Topics. (3)
fall and spring
Topics may include the following:
- Basic Concepts of Digital Signal Processing and Programming for Artists. (3)
  spring
  Introduces the basic concepts behind the functioning of existing, widely used digital arts/media tools. Covers basic DSP concepts generic to all such tools (time-frequency relationships, basic signal theory [such as representational models, quatization, filtering, compression]). Concepts embellished using standard image/video/audio manipulation tools.

CFA 498 Pro-Seminar. (1–7)
fall and spring

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

School of Art

herbergercollege.asu.edu/art
480/965-3468
ART 102

Jon W. Sharer, Interim Director

Regents' Professors: Klett, Weiser

Professors: Alquist, Bates, Britton, Cocke, Codell, Duncan, Eckert, Erickson, Fahlman, Fronske, Gillingwater, Hajicek, Kaida, Magenta, Marc, Maxwell, Meissinger, Mesch, Pile, Pimentel, Pittsley, Risseeuw, Schmidt, Sharer, Stokrocki, Sweeney, Verstegen, White, Young

Associate Professors: Brown, Collins, Gully, Jenkins, McIver, Pessler, Schleif, Schoebel, Schutte, Segura, Serwint, Umberger, Wolfthal

Assistant Professors: Newport, Schneider

Senior Lecturer: Hokin

All students registering in a School of Art degree program enroll through the Herberger College of Fine Arts. Each degree program and area of specialization has its own check sheet, which describes the particulars of course sequence and special requirements. Check sheets are available in the School of Art Undergraduate Advising Center.

Art majors seeking a second B.A. or B.F.A. degree in art must petition the Herberger College of Fine Arts after completing 12 semester hours in the specialization of the second degree. The second degree in art requires at least 30 semester hours of courses which meet art requirements in the major. These 30 semester hours should not duplicate any of the courses taken for the first degree.

ART—B.A.

The faculty in the School of Art offer four concentrations for students in the B.A. degree in Art program: art history, digital art, museum studies, and studio art. These concentrations are intended to give the student a broadly based general education in the field with specialized work at the upper-division level.

The major in Art consists of 45 to 79 semester hours, depending on the concentration, and includes the requirements listed on this page for each concentration. B.A. degree programs are especially suited for individuals pursuing interdisciplinary studies or a minor in another discipline. All courses in the major must be completed with a "C" or higher.

Graduation Requirements. In addition to fulfilling the major requirements, students must meet all university graduation requirements and college degree requirements.

All art majors in studio B.F.A. programs and the B.A. in Digital Art program must enroll in ART 494 Senior Exhibition and Portfolio during their senior year. Successful completion of this course is required for graduation.

See "University Graduation Requirements," page 81, and "College Degree Requirements," page 259.

Art History

This concentration consists of a minimum of 45 to 61 semester hours. It requires 33 semester hours of art history, 12 semester hours of related study, and 16 semester hours of foreign language (101, 102, 201, and 202) or a demonstrated proficiency in one foreign language which is equivalent to the completion of two years of language at the college level. At least 27 of the 45 semester hours must be upper-division credit. Satisfactory completion of ARS 480 Research Methods is required before the senior year.

Art History Requirements

ARS	101 Art from Prehistory Though Middle Ages *HU, H*	3
ARS	102 Art from Renaissance to Present *HU, H*	3
ARS	480 Research Methods *L*	3
ARS	498 PS: Art History	3
Total		12

Also required is at least one 300- or 400-level art history (ARS) course from each of the following areas:

Ancient	3
Medieval	3
Modern/Contemporary	3
Non-Western	3
Renaissance/Baroque	3
Any ARS courses	6

B.I.S. CONCENTRATION

A concentration in art history is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Related Subject Field. Select three courses (nine semester hours) from those with the prefix APH, ARA, ARE, or from the following:

ART	111 Drawing I	3
ART	112 Two-Dimensional Design	3
ART	113 Color	3
ART	115 Three-Dimensional Design	3
ART	201 Photography I	3
ART	274 Wood I	3
ART	294 Special Topics	3

Also required is an approved upper-division elective. Six semester hours of ART courses are recommended.

Foreign Language. Sixteen semester hours of 101, 102, 201, and 202 language courses; or a demonstrated

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

proficiency in at least one foreign language equivalent to the level attained through the completion of two years of study at the college level is required. For specific courses, see the "Department of Languages and Literatures," page 376. (SHS courses are not acceptable.)

Digital Art

Sixty-nine semester hours are required for the concentration in digital art. It requires 18 semester hours of core curriculum, 18 semester hours of course work with a digital art emphasis, nine semester hours of art history, and 24 semester hours of related study. The faculty in the student's declared emphasis must approve course work in the digital art concentration and the related subject field. A senior exhibition is also required. Guidelines for the portfolio and exhibition are available in the Art Building (room 151) or by accessing the Web site at art.asu.edu/ug_advising/ug_index.

Portfolio Review. Admission to digital art courses require both a portfolio review and a minimum GPA of 2.70. Students must also declare an emphasis in 3D imaging and animation, digital photography, or video. The portfolio deadlines are October 15 for spring classes and March 15 for fall classes.

Core Curriculum. See "Studio Art," page 264, for courses that make up the core curriculum.

Specialization. Select 18 semester hours (including 12 semester hours of upper-division study) from the following:

ART	294 ST: Digital Art	3
	or ART 394 ST: Digital Art (3)	
ART	308 Digital Photographic Images	3
ART	345 Visualization and Prototyping I	3
ART	346 3D Computer Imaging and Animation *CS*	3
ART	348 Animation Motion Studies	3
ART	440 New Media Concepts	3
ART	441 Video Art	1
ART	449 Computer Animation and Video	3
ART	450 Computer Animation and Audio	3
ART	470 Computer Animation Portfolio *CS*	3
ART	494 ST: Digital Photographic Images II	3
	or ART 494 ST: Visualization and Prototyping II (3)	
	or any ART 494 digital art course (3)	

Related Subject Area. Select 24 semester hours of course work outside of the specialization. This may include courses in the School of Art, Herberger College of Fine Arts, and throughout the university that further students' fine arts goals in digital media and aid them in preparation for the senior exhibition.

Museum Studies

A minimum of 67 hours is required for the museum studies concentration. This concentration is an interdisciplinary program, which involves courses in the School of Art, Department of Anthropology, W. P. Carey School of Business, American Humanics/Department of Recreation Management, and the Department of Languages and Literatures.

Specialization

ARS	101 Art from Prehistory Though Middle Ages *HU, H*	3
ARS	102 Art from Renaissance to Present *HU, H*	3
ARS	201 Art of Asia *HU, G, H*	3
ARS	202 Art of Africa, Oceania, and the Americas *HU, G, H*	3
ARS	480 Research Methods *L*	3
ARS	484 Internship: Museum	3

Also required is at least one 300- or 400-level art history (ARS) course from each of the following areas:

ART	409 Photographic Exhibition	3
	or ARA 460 Gallery Exhibitions (3)	
ASB	471 Introduction to Museums *L*	3
	or ARS 494 ST: Introduction to Museums (3)	
Ancient		3
Any ARS courses		6
Medieval		3
Modern/contemporary		3
Non-Western		3
Renaissance/baroque		3

Related Study

COB	380 Small Business Leadership	3
COB	381 Small Business Accounting and Finance	3
COB	382 Small Business Sales and Marketing Development	3

Free Electives. Students must select a minimum of 12 semester hours of free electives. Recommended courses include REC 300 or 310; art history, anthropology, history, and/or business courses.

Foreign Language. Sixteen semester hours of 101, 102, 201, and 202 language courses are required or a demonstrated proficiency in at least one foreign language equivalent to the level attained through the completion of two years of study at the college level. For specific courses, see the "Department of Languages and Literatures," page 376. (SHS courses are not acceptable.)

Studio Art

Core Curriculum. The following courses make up the core curriculum:

ARS	101 Art from Prehistory Though Middle Ages *HU, H*	3
ARS	102 Art from Renaissance to Present *HU, H*	3
ART	111 Drawing I	3
ART	112 Two-Dimensional Design	3
ART	113 Color	3
ART	115 Three-Dimensional Design	3
Total		18

Specialization. Eighteen semester hours (including 12 hours of upper-division study) of ART focus courses must be selected from the following areas: ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, and sculpture.

Art History. Nine semester hours of ARS courses are required, which must include three semester hours of non-Western art. At least six semester hours must be upper-division ARS courses.

Related Subject Area. Related subject area includes courses outside the area of specialization in the School of Art, Herberger College of Fine Arts, and the university. Course selection must be related to student's professional goals in art and approved by area of specialization faculty and an academic advisor. A minimum of 24 hours is required, of which 18 hours must be of upper-division study.

Art History Minor

The School of Art offers a minor in Art History consisting of 18 semester hours of course work, including 12 upper-division electives. A minimum grade of "C" is required of all classes in the minor and for those pursuing a minor, a minimum overall GPA of 2.00 is required. Courses may not be double counted in a major and the minor, and a minimum of 12 hours of resident credit at ASU Main is required.

ARS 100 or 300 may be used toward a minor. ARS 100 and 300 may not be used toward an Art History minor if the student is an Art major or has credit in ARS 101 and 102.

Required Courses. Select two of the following four required courses:

ARS	101 Art from Prehistory Though Middle Ages *HU, H*	3
ARS	102 Art from Renaissance to Present *HU, H*	3
ARS	201 Art of Asia *HU, G, H*	3
ARS	202 Art of Africa, Oceania, and the Americas *HU, G, H*	3

Elective Courses. Students pursuing an art history minor select four three-semester-hour upper-division courses. A seminar is strongly recommended for those considering graduate study. Students need to be aware of lower-division prerequisites for all upper-division courses. Interested students should contact the School of Art for specific requirements and admission procedures.

ART—B.F.A.

The major in Art consists of 75 semester hours, with a concentration in one area selected on the basis of the student's interests. The following concentrations are available to the student: art education, ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, and sculpture. A portfolio review is required for admission to courses in the specialization for drawing, intermedia, painting, or photography. A senior portfolio and exhibition are required for all B.F.A. programs except Art Education. Guidelines for the portfolio and exhibition are available in the Art Building (room 151) and on the Web at art.asu.edu/ug_advising/ug_index.

B.F.A. Core Curriculum. All students in this degree program follow the same core curriculum in art for the first two semesters:

ARS	101 Art from Prehistory Though Middle Ages *HU, H*	3
ARS	102 Art from Renaissance to Present *HU, H*	3
ART	111 Drawing I	3
ART	112 Two-Dimensional Design	3
ART	113 Color	3
ART	115 Three-Dimensional Design	3
Total		18

At least 30 upper-division semester hours must be earned within the major, with a minimum of 12 semester hours within the concentration.

All course work counted in the major must be completed with a "C" or higher. The specific requirements for each concentration are recommended by the faculty advisors of the area and are listed on School of Art check sheets.

Courses from other departments, when approved by the advisor and the School of Art, may be applied to the major if deemed appropriate to the student's program of study. Art courses that do not have the same title and description as ASU catalog courses must have the approval of the School of Art Standards Committee.

Graduation Requirements. In addition to fulfilling the major requirements, students must meet all university graduation requirements and college degree requirements. See "University Graduation Requirements," page 81, and "College Degree Requirements," page 259.

Art Education

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ARE	440 Disciplines of Art Education	3
ARE	450 Teaching Inquiry in Art	3
ARE	470 Teaching Visual Culture	3
ARE	482 Teaching Art Processes	3
ARE	486 Art Education: Strategies and Applications	3
ARE	494 Special Topics	3
ARE	496 Methods and Assessment of Learning in Art	3
Total		21

Area of Proficiency. Twenty-one semester hours are required with a minimum of 15 semester hours in a specific area of studio art or art history. Twelve of these semester hours must be upper-division credits.

Art History. Six semester hours of ARS upper-division courses are required. One course must be a 20th-century ARS course. Non-Western art is recommended for the second course.

Additional Requirements. The following courses are additional requirements:

ART	201 Photography I	3
ART	223 Painting I	3
	or ART 211 Drawing II (3)	
	or ART 253 Introduction to Printmaking (3)	
ART	231 Sculpture I	3
	or ART 261 Ceramic Survey (3)	
	or ART 272 Jewelry I (3)	
	or ART 274 Wood I (3)	
	or ART 276 Fibers I (3)	
Total		9

The concentration in art education consists of 75 semester hours with 21 semester hours in art education and 21 semester hours in an art proficiency approved by an art education advisor. The art proficiency courses must include a minimum of 15 semester hours in a specific area of studio art or art history. Twelve of these semester hours must be upper-division credits. The art proficiency can be in art history, ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, or sculpture. Teaching experience is provided in the Children's Art Workshop, which is

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

an on-campus program based in studio art and art history for children ages five to 15. Participation in the workshop is part of the requirements for ARE 486 Art Education: Strategies and Applications. ARE 486 meets the state certification requirements for the elementary methods class, and ARE 496 Methods and Assessment of Learning in Art meets the requirements for the secondary methods class in the subject area. Both of these courses have prerequisites.

A student pursuing a B.F.A. degree in Art with a concentration in art education may also choose to become certified for teaching art K–12. If certification is elected while pursuing the art education undergraduate degree, additional semester hours are required in the College of Education. Students must make special application to the Initial Teacher Certification (ITC) program in the College of Education. Application deadlines for the ITC programs are February 1 for fall admission and September 1 for spring admission. Appointments with an advisor can be made in the Office of Student Services in the College of Education, or by calling 480/965-5555.

Certification is also available through the postbaccalaureate program in the College of Education. Interested students should contact an advisor in the College of Education and in art education for admission requirements to the postbaccalaureate program.

Art education courses for this program are as follows:

ARE 450 Teaching Inquiry in Art	3
ARE 482 Teaching Art Processes	3
ARE 486 Art Education: Strategies and Applications	3
ARE 496 Methods and Assessment of Learning in Art	3
Total	12

The B.F.A. degree in Art with a concentration in art education and the postbaccalaureate program for certification in art has a special art education application procedure. This procedure is separate from, and in addition to, the admission requirements of ASU. Acceptance is based on a 2.50 GPA, completion of foundations courses (ART 111, 112, 113, and 115), completion of 12 semester hours of art history courses (ARS 101 and 102 and two upper-division courses), and a "B" or higher in ARE 440 and 450. In addition, undergraduate and postbaccalaureate students seeking K–12 certification should check requirements and deadlines for admission to the College of Education professional program.

To be accepted into student teaching, a student must be recommended in writing by the art education faculty and must have completed all art education classes. For additional student teaching requirements, see "Student Teaching," page 186. Students who are not recommended may complete the B.F.A. degree in Art with a concentration in art education without certification or may reapply after meeting deficiencies in knowledge and skills related to the teaching of art.

Ceramics

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ART 231 Sculpture I	3
ART 261 Ceramic Survey	3
ART 360 Ceramic Throwing	3
ART 364 Ceramic Handbuilding I	3
ART 365 Ceramic Handbuilding II	3
ART 460 Ceramic Clay	3
ART 463 Ceramic Glaze	3
ART 466 Special Problems in Ceramics	6
Total	27

Art History. Six semester hours of upper-division ARS courses, including a 20th-century and a non-Western ARS course, are required.

Additional Requirements. One of the following four courses is required:

ART 211 Drawing II	3
ART 214 Life Drawing I	3
ART 227 Watercolor I	3
ART 443 Intermedia	3

Two of the following three courses (six semester hours) are required:

ART 272 Jewelry I	3
ART 274 Wood I	3
ART 276 Fibers I	3

Art Electives. Fifteen semester hours of ARA, ARE, ARS, and ART courses are required.

Drawing

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Portfolio Review. Admission to the courses listed below requires a portfolio review, a minimum overall GPA of 2.70 and a School of Art GPA of 3.00. Students must also declare an emphasis in mixed media, 3D imaging and animation, or video. The portfolio deadlines are October 15 for spring classes and March 15 for fall classes.

Specialization. The following courses make up the specialization:

ART 211 Drawing II	3
ART 214 Life Drawing I	3
ART 223 Painting I	3
ART 227 Watercolor I	3
ART 311 Drawing III	3
ART 314 Life Drawing II	3
ART 315 Life Drawing III	3
ART 411 Advanced Drawing	3
Total	24

Also required are six semester hours of ART 411, 414, or 494 drawing, painting, or printmaking (three semester hours).

Art History. Nine semester hours, including six semester hours of upper-division and three semester hours of non-Western ARS courses, are required.

Additional Requirements. Two of the following six courses (six semester hours) are required:

ART 201 Photography I	3
ART 231 Sculpture I	3
ART 261 Ceramic Survey	3

ART 272 Jewelry I 3
ART 274 Wood I 3
ART 276 Fibers I 3

Art Electives. Nine semester hours of ARA, ARE, ARS, or ART courses are required.

Fibers

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ART 276 Fibers I 3
ART 376 Fibers: Loom Techniques 3
ART 377 Surface Design 3
ART 476 Fibers: Multiple Harness Weaving 6
ART 477 Printed Textiles 6
Total 21

Art History. Six semester hours of upper-division ARS courses are required, including a 20th-century elective.

Additional Requirements. Three of the following six courses (nine semester hours) are required:

ART 201 Photography I 3
ART 231 Sculpture I 3
ART 261 Ceramic Survey 3
ART 272 Jewelry I 3
ART 274 Wood I 3

Art Electives. Twenty-one semester hours of ARA, ARE, ARS, and ART courses are required.

Intermedia

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Portfolio Review. Admission to the courses listed below requires a portfolio review, a minimum overall GPA of 2.70 and a School of Art GPA of 3.00. Students must also declare an emphasis in mixed media, 3D imaging and animation, or video. The portfolio deadlines are October 15 for spring classes and March 15 for fall classes.

Specialization. Eighteen to 19 semester hours are required. Students must select three semester hours of non-electronic media and three hours of digital imaging. The remaining 15 to 16 hours are completed in either non-electronic media or digital imaging, depending on the emphasis selected.

Select three semester hours from the following non-electronic media courses:

ART 439 Mixed Media 3
ART 443 Intermedia 3
ART 494 ST: Mixed Media 3

Select three or four semester hours from the following digital imaging courses:

ART 345 Visualization and Prototyping I 3
ART 346 3D Computer Imaging and Animation *CS* 3
ART 348 Computer Animation I 3
ART 440 New Media Concepts 3
ART 441 Video Art 1
ART 494 Visualization and Prototyping II 3
or any ART 494 digital art course (3)

Intermedia-Related Study

Two of the following two-dimensional courses (six semester hours) are required:

ART 201 Photography I 3
ART 211 Drawing II 3
ART 214 Life Drawing I 3
ART 223 Painting I 3
ART 227 Watercolor I 3
ART 351 Intaglio I 3
ART 352 Lithography I 3
ART 354 Screen Printing I 3
ART 355 Photo Process for Printmaking I 3

Two of the following three-dimensional courses (six semester hours) are required:

ART 231 Sculpture I 3
ART 261 Ceramic Survey 3
ART 272 Jewelry I 3
ART 274 Wood I 3
ART 276 Fibers I 3

Art History. Nine semester hours, including three hours of non-Western, and six hours of 20th-century and/or contemporary art history (ARS) classes are required. Six hours must be in the upper division.

Art Electives. Seventeen to 18 semester hours of ARA, ARE, ARS, and ART courses are required.

The deadline for submitting review materials to enroll in computer animation courses is March 15 for fall semester and October 15 for spring semester.

Metals

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ART 272 Jewelry I 3
ART 372 Jewelry II 3
ART 373 Metalworking I 3
ART 472 Advanced Jewelry 6
ART 473 Advanced Metalworking 6
ART 494 ST: Metals 3
Total 24

Art History. Six semester hours of upper-division ARS courses are required, including a 20th-century elective.

Additional Requirements. Three of the following six courses (nine semester hours) are required:

ART 201 Photography I 3
ART 223 Painting I 3
ART 231 Sculpture I 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ART 261 Ceramic Survey 3
ART 274 Wood I 3
ART 276 Fibers I 3

Art Electives. Eighteen semester hours of ARA, ARE, ARS, and ART courses are required.

Painting

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Portfolio Review. Admission to the courses listed below requires a portfolio review, a minimum overall GPA of 2.70 and a School of Art GPA of 3.00. Students must also declare an emphasis in mixed media, 3D imaging and animation, or video. The portfolio deadlines are October 15 for spring classes and March 15 for fall classes.

Specialization. The following courses make up the specialization:

ART 211 Drawing II 3
ART 214 Life Drawing I 3
ART 223 Painting I 3
ART 227 Watercolor I 3
ART 311 Drawing III 3
ART 314 Life Drawing II 3
ART 323 Painting II 3
ART 324 Painting III 3
or ART 327 Watercolor II (3)
ART 325 Figure Painting 3
ART 423 Advanced Painting 3
or ART 427 Advanced Watermedia (3)

Total 30

One of the following six courses (three semester hours) is required:

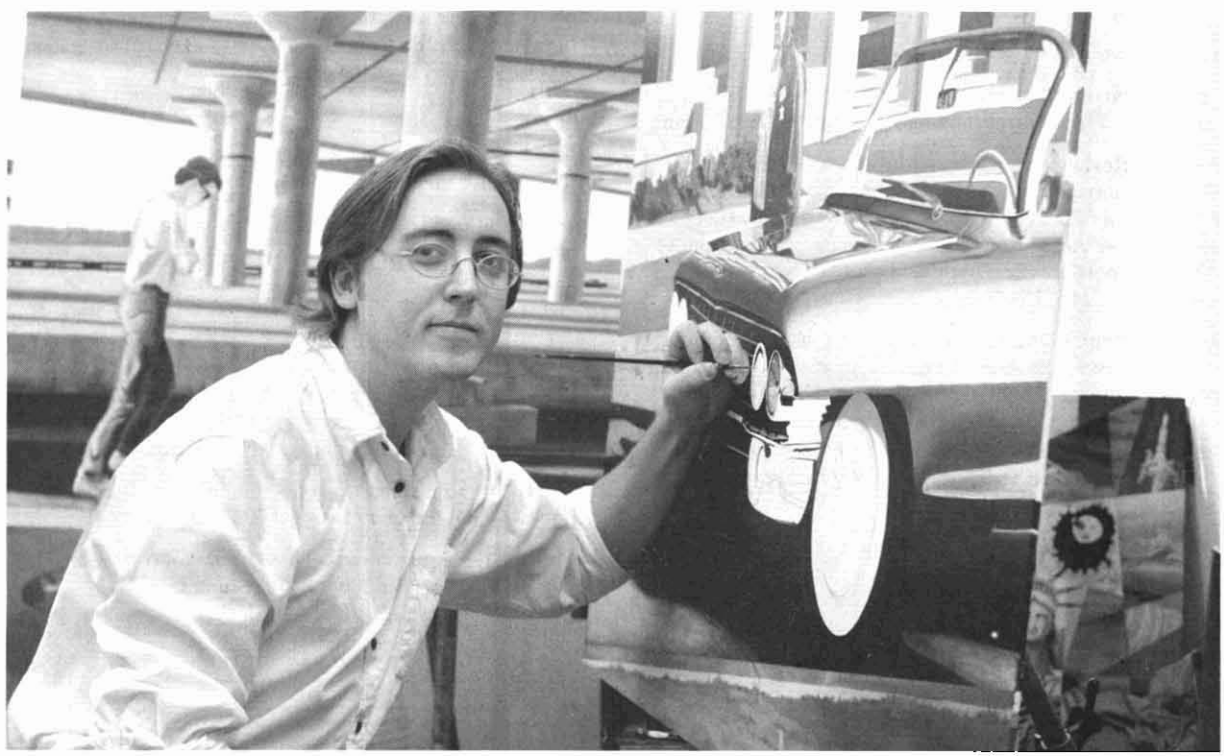
ART 324 Painting III 3
ART 327 Watercolor II 3
ART 411 Advanced Drawing 3
ART 423 Advanced Painting 3
ART 425 Advanced Figure Painting 3
ART 427 Advanced Watermedia 3
ART 494 ST: Drawing 3
or ART 494 ST: Painting (3)

Art History. Nine semester hours of ARS courses are required, including three hours of non-Western. Six hours must be upper-division ARS courses.

Additional Requirements. Two of the following six courses (six semester hours) are required:

ART 201 Photography I 3
ART 231 Sculpture I 3
ART 261 Ceramic Survey 3
ART 272 Jewelry I 3
ART 274 Wood I 3
ART 276 Fibers I 3

Art Electives. Nine semester hours of ARA, ARE, ARS, and ART courses are required.



Dane Hamblin at work in a School of Art studio. He received a University Merit Scholarship and Regents' scholarship and is graduating summa cum laude with a Bachelor of Fine Arts degree in painting. Tim Trumble photo

Photography

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Portfolio Review. Admission to the courses listed below requires a portfolio review, a minimum overall GPA of 2.70 and a School of Art GPA of 3.00. Students must also declare an emphasis in mixed media, 3D imaging and animation, or video. The portfolio deadlines are October 15 for spring classes and March 15 for fall classes.

Specialization. The following courses make up the specialization:

ARA	202 Understanding Photographs	3
ART	201 Photography I	3
ART	301 Photography II	3
ART	304 Advanced Photography	3
Total		12

Three of the following ten courses (nine semester hours) are required:

ART	305 Color Photography I	3
ART	308 Digital Photographic Images	3
ART	401 Nonsilver Photography	3
ART	403 Senior Photographic Projects	3
ART	404 Portraiture Photography	3
ART	405 Advanced Color Photography	3
ART	406 Photo Techniques	3
ART	407 View Camera	3
ART	409 Photographic Exhibition	3
ART	494 ST: Photo	3

Art History. Twelve semester hours are required including ARS 250 History of Photography and a non-Western art history course. Six hours must be upper-division.

Additional Requirements. Select one of the following courses:

ART	211 Drawing II	3
ART	214 Life Drawing I	3
ART	223 Painting I	3
ART	227 Watercolor I	3

One of the following five courses (three hours) is required:

ART	231 Sculpture I	3
ART	261 Ceramic Survey	3
ART	272 Jewelry I	3
ART	274 Wood I	3
ART	276 Fibers I	3

Art Electives. Eighteen semester hours of ARA, ARE, ARS, and ART courses are required.

Printmaking

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ART	211 Drawing II or ART 214 Life Drawing I (3)	3
ART	351 Intaglio I	3
ART	352 Lithography I	3
ART	354 Screen Printing I	3
Total		12

Three of the following 10 courses (nine semester hours) are required:

ART	253 Introduction to Printmaking	3
ART	355 Photo Process for Printmaking I	3
ART	451 Advanced Intaglio	3
ART	452 Advanced Lithography	3
ART	454 Advanced Screen Printing	3
ART	455 Advanced Photo Processes for Printmaking	3
ART	456 Fine Printing and Bookmaking I	3
ART	457 Fine Printing and Bookmaking II	3
ART	458 Papermaking	3
ART	459 Monoprinting	3

Two of the following five courses (six semester hours) are required:

ART	214 Life Drawing I	3
ART	311 Drawing III	3
ART	314 Life Drawing II	3
ART	315 Life Drawing III	3
ART	411 Advanced Drawing	3

Art History. Six semester hours of upper-division ARS courses are required.

Additional Requirements. Two of the following eight courses (six semester hours) are required:

ART	201 Photography I	3
ART	223 Painting I	3
ART	227 Watercolor I	3
ART	231 Sculpture I	3
ART	261 Ceramic Survey	3
ART	272 Jewelry I	3
ART	274 Wood I	3
ART	276 Fibers I	3

Art Electives. Eighteen semester hours of ARA, ARE, ARS, and ART courses are required.

Sculpture

Core Curriculum. See "B.F.A. Core Curriculum," page 265, for the courses that make up the core curriculum.

Specialization. The following courses make up the specialization:

ART	223 Painting I	3
ART	231 Sculpture I	3
ART	274 Wood I	3
ART	331 Sculpture II	3
ART	332 Sculpture III	3
ART	431 Special Problems in Sculpture	3
Total		18

Four of the following nine courses (12 semester hours) are required (note that all are repeatable except ART 333):

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ART 333 Foundry Casting Methods 3
ART 374 Wood II 3
ART 431 Special Problems in Sculpture 3
ART 432 Neon Sculpture 3
ART 436 Architectural Sculpture 3
ART 437 Film Animation 3
ART 438 Experimental Systems in Sculpture 3
ART 474 Advanced Wood 3
ART 494 ST: Special Topics in Sculpture 3

Art History. Six semester hours of upper-division ARS courses are required.

Additional Requirements. Two of the following three courses are required:

ART 261 Ceramic Survey 3
ART 272 Jewelry I 3
ART 276 Fibers I 3

Art Electives. Fifteen semester hours of ARA, ARE, ARS, and ART courses are required.

GRADUATE PROGRAMS

The faculty in the School of Art offer programs leading to the M.A. degree in Art, with a concentration in art education or art history, the Master of Fine Arts degree with a concentration in ceramics, drawing, fibers, intermedia, metals, painting, photographic studies, photography, printmaking, sculpture, or wood, and a Ph.D. degree in History and Theory of Art. In cooperation with the College of Education, the Doctor of Education degree is offered with a concentration in art education. See the *Graduate Catalog* for requirements for all graduate degrees.

ART AUXILIARY (ARA)

ARA 202 Understanding Photographs. (3)
once a year
Slide lecture course in understanding photography as a fine art form.

ARA 311 Art Appreciation and Human Development. (3)
fall
Foundations of art for children and young adults. Emphasis on learning, development, and understanding art in historical and cultural contexts. Lecture, discussion. Prerequisites: ENG 101, 102; junior standing.
General Studies: HU

ARA 460 Gallery Exhibitions. (3)
fall and spring
Practical experience in all phases of department gallery operations and preparation of gallery publications. May be repeated for credit. Prerequisite: instructor approval.

ARA 488 Understanding Art. (3)
fall and spring
Understanding art as an emergent cultural phenomenon with an emphasis on a critical examination of conceptual issues in art. Requires writing. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: L/HU

ARA 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Advanced Photo Aesthetics. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ART EDUCATION (ARE)

ARE 301 Studio Art and Human Development. (3)
once a year
Study of human development in studio art from early childhood to adult years.

ARE 440 Disciplines of Art Education. (3)
fall and spring
Explorations in art education's disciplines, history, and people's artmaking development at diverse age levels and abilities. Lecture, discussion. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 or only instructor approval.

ARE 450 Teaching Inquiry in Art. (3)
fall and spring
Designing inquiry-based curriculum units built on developmental levels of art making and art understanding. 2 hours lecture, 2 hours applied practice. Prerequisites: ARS 101, 102.

ARE 470 Teaching Visual Culture. (3)
fall
Explores issues and applications of everyday aesthetics that contain powerful technological, social, and economic factors. Lecture, discussion. Prerequisite: ARE 440 or instructor approval.

ARE 482 Teaching Art Processes. (3)
spring
Art traditions of the 20th century as a basis for studio and art history instruction. Meets art postbaccalaureate certification requirement. 2 hours lecture, 2 hours studio. Prerequisite: ARE 450.

ARE 486 Art Education: Strategies and Applications. (3)
fall
Implementation and evaluation of art instruction for K–12 population. Includes teaching of Saturday classes in the Children's Art Workshop. Meets art postbaccalaureate certification requirement. Prerequisite: ARE 482.

ARE 494 Special Topics. (3)
once a year

ARE 496 Methods and Assessment of Learning in Art. (3)
once a year
Individual or group research on the assessment of art learning incorporating theory and practice. Meets art postbaccalaureate certification requirement. Prerequisites: both ARE 470 and 486 or only instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ART HISTORY (ARS)

ARS 100 Introduction to Art. (3)
fall, spring, summer
Understanding of art and its relationship to everyday life through painting, sculpture, architecture, and design. No credit for Art majors or students who have completed ARS 101 or 102 or 300.
General Studies: HU

ARS 101 Art from Prehistory Through Middle Ages. (3)
fall, spring, summer
History of Western art from the Paleolithic period through the Middle Ages.
General Studies: HU, H

ARS 102 Art from Renaissance to Present. (3)
fall, spring, summer
History of Western art from the Renaissance to the present.
General Studies: HU, H

ARS 201 Art of Asia. (3)
once a year
History of the art of the Asian cultures, with emphasis on China, Japan, and India. Meets non-Western art history requirement.
General Studies: HU, G, H

ARS 202 Art of Africa, Oceania, and the Americas. (3)
spring
History of art of Africa, Oceania, and the New World. Meets non-Western art history requirement. Lecture, discussion. Cross-listed as AFH 202. Credit is allowed for only AFH 202 or ARS 202.
General Studies: HU, G, H

ARS 250 History of Photography. (3)
once a year
History of photography from the 19th century to the present.
General Studies: HU

ARS 300 Introduction to Art. (3)
fall and spring
Course content same as ARS 100 but requires a higher level of accomplishment and comprehension. No credit for students who have completed ARS 100 or used as art history credit by Art majors.
General Studies: HU

ARS 302 Art of Africa, Oceania, and the Americas. (3)
once a year
History of art of Africa, Oceania, and the New World. Meets non-Western art history requirement. Credit is allowed for only ARS 302 or 202. Prerequisites: ARS 101, 102.
General Studies: HU, G, H

ARS 310 The Renaissance in Tuscany. (3)
summer
Course taught in Florence, Italy. History of arts in Tuscany with focus on city of Florence from 14th through 16th centuries. Completion of ARS 101 and 102 suggested. Lecture, tours.

ARS 340 Art in America. (3)
once a year
American art from colonial times through the Second World War. Not available to students who have completed ARS 444, 542, or 543. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 400 History of Printmaking. (3)
once a year
History of the print as an art form and its relation to other modes and forms of artistic expression. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 402 Art of Ancient Egypt. (3)
selected semesters
Aesthetic, philosophical, and cultural basis of Egyptian art from pre-Dynastic period through New Kingdom. Emphasis on sculpture and architectural monuments. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 404 Greek Art. (3)
once a year
History of art, architecture of Aegean civilizations (Cycladic, Minoan, Mycenaean) and of Greece to end of Hellenistic period. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 406 Roman Art. (3)
once a year
Art and architecture of Etruria, the Roman Republic, and the Roman Empire. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 410 Early Christian and Byzantine Art. (3)
once a year
Art and architecture of the early church and the Byzantine Empire from the 4th to the 15th century. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 412 Early Medieval Art. (3)
selected semesters
Painting, sculpture, architecture, and the minor arts from Migration, Carolingian, and Ottonian periods considered within religious, social, and economic contexts. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 414 Romanesque Art. (3)
once a year
Sculpture, painting, architecture, and minor arts in western Europe, ca. 1030–1200, considered within religious, economic, and social contexts. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 416 Gothic Art. (3)
once a year
Painting, sculpture, and architecture in western Europe during the Gothic period. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 417 Late Gothic Art in Central Europe. (3)
selected semesters
Sculpture, painting, and architecture of the late-Gothic style, ca. 1350–1525, considered within religious, social, economic, and political contexts. Prerequisites: both ARS 101 and 102 or only instructor approval.

ARS 418 Renaissance Art in Northern Europe. (3)
once a year
Graphics, painting, sculpture, and architecture, ca. 1450–1550. Reformation themes and Renaissance style considered within religious, political, social, and economic contexts. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 420 Early Renaissance Art in Italy. (3)
selected semesters
Painting, sculpture, and architecture in Italy from 1300 to 1500. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 422 Italian High Renaissance Art and Mannerism. (3)
once a year
History of Italian art during the 16th century, including the achievements and influence of Leonardo da Vinci, Raphael, and Michelangelo. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 424 Italian Baroque Art. (3)
once a year
Italian painting, sculpture, and architecture of the 17th century. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 426 Art of the 17th Century in Northern Europe. (3)
once a year
Baroque painting, sculpture, and architecture in Flanders, the Netherlands, France, and England. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 428 Art of the 18th Century. (3)
once a year
History of painting, sculpture, architecture, graphic arts, and the decorative arts from 1700 to the French Revolution (1789). Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 430 Art of Spain and Its Colonies. (3)
once a year
Architecture, painting, and sculpture from 1500 to 1800. Colonial focus on central Mexico and the American Southwest. Prerequisite: ARS 102 or instructor approval.
General Studies: HU, H

ARS 432 19th-Century French Art and Culture. (3)
fall
History of painting, graphic arts, sculpture, and architecture, 1800 to 1900 in France in its political, social, and economic contexts. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ARS 434 Art and Visual Culture of 19th Century. (3)
spring
History of European art (all media) from French Revolution to Paris World Fair of 1900. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 436 The Artist, War, and Revolution (Versailles to Vietnam). (3)
fall
Critical study of artistic responses to war and revolution in Europe and United States from French Revolution to Vietnam conflict. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 438 Art of the 20th Century I. (3)
once a year
Developments and directions in art between 1900 and World War II. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 439 Art of the 20th Century II. (3)
once a year
Art since World War II, with consideration of new concepts and experimentation with media and modes of presentation. Prerequisites: a combination of ARS 101 and 102 and 438 or only instructor approval.
General Studies: HU, H

ARS 442 Critical Issues in American Painting I. (3)
once a year
Explores themes and social issues in American art with a critical study of American painting from the 18th century to 1850. Lecture, discussion. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 443 Critical Issues in American Painting II. (3)
once a year
Explores themes and social issues in American art with a critical study of American painting from 1850 to 1900. Lecture, discussion. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 444 Modern American Art, 1900–1945. (3)
once a year
American painting, sculpture, photography, and architecture, 1900–1945. Covers major monuments, including the Eight, modernism, precisionism, regionalism, and the WPA. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 458 Critical Theories in the Visual Arts. (3)
selected semesters
Examines current critical theories through their application to all visual arts. May include new historicism, Marxism, deconstruction, post-structuralism, semiotics, Lacanian psychoanalysis, feminism, postmodernism. Lecture, discussion, student presentations. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 459 Writing Art Criticism. (3)
selected semesters
Traditional and contemporary approaches to the criticism of art. Students write critical essays. Latter half of the semester stresses the criticism of contemporary art in various media. Prerequisite: ARS 458 or instructor approval.

ARS 462 Pre-Columbian Art. (3)
once a year
Architecture, sculpture, ceramics, painting, and other arts of Mesoamerica before European contact. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 465 Native North American Art. (3)
once a year
Native American art forms of the United States and Canada from prehistoric times to the present. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 466 Native American Art of the Southwest. (3)
once a year
American Indian art in the southwestern states from its origins to the present day. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, C, H

ARS 468 Art of the Arctic and Northwest Coast. (3)
selected semesters
Art associated with ceremony, shamanism, and daily life in the Arctic and on the Northwest Coast. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 469 Mexican Art. (3)
once a year
Art of Mexico and related Central American cultures from the prehistoric to the contemporary schools. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU, H

ARS 472 Art of China. (3)
once a year
Study of major forms in Chinese art: ritual bronze, sculpture, ceramic, calligraphy, painting, and architecture. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 473 Art of Japan. (3)
once a year
Japanese art from the Joman period to the present. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 475 Chinese Painting. (3)
once a year
From Ku K'ai-chin to Ch'i Pai-shih. Major artists, styles, and movements in Chinese painting. Meets non-Western art history requirement. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: HU

ARS 480 Research Methods. (3)
fall and spring
Methodology and resource material for art historical research. Techniques of scholarly and critical writing and evaluation of bibliographic sources. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: L

ARS 484 Internship. (1–12)
selected semesters
Topics may include the following:
- Museum

ARS 485 Women in the Visual Arts. (3)
spring
Historical study of art by women in various media; related social, political, educational issues; representation of women in art. Lecture, discussion. Prerequisites: both ARS 101 and 102 or only instructor approval.
General Studies: L

ARS 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- History of Photography. (3)
- Introduction to Museums. (3)

ARS 498 Pro-Seminar. (1–7)
once a year
Undergraduate seminar. Problems or criticism in topics that may include the following:
- American Art. (3–6)
- American Indian Art. (3–6)
- Ancient Art. (3–6)
- Art History. (3–6)
- Baroque Art. (3–6)
- British Empire. (3–6)

- Chinese Art. (3–6)
- Medieval Art. (3–6)
- Modern Art. (3–6)
- Photographic History. (3–6)
- Pre-Columbian Art. (3–6)
- Renaissance Art. (3–6)

Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ART (ART)

Studio Core Curriculum

ART 111 Drawing I. (3)
fall, spring, summer
Fundamental, technical, and perceptual skills using common drawing media and their application to pictorial organization. 6 hours a week.

ART 112 Two-Dimensional Design. (3)
fall, spring, summer
Fundamentals of pictorial design. 6 hours a week.

ART 113 Color. (3)
fall, spring, summer
Principles of color theory as related to the visual arts. 6 hours a week. Prerequisites: ART 111, 112.

ART 115 Three-Dimensional Design. (3)
fall, spring, summer
Fundamentals of 3D form. 6 hours a week. Fee. Prerequisites: ART 111, 112.

ART 294 Special Topics. (3)
fall and spring

Ceramics

ART 261 Ceramic Survey. (3)
fall, spring, summer
Handforming methods, throwing on the wheel, decorative processes, and glaze application. 6 hours a week. Fee. Prerequisites: ART 112, 115.

ART 360 Ceramic Throwing. (3)
fall and spring
Design analysis and production of functional pottery. Emphasis on throwing techniques, surface enrichment, and glaze application. 6 hours a week. May be repeated once for credit. Fee. Prerequisites: ARS 101, 102.

ART 364 Ceramic Handbuilding I. (3)
fall
Search for form using handbuilding techniques. Kiln firing and related problems. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 261 or only instructor approval.

ART 365 Ceramic Handbuilding II. (3)
spring
Continuation of ART 364 with an additional focus on large-scale works, surface treatments, and glaze decoration with related kiln firing applications. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 364 or only instructor approval.

ART 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Ceramics
  Fee.
- Turning
  Fee.

ART 460 Ceramic Clay. (3)
spring
Research into various clay body formulations, local natural materials, slip glazes, and engobes. Lecture, lab, studio. Fee. Prerequisites: both ART 360 and 364 or only instructor approval.

ART 463 Ceramic Glaze. (3)
fall
Glaze calculation and formulation using various glaze colors and surfaces. Lecture, lab, studio. Fee. Prerequisite: ART 460 or instructor approval.

ART 466 Special Problems in Ceramics. (3)
fall, spring, summer
Emphasis on personal expression within structure of seminars, critiques, and studio work. Professional methods of presentation/documentation of work. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 364 or instructor approval.

ART 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Ceramics Printmaking
  Fee.
- Enameling
  Fee.
- Turning
  Fee.
- Vapor Glazes
  Fee.

Drawing

ART 211 Drawing II. (3)
fall, spring, summer
Continued development of technical and perceptual skills. Emphasis on materials and pictorial content. 6 hours a week. Prerequisites: ART 113, 115.

ART 214 Life Drawing I. (3)
fall, spring, summer
Development of skill and expressiveness in drawing the basic form, construction, and gesture from the human figure. 6 hours a week. Fee. Prerequisites: ART 113, 115.

ART 311 Drawing III. (3)
fall and spring
Emphasis on composition, exploration of drawing media. 6 hours a week. Prerequisites: a combination of ARS 101 and 102 and ART 211 and 214 or only instructor approval.

ART 314 Life Drawing II. (3)
fall and spring
Drawing from the model with greater reference to structural, graphic, and compositional concerns. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 214 or only instructor approval.

ART 315 Life Drawing III. (3)
fall and spring
The human figure as the subject for drawing. Emphasis on conceptual alternatives and management of materials. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 314 or only instructor approval.

ART 411 Advanced Drawing. (3)
fall and spring
Visual and intellectual concepts through problem solving and independent study. Emphasis on the individual creative statement. 6 hours a week. May be repeated for credit. Prerequisites: ART 311; instructor approval.

ART 414 Advanced Life Drawing. (3)
fall and spring
Various media and techniques on an advanced level. The human figure as an expressive vehicle in various contexts. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 315 or instructor approval.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ART 415 Art Anatomy. (4)
selected semesters
Study of human anatomical structures as applied to the practice of figure-oriented art. 3 hours lecture, 5 hours studio a week. Fee. Prerequisite: ART 214.

ART 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Drawing. (3)

Fibers

ART 276 Fibers I. (3)
fall and spring
Explores traditional and contemporary materials and basic techniques related to fibers. Embroidery, feltmaking, dyeing, block printing, plaiting, 3D structures. Fee. Prerequisites: both ART 113 and 115 or only instructor approval.

ART 294 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Fibers for Nonmajors
  Fee.

ART 376 Woven Structures I. (3)
once a year
Explores weaver- and loom-controlled structures with an emphasis on formal issues, historic precedence, and contemporary investigations. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 276 or only instructor approval.

ART 377 Surface Design. (3)
fall and spring
Application of dyes and pigments on cloth exploring techniques, formal issues, and content. Cyanotype, monoprinting, painting on silk, resists, stenciling. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 276 or only instructor approval.

ART 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Fibers Design for Nonmajors
  Fee.

ART 476 Woven Structures II. (3)
fall and spring
Emphasizes personal expression and continues technical exploration in woven structures. Fee. Prerequisite: ART 376 or instructor approval.

ART 477 Printed Textiles. (3)
once a year
Techniques for screen printing on fabric exploring pattern as a compositional element. Various stencil methods, including photographic processes. May be repeated for credit. Studio. Fee. Prerequisite: ART 377 or instructor approval.

ART 478 Advanced Surface Design. (3)
spring in odd years
Emphasis on personal expression with advanced problems in stitch resist, arashi shibori, transfers, indigo, vat and disperse dyes, and pigments. Studio. Fee. Prerequisites: both ART 377 and 477 or only instructor approval.

ART 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- 3-Dimensional Fibers
  Fee.
- Fibers and Surface
  Fee.
- Print Textiles
  Fee.

Intermedia

ART 345 Visualization and Prototyping I. (3)
spring in even years
Studio/seminar introduces concepts of computer visualization, modeling, and rapid prototyping in an interdisciplinary manner. Lecture, studio. Prerequisites: a combination of ARS 101 and 102 and a General Studies CS course or only instructor approval.

ART 346 3D Computer Imaging and Animation. (3)
fall and spring
3D modeling and animation. Emphasis on concepts and fine arts applications. Studio. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and junior standing or only instructor approval.
General Studies: CS

ART 348 Animation Motion Studies. (3)
fall and spring
Computer animation motion studies, modeling, and editing for fine arts. Studio. Fee. Prerequisites: ART 346; junior standing; instructor approval.

ART 439 Mixed Media. (3)
fall and spring
Exploring visual effects by combining traditional and nontraditional methods, techniques, and concepts. 6 hours a week. May be repeated for credit. Studio. Prerequisites: a combination of ART 113 and 115 and 6 hours additional studio requirements or only instructor approval.

ART 440 New Media Concepts. (3)
fall and spring
Continued experiments with new media and interdisciplinary concerns in art. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 443. Corequisite: ART 441.

ART 441 Video Art. (1)
fall and spring
Utilizing video and audio equipment essential to the production of broadcast quality video art. 2 hours a week. May be repeated for credit. Corequisite: ART 440.

ART 442 Folk/Outsider Art. (3)
fall
Explores ideas, attitudes, and art of contemporary "self-taught," "visionary," and "outsider" artists. Research and studio practice. Lecture, studio. Prerequisites: both ART 113 and 115 or only instructor approval.

ART 443 Intermedia. (3)
fall and spring
Experimental, conceptual, and interdisciplinary studio art with emphasis on new media and technologies. 6 hours a week. May be repeated once for credit. Prerequisites: both ART 113 and 115 or only instructor approval.

ART 449 Computer Animation and Video. (3)
fall and spring
Integrates 3D fine arts animation with video and compositing. May be repeated for credit. Studio. Fee. Prerequisite: ART 348 or instructor approval.

ART 450 Computer Animation and Audio. (3)
fall and spring
Integrates audio with 3D animation for fine arts applications. Includes compositing and effects. May be repeated for credit. Studio. Fee. Prerequisites: ART 449; instructor approval.

ART 470 Computer Animation Portfolio. (3)
fall and spring
Production of videotape and CD 3D animation portfolios for fine arts and industry integrating animation, video, and audio. May be repeated for credit. Studio. Fee. Prerequisites: ART 449; instructor approval.
General Studies: CS

ART 484 Internship. (1–12)
selected semesters

ART 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Digital. (3)
- Intermedia. (3)
- Intermedia Elective. (3)
- Mixed Media. (3)
- Nonelectronic Intermedia. (3)

ART 499 Individualized Instruction. (1–3)
selected semesters

Metals

ART 272 Jewelry I. (3)
fall and spring
Emphasis on fabrication in jewelry making. Basic techniques of cutting and piercing, forging and soldering, and forming. Not open to seniors. 6 hours a week. Fee.

ART 372 Jewelry II. (3)
fall and spring
Fabricated approach to jewelry making. Techniques in stone setting and surface embellishment. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 272 or only instructor approval.

ART 373 Metalworking I. (3)
once a year
Compression, die, and stretch forming as applied to hollow form construction. Hot and cold forging techniques as applied to smithing. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 272 or only instructor approval.

ART 472 Advanced Jewelry. (3)
fall and spring
Jewelry making with emphasis on developing personal statements and craftsmanship. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 372; instructor approval.

ART 473 Advanced Metalworking. (3)
once a year
Forging and forming techniques in individualized directions. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 373; instructor approval.

ART 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Metals. (3)

Painting

ART 223 Painting I. (3)
fall, spring, summer
Fundamental concepts and materials of traditional and experimental painting media. Emphasis on preparation of painting supports, composition, and color. 6 hours a week. Prerequisites: ART 113, 115.

ART 227 Watercolor I. (3)
fall and spring
Fundamental concepts, materials, and techniques of watercolor. Emphasis on problem solving, basic skills, composition, and color. 6 hours a week. Fee. Prerequisites: ART 113, 115.

ART 323 Painting II. (3)
fall and spring
Development of competency in skills and expression. Assigned problems involve light, space, color, form, and content. 6 hours a week. Prerequisites: a combination of ARS 101 and 102 and ART 223 or only instructor approval.

ART 324 Painting III. (3)
fall and spring
Continuation of ART 323. 6 hours a week. Prerequisites: a combination of ARS 101 and 102 and ART 323 or only instructor approval.

ART 325 Figure Painting. (3)
fall and spring
The human figure clothed and nude as the subject for painting in selected media. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 314 and 323 or only instructor approval.

ART 327 Watercolor II. (3)
once a year
Explorations of personal expression in watercolor. Continued development of watercolor skills using traditional and experimental materials and techniques. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 227 or only instructor approval.

ART 423 Advanced Painting. (3)
fall and spring
Continuation of ART 324. 6 hours a week. May be repeated for credit. Prerequisite: ART 324.

ART 425 Advanced Figure Painting. (3)
fall and spring
Continuation of ART 325. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 315, 324, 325.

ART 427 Advanced Watermedia. (3)
fall and spring
Continuation of ART 327. Advanced techniques, concepts, and methods with watercolor and other water-based media on paper. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 327 or instructor approval.

ART 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Painting. (3)

Photography

ART 201 Photography I. (3)
fall and spring
Development of skills and techniques of black and white photography. Emphasis on camera work and darkroom procedures. Must be taken with ART 202.

ART 202 Photography I Lab. (0)
fall and spring
See ART 201. Fee.

ART 294 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Digital Art. (3)

ART 301 Photography II. (3)
fall and spring
Photography as an art medium with additional exploration into personal photographic aesthetics. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 201 or only instructor approval.

ART 304 Advanced Photography. (3)
fall and spring
Interpretation and manipulation of light as a tool in the performance of expressive photography. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 301 or only instructor approval.

ART 305 Color Photography I. (3)
fall and spring
Application of color transparencies and prints to photographic art. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 304 or only instructor approval.

ART 308 Digital Photographic Images. (3)
fall and spring
Scanning, manipulation, refinement, and compositing of photographic images in the computer. Lab, studio. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 201 and junior standing or only instructor approval.

ART 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Digital Art. (3)

ART 401 Nonsilver Photography. (3)
fall and spring
Recognition of the inherent characteristics of nonsilver processes and their use in communicating ideas. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 304 or instructor approval.

ART 403 Senior Photographic Projects. (3)
fall and spring
Technical and philosophical refinement of personal aesthetic with various photographic media. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 304 or instructor approval.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ART 404 Portraiture Photography. (3)
fall and spring
Photographing people. Critical discussions and slide lectures on issues in portraiture. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 304 or instructor approval.

ART 405 Advanced Color Photography. (3)
fall and spring
Intensive use of subtractive color process in photographic printing. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 305 or instructor approval.

ART 406 Photo Techniques. (3)
fall and spring
Camera and darkroom techniques with emphasis on creative control of the black and white print. 6 hours a week. Prerequisite: ART 301 or instructor approval.

ART 407 View Camera. (3)
fall and spring
View camera and darkroom techniques. Studio, lab. Fee. Prerequisite: ART 301 or instructor approval.

ART 409 Photographic Exhibition. (3)
once a year
Care of photographic prints, print presentation, and exhibition. Practical experience in gallery operations. 6 hours a week. May be repeated for credit. Prerequisite: ART 304 or instructor approval.

ART 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Collotype
  Fee.
- Digital Photographic Images II. (3)
  Fee.
- Digital Printing
  Fee.
- Documentary Photography
  Fee.
- Issues in Digital Photography
  Fee.
- Landscape Photography
  Fee.
- 19th-Century Photo Processes. (3)
- Photo. (3)
- Photographic Fabrications
  Fee.
- Photogravure
  Fee.
- Visualization and Prototyping II. (3)

ART 498 Pro-Seminar. (1–7)
selected semesters
Topics may include the following:
- Landscape Photography: Theory
  Fee.

Printmaking

ART 253 Introduction to Printmaking. (3)
once a year
Introduction to basic monotype, intaglio, relief, and related techniques. Studio. Fee. Prerequisite: ART 113.

ART 351 Intaglio I. (3)
fall and spring
Introduces contemporary and traditional developmental techniques for black and white prints. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 or only instructor approval.

ART 352 Lithography I. (3)
fall and spring
Monochromatic and color planographic printmaking utilizing stone and aluminum plate processes. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 or only instructor approval.

ART 354 Screen Printing I. (3)
fall and spring
Introduces paper, direct, and photographic stencil techniques. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 or only instructor approval.

ART 355 Photo Process for Printmaking I. (3)
fall
Introduces photographic principles and skills for photomechanical printmaking processes, including photosilkscreen, photolitho, and photoetching. 6 hours a week. Fee. Prerequisite: ART 201 (or its equivalent).

ART 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Relief Printmaking
  Fee.

ART 451 Advanced Intaglio. (3)
fall and spring
Various contemporary and traditional methods of printing to achieve color prints. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 351 or instructor approval.

ART 452 Advanced Lithography. (3)
fall and spring
Continuation of ART 352. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 352 or instructor approval.

ART 454 Advanced Screen Printing. (3)
once a year
Continuation of ART 354. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 354 or instructor approval.

ART 455 Advanced Photo Processes for Printmaking. (3)
once a year
Continued study of photomechanical techniques and applications to printmaking or photographic processes. Fee. Prerequisite: ART 355 or instructor approval.

ART 456 Fine Printing and Bookmaking I. (3)
once a year
Letterpress printing and typography as fine art. Study of history, alphabets, mechanics of hand typesetting, presswork, and various forms of printed matter. Fee. Prerequisite: instructor approval.

ART 457 Fine Printing and Bookmaking II. (3)
once a year
Continuation of ART 456. Bookbinding, book design and printing, advanced typography, theory, and presswork. May be repeated for credit. Fee. Prerequisites: ART 456; instructor approval.

ART 458 Papermaking. (3)
fall and spring
History, theory, demonstrations, sheet forming, collage treatments, and 3-dimensional approaches. 6 hours a week. May be repeated for credit. Fee. Prerequisite: instructor approval.

ART 459 Monoprinting. (3)
fall and spring
Nonmultiple printed image using a variety of technical approaches. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 311, 323 (or any 300-level printmaking class); instructor approval.

ART 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Artists' Books
  Fee.
- Experimental Paper
  Fee.
- Experimental Printmaking
  Fee.
- Relief Printmaking
  Fee.

Sculpture

ART 231 Sculpture I. (3)
fall, spring, summer
Explores sculptural forms through concepts related to basic materials. Focus on studio production, safety, aesthetic criticism, and history of sculpture. 6 hours a week. Fee. Prerequisites: both ART 113 and 115 or only instructor approval.

ART 274 Wood I. (3)
fall and spring
Fundamental woodworking techniques to produce creative functional 3D objects. 6 hours a week. Fee.

ART 331 Sculpture II. (3)
fall and spring
Continuation of ART 231 with an emphasis on metal fabrication as an expressive sculptural process. Techniques in welding, cutting and bending of metals and their aesthetics. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 231 or only instructor approval.

ART 332 Sculpture III. (3)
fall and spring
Explores diverse media with a focus on mold-making processes. Development of the sculpture portfolio. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 331 or only instructor approval.

ART 333 Foundry Casting Methods. (3)
fall and spring
Fine art and techniques of metal casting: mold making, foundry safety, finishing techniques, application of patinas, and history of casting. 6 hours a week. May be repeated for credit. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 332 or only instructor approval.

ART 374 Wood II. (3)
fall and spring
Individual and directed problems in wood related to the production of unique functional art objects. 6 hours a week. Fee. Prerequisites: a combination of ARS 101 and 102 and ART 113 and 115 and 274 or only instructor approval.

ART 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Carving
  Fee.

ART 431 Special Problems in Sculpture. (3)
fall and spring
Development of a personal approach to sculpture. Emphasis on form, individual problems, and related color technology. Professional practices and presentation. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 332; instructor approval.

ART 432 Neon Sculpture. (3)
fall
Techniques for creating neon in an art context. Glass tube bending and fabrication. Construction of artworks utilizing light-generating gasses. 6 hours a week. May be repeated for credit. Fee. Prerequisite: instructor approval.

ART 433 Foundry Research Methods. (3)
fall and spring
Research in foundry techniques. Studio. Pre- or corequisite: ART 333 or instructor approval.

ART 436 Architectural Sculpture. (3)
selected semesters
Sculptural concepts as related to architecture and other man-made environments. Scale drawing, models, and relief sculpture. 6 hours a week. May be repeated for credit. Fee. Prerequisite: ART 332 or instructor approval.

ART 437 Film Animation. (3)
fall
Production of short 16mm films that feature articulated sculptural objects, models, dolls, puppets, and graphics through the use of single-frame filming techniques. 6 hours a week. May be repeated for credit. Fee. Prerequisite: instructor approval.

ART 438 Experimental Systems in Sculpture. (3)
spring
Simple electrical and mechanical systems that can be utilized in the context of studio art and installations. Requires active production of studio artworks. 6 hours a week. May be repeated for credit. Fee. Prerequisite: instructor approval.

ART 474 Advanced Wood. (3)
fall and spring
Extended experience and advanced techniques in the use of wood to create functional works of art. 6 hours a week. May be repeated for credit. Fee. Prerequisites: ART 374; instructor approval.

ART 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Advanced Sculpture
- Carving
  Fee.
- Film: Post-Production
  Fee.
- Foundry Casting Methods
  Fee.
- Foundry Research Methods
  Fee.
- Live Action Filmmaking
  Fee.
- Special Topics in Sculpture

Special Studio Art

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Dance

herbergercollege.asu.edu/dance
480/965-5029
PEBE 107A

Claudia Murphey, Chair

Professors: Kaplan, Keuter, Murphey

Associate Professors: Jackson, Matt, Mooney

Assistant Professors: Fitzgerald, Lindholm Lane, Parrish, Rolnick, Tsukayama, Vissicaro

Associate Research Professional: Mitchell

Lecturer: Tongret

The Department of Dance is committed to providing a stimulating and diverse environment where students develop as scholars, educators, and artists through participation in innovative programs, residencies, performances, and partnerships. All students registering in a degree program enroll through the Herberger College of Fine Arts. Admission policies and procedures and the specific requirements of each

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Bachelor of Fine Arts degree concentration are available from the Department of Dance Advisement Office.

Audition/Admission. Students applying to the university as freshman or transfer students who are interested in becoming dance majors are designated into a preprofessional status. Individuals intending to enroll in the undergraduate dance degree program and participate in dance major classes are required to pass an entrance audition before being admitted to the department's dance major classes. These auditions take place in the fall and spring of each academic year. Auditions, conducted by the Dance faculty, determine technical proficiency, placement, and scholarship awards. Criteria for placement in dance technique classes as well as the audition form and specific audition requirements are published in the department's student handbook. The handbook is available through the Dance Advisement Office and on the department's Web site. Students who do not successfully complete the audition are allowed to remain in preprofessional status for two semesters. At the end of that term they are allowed to re-audition.

Upon successful completion of the audition, students gain access to Dance major classes. By the second semester of their sophomore year all dance preprofessional students who have passed the audition must petition for admission into one of the four concentrations: choreography, dance education, dance studies, and performance. Depending upon the concentration selected, the petition process may include a technique audition, and the submission of video tapes of choreographed works, an artistic portfolio, a writing sample, a written statement of intent and/or research interests. All students are interviewed and must have a 3.00 GPA before being accepted into an area of concentration.

Specific criteria and policies related to petition procedures for each of the concentrations are available through the Dance Advisement Office and on the Web site. Admission is highly selective. Students who fail to meet the criteria for the concentrations are not dismissed from the Bachelor of Fine Arts program and may re-petition once during the following semester. If a student still fails to meet the criteria of one of the four concentrations, he or she will not be dismissed from the university altogether; the student may transfer to another program. Students should work closely with the department advisor during the decision making process.

Scholarship Auditions. Highly competitive scholarship auditions are conducted for incoming and transfer students during the Spring Admission Audition. For additional information contact the Dance Advisement Office.

Transfer Students, Dance Minors, and Bachelor of Integrated Studies Students. Transfer, Minor, and B.I.S. students must successfully complete the admittance audition before enrolling in dance major courses. Additionally, transfer students who have completed music theory for dance, dance production or choreography courses at other institutions must also take placement examinations in these areas. These examinations are offered during the August and January orientation periods.

DANCE—B.F.A.

The faculty in the Department of Dance offer a Bachelor of Fine Arts (B.F.A) degree at the undergraduate level with four areas of concentration: choreography, dance education, dance studies, and performance. All new students are admitted into the preprofessional program and petition for admission into one of the concentrations during the sophomore year of study. Transfers, who have successfully completed the admission audition, may petition into one of the four concentrations after one semester in residence. Further details may be obtained from the Department of Dance.

Graduation Requirements. In addition to fulfilling the major requirements, students must meet all university graduation requirements and college degree requirements. At least 45 semester hours must be upper-division courses. See "University Graduation Requirements," page 81, and "College Degree Requirements," page 259.

Preprofessional Dance Major Program. First-semester preprofessional students who passed the audition should take the following courses:

DAN 134 Technique and Theory of Modern Dance	3
DAN 135 Technique and Theory of Ballet	2
ENG 101 First-Year Composition	3
Dance elective	2
General Studies courses	6
Total	16

Core Curriculum

The Dance major consists of a minimum of 59 semester hours in the dance core. All courses in the major must be completed with a grade of "C" or higher. The following areas make up the core curriculum.

Technique. Twenty-six semester hours in ballet and modern technique are required.

Performance. Two upper-division courses are required.

Theory. The following dance theory courses are required:

DAH 100 Dance in World Cultures *HU, G*	3
or DAH 191 First-Year Seminar (3)	
DAN 221 Rhythmic Theory for Dance I	2
DAN 222 Rhythmic Theory for Dance II	2
DAN 340 Dance Kinesiology	4
Total	11

Choreography and Improvisation. The following courses are required:

DAN 264 Improvisational Structures	3
DAN 265 Approaches to Choreography	3
Total	6

History. Choose two from the following three courses:

DAH 301 Philosophy and Criticism of Dance *L/HU*	3
DAH 302 Cross-Cultural Dance Studies *L/HU, G*	3
DAH 401 Dance History *HU*	3

Production. For the concentration in dance studies, choose one of the following two courses:

DAN 210 Dance Production I* 3
DAN 211 Dance Production II* 3

* Both courses are required for performance, choreography, and dance education concentrations. Dance studies students should select one of the two courses.

Dance Concentration Curriculum. Each concentration in the dance curriculum—choreography, dance education, dance studies, and performance—is composed of specific criteria as defined by the concentration. Refer to the following for details.

Choreography Concentration

Core Curriculum. See "Core Curriculum," page 278.

Concentration Requirements. The following courses are required for the choreography concentration:

DAN 321 Music Literature for Dance 3
DAN 364 Choreography and Accompaniment 3
DAN 365 Advanced Choreography 3
DAN 480 Senior Performance in Dance 4
Total 13

Dance Education Concentration

Core Curriculum. See "Core Curriculum," page 278.

Concentration Requirements. The following courses are required for the dance education concentration:

DAN 350 Methods of Teaching Children's Dance 3
DAN 352 Dance Education Theory 3
DAN 356 Methods of Teaching Contemporary Dance Technique and Composition in Secondary Education 4
DAN 364 Choreography and Accompaniment 3
DAN 394 Integrated Approaches in Dance Education 3
DAN 484 Dance internship 2
DAN 494 ST: Senior Dance Education Project 4
Total 22

A student pursuing the dance education concentration may also choose to become certified to teach dance (K–12) in Arizona public schools. Students should apply to the College of Education in the middle of the sophomore year. To be considered for admission to the teacher certification program students must complete an admission portfolio specified by the College of Education. Students should be advised that at least 20 additional semester hours are required to complete certification requirements. For more information, consult the dance education advisor and College of Education Office of Student Services, or phone 480/965-5555.

For specific information related to the Initial Teacher Certification (ITC) application deadlines and eligibility for admission, see "Initial Teacher Certification Professional Program Admission," page 181.

Additional requirements are listed on the check sheet available from the Department of Dance.

Dance Studies Concentration

Core Curriculum. See "Core Curriculum," page 278.

Concentration Requirements. The following courses are required for the dance studies concentration:

DAH 495 Theory and Methods of Dance Research 3
DAH 496 Senior Dance Studies 4
Total 7

Eighteen additional semester hours in related fields must be approved by the B.F.A. Dance Studies Committee. The content of related fields should support the research project. Students also have a flexible two to four semester hour option to fulfill dance science requirements for the Dance major core curriculum by taking courses such as Kinesiology, Feldenkrais, Bodywork for Dancers, and Pilates.

Additional requirements are listed on the check sheet available from the Department of Dance.

Performance Concentration

Core Curriculum. See "Core Curriculum," page 278.

Concentration Requirements. The following courses are required for the performance concentration:

DAN 321 Music Literature for Dance 3
DAN 380 Performance Studies Practicum 3
DAN 480 Senior Performance in Dance 4
THP 101 Introduction to the Art of Acting 3
Total 13

Performance. Choose from the following three courses (six semester hours are required):

DAN 371 Dance Theatre Performance/Production 1–3
DAN 471 Dance Arizona Repertory Theatre 3–4
DAN 472 Concert Dance 2

Additional requirements are listed on the check sheet available from the Department of Dance.

MINOR

All students interested in a Dance minor must successfully complete the Admission Audition. The department offers a minor in Dance consisting of 18 semester hours of course work, including 12 upper-division hours. A minimum grade of "C" is required in all courses. Additional Dance minor requirements include the following:

Performance or choreography 3
Technique 6
Theory 6
Elective 3

Interested students should contact the Department of Dance for specific requirements and audition/admission procedures.

B.I.S. CONCENTRATION

A concentration in dance is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that

might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAM

Dance—M.F.A.

The M.F.A. degree in Dance is a 60-semester-hour program designed to provide opportunities for the student to continue to develop in areas of dance technique, choreography, performance, and production; to gain further understanding of the philosophy, history, theory, education, and science and somatics of dance; and to begin to chart the direction of the future through technology, media opportunities, outreach, and community partnerships.

DANCE HISTORY (DAH)

DAH 100 Dance in World Cultures. (3)
fall, spring, summer
Orientation to the field of dance focusing on history, styles, cultural, and theatrical aspects of the art form from a global perspective. Fee.
General Studies: HU, G

DAH 190 Introduction to the Dance Profession. (3)
fall
Orientation to the dance profession introducing career options, wellness, technical, historical, and cultural aspects. Designed for premajors in Dance.

DAH 191 First-Year Seminar. (1–3)
selected semesters

DAH 300 Focus on Dance. (3)
fall, spring, summer
Specialized study of cultural and theatrical aspects of dance, such as social dance forms, specific genres or historical periods. May be repeated for credit. Lecture, studio. Fee.
General Studies: HU

DAH 301 Philosophy and Criticism of Dance. (3)
fall and spring
Philosophical issues in dance and dance criticism, with emphasis on written analysis and interpretation. Fee. Prerequisite: 1 semester of First-Year Composition.
General Studies: L/HU

DAH 302 Cross-Cultural Dance Studies. (3)
fall
Introduces the anthropology of dance. Examines comparative frameworks for studying dance in diverse contexts. Ethnographic dance research project. Lecture, field experience. Prerequisite: completion of First-Year Composition requirement. Pre- or corequisite: DAH 100 or 191 or instructor approval.
General Studies: L/HU, G

DAH 401 Dance History. (3)
fall and spring
History of dance with a focus on Western forms from the Renaissance to contemporary times. Fee.
General Studies: HU

DAH 495 Theory and Methods of Dance Research. (3)
spring
Examines modes of inquiry, data gathering techniques, data analysis and representation, prospectus design, and presentation style for dance research studies. Seminar. Prerequisite: instructor approval. Pre- or corequisite: DAH 301 or 302.

DAH 496 Senior Dance Studies. (2)
fall and spring
Original research that integrates dance and a related field of interest. Includes production of written document and public presentation. Fall semester must be completed prior to spring registration. May be repeated for a total of 4 semester hours. Prerequisite: DAH 495.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

DANCE (DAN)

DAN 130 Dance. (2)
fall, spring, summer
Introduces styles and forms of dance; ballet, modern, jazz, tap, ballroom, ethnic. May be repeated for credit. Topics may include the following:
- Ballet I
- Ballet II
- Beginning Modern I

DAN 134 Technique and Theory of Modern Dance. (3)
fall and spring
Elementary concepts of modern dance technique. Development of movement quality and performance skills. 6 hours weekly. May be repeated for credit. Prerequisites: Dance major; placement audition.

DAN 135 Technique and Theory of Ballet. (2)
fall and spring
Elementary ballet technique with emphasis on alignment, control, and development of the feet with proper awareness of style and phrasing. 4 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 194 Special Topics. (1–4)
selected semesters
Topics may include the following:
- African Dance
- Argentine Tango I
- Ballet I
- Beginning Ballet
- Big Band Swing I
- Competitive International Ballroom I
- Contemporary Dance
- Country Western I
- Hip Hop I
- Improvisation
- Irish Dance I
- Irish Step I
- Irish Step II
- Latin Salsa I
- Latin/Swing/Ballroom I
- Strictly Ballroom
- Swing/Lindy I
- West African Dance I

DAN 210 Dance Production I. (3)
fall
Theory and practice of lighting, scenery, sound, and stage management for dance production. Labs cover all areas of production. Lecture, lab.

DAN 211 Dance Production II. (3)
spring
Theory and practice of arts management and costume design for dance production. Labs cover all areas of production. Lecture, lab.

DAN 221 Rhythmic Theory for Dance I. (2)
fall
Elements of music, music structures, and their relationship to dance. Emphasis on rhythmic analysis and dance accompaniment.

DAN 222 Rhythmic Theory for Dance II. (2)
spring
Continuation of DAN 221 with an emphasis on small group/movement projects in relation to musical time and structure. CD-ROM work included. Prerequisite: DAN 221 or proficiency exam.

DAN 228 Dance Notation. (3)
fall and spring
Surveys systems of dance notation. Introduces effort-shape analysis of movement. Emphasizes learning elementary labanotation. Lecture, studio. Prerequisites: DAN 221; MUS 100.

DAN 230 Dance. (2)
fall, spring, summer
Intermediate levels. Continuation of DAN 130. May be repeated for credit.

DAN 234 Technique and Theory of Modern Dance. (3)
fall and spring
Intermediate concepts of modern dance technique. Development of movement quality and performance skills. 6 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 235 Technique and Theory of Ballet. (2)
fall and spring
Advanced study of elementary ballet technique through the traditional exercises, with proper awareness of style and phrasing. 4 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 237 Beginning Pointe. (1)
fall and spring
Study of elementary pointe technique through the traditional exercises. 2 hours weekly. May be repeated for credit. Prerequisites: basic ballet training; instructor approval.

DAN 264 Improvisational Structures. (3)
fall
Introduces basic improvisational and choreographic principles with emphasis on current media and technology, group structures, and movement invention. Lecture, studio.

DAN 265 Approaches to Choreography. (3)
fall
Intermediate application of basic choreographic principles with emphasis on improvisation, form, content, and evaluative skills. Lecture, studio. Prerequisite: DAN 264 or instructor approval.

DAN 294 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Argentine Tango II
- Ballet II
- Competitive International Ballroom II
- Country Western II
- Irish Dance II
- Irish Step I
- Irish Step II
- Latin Salsa II
- Latin/Swing/Ballroom II
- Latin Team II
- Swing/Lindy II
- West African Dance II

DAN 321 Music Literature for Dance. (3)
fall and spring
Historical survey of music and compositional elements relative to dance. Emphasis on analysis of choreography from a musical standpoint. Lecture, lab, CD-ROM lab. Prerequisites: both DAN 221 and 222 or only instructor approval. Pre- or corequisite: MUS 340.

DAN 330 Dance. (2)
fall, spring, summer
Advanced levels. Continuation of DAN 230. May be repeated for credit.

DAN 334 Technique and Theory of Modern Dance. (3)
fall and spring
Advanced concepts of modern dance technique. Development of movement quality and performance skills. 6 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 335 Technique and Theory of Ballet. (2)
fall and spring
Intermediate ballet technique with emphasis on strength, dynamics, rhythmical impulses, and transitions with awareness of proper style and phrasing. 4 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 337 Intermediate Pointe. (1)
fall and spring
Study of intermediate and advanced pointe technique through the traditional exercises. 2 hours weekly. May be repeated for credit. Prerequisite: DAN 237 or instructor approval.

DAN 340 Dance Kinesiology. (4)
fall and spring
Principles of kinesiology applied to the lower extremity, including identification of muscular imbalances, inherited anatomical differences, and pathomechanics in dance movement. Prerequisites: both BIO 201 and admission to a Dance B.F.A. concentration or only instructor approval.

DAN 342 Ideokinesis. (2)
fall
Study of posture using the visualization of image/goals to facilitate improved alignment and movement efficiency. May be repeated for credit. Lecture, studio.

DAN 350 Methods of Teaching Children's Dance. (3)
fall
Theory and practice of teaching creative dance to children. Lecture, studio, field experience. Prerequisite: Dance major or instructor approval.

DAN 351 Methods of Teaching Ballet. (3)
spring
Analysis and acquisition of teaching techniques and materials for ballet. Lecture, studio. Pre- or corequisite: DAN 352.

DAN 352 Dance Education Theory. (3)
fall
Motivation; learning; assessment; historical, cultural, and social constructs; outreach; service; advocacy; curriculum development in dance education. Lecture, field experience. Fee. Prerequisite: Dance major or instructor approval.

DAN 356 Methods of Teaching Contemporary Dance Technique and Composition in Secondary Education. (4)
fall
Analysis and acquisition of skills and materials for teaching contemporary dance technique and composition in secondary education. Lecture, studio, field experience. Pre- or corequisites: both DAN 350 and 352 or only instructor approval.

DAN 364 Choreography and Accompaniment. (3)
fall
Experience in the use of traditional and nontraditional musical structures as a basis for choreographic projects. Lecture, studio. Prerequisite: DAN 321 or instructor approval.

DAN 365 Advanced Choreography. (3)
spring
Investigation and practice of contemporary styles of choreography. Studio. Prerequisites: DAN 264 and 265 (or their equivalents).

DAN 371 Dance Theatre Performance/Production. (1–3)
fall and spring
Performance or technical theatre work in designated dance productions. 3 hours a week per semester hour. May be repeated for credit. Prerequisite: instructor approval.

DAN 380 Performance Studies Practicum. (3)
spring
Focus on developing rehearsal skills and achieving performance excellence through the preparation of three completed works. Studio, lab.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

DAN 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Advanced Hip Hop
- Ballet Methodology
- Capoeira
- Competition/Exhibition
- Competition/Exhibition II
- Competitive Ballroom/Latin
- Competitive International Ballroom
- Competitive International Ballroom III
- Integrated Approaches in Dance Education
- Intermediate Hip Hop
- Intermediate Modern Dance
- International Ballroom
- Latin Formation Teams
- Latin Salsa III
- Latin Salsa IV
- Latin/Swing/Ballroom III
- Pilates Mat
- Pilates/Yoga
- Swing/Latin/Ballroom III

DAN 423 Dance, Computers, and Multimedia. (3)
fall and spring
Introduces desktop multimedia as it relates to dance creation, education, production, and research. Lecture, lab. Fee.
General Studies: CS

DAN 434 Technique and Theory of Modern Dance. (3)
fall and spring
Preparation in the performance and comprehension of professional-level modern dance technique. 6 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 435 Technique and Theory of Ballet. (2)
fall and spring
Study of professional advanced ballet technique with emphasis on preparation for performance. 4 hours weekly. May be repeated for credit. Prerequisite: placement audition.

DAN 443 Bodywork for Dancers. (2)
spring
Introduces various massage therapy modalities for dancers, including Shiatsu, Swedish massage, sports massage and proprioceptive neuromuscular facilitation techniques.

DAN 445 Laban Movement Analysis. (3)
spring
Theory and practice of Laban movement analysis and Bartenieff fundamentals through movement investigation, observation, notation, and analysis. Lecture, studio. Prerequisite: admission to a B.F.A. in Dance concentration.

DAN 471 Dance Arizona Repertory Theatre. (3–4)
fall and spring
Preprofessional modern dance company, emphasizing outreach and performance. Opportunity to work with guest artists and community schools and organizations. Lecture, studio. Prerequisite: instructor approval.

DAN 472 Concert Dance. (2)
fall and spring
Extensive preparation of repertory or new works created by experienced choreographers. Simulates dance company experience, culminating in performance. Studio. Prerequisites: audition; instructor approval.

DAN 480 Senior Performance in Dance. (2)
fall
Original choreography for group performance with analysis and critique of problems encountered in production. Must be repeated for a total of 4 credits. Prerequisites: DAN 364, 365.

DAN 484 Dance Internship. (1–3)
fall and spring

DAN 494 Special Topics. (1–4)
once a year
Topics may include the following:
- Collaborative Multimedia
  Fee.
- Concert Dance. (2)
- Dance Education and Technology
  Fee.
- Integrative Teaching Methods
  Fee.
- Performance Technology I
  Fee.
- Performance Technology II
  Fee.
- Senior Dance Education Project
- Sound Lab
  Fee.

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School of Music

music.asu.edu
480/965-3371
MUSIC E185

Wayne A. Bailey, Director

Kimberly Marshall, Associate Director, Graduate Studies

Karen M. Bryan, Associate Director, Undergraduate Studies

Regents' Professors: Hickman, Pagano

Professors: Bailey, Britton, Cosand, Crowe, DeMars, Doan, Dreyfoos, Hackbarth, Hamilton, Hill, Hoffer, Humphreys, Kliewer-Britton, Koonce, Lockwood, Marohnic, Marshall, Metz, Oldani, Pilafian, Reber, Rikakis, Rogers, Russell, Schildkret, Sellheim, Shinn, Solís, Spring, Stauffer, Sunkett, Swaim, Thompson, Williamson, Wytko

Associate Professors: Buck, Bush, Carpenter, Haefer, Holbrook, Kopta, Lyman, May, Rockmaker, Schuring, Smith, Wilson

Assistant Professors: Bryan, Ericson, Feisst, Landschoot, Lingas, McLin, Meir, Norton, Province, Rio, Schmidt, Sullivan, Swartz

Senior Lecturers: A. Campbell, Shellans

Lecturer: Tongret

Academic Professional: G. Campbell

The School of Music in the Katherine K. Herberger College of Fine Arts at ASU is an accredited institutional member of the National Association of Schools of Music. The requirements for entrance and graduation set forth in

this catalog are in accordance with the published regulations of the association.

The School of Music strives to create an environment that enriches and enlivens the role of music in our society by providing the highest level of instruction and research for music professionals in the fields of performance, conducting, pedagogy, music education, music therapy, music history, music theory, and composition.

The following statement of basic musicianship is endorsed by the School of Music:

> All musicians, whether performers, composers, scholars, or teachers, share common professional needs. Every musician must to some extent be a performer, a listener, a historian, a composer, a theorist, and a teacher. For this reason, certain subject matter areas and learning processes are common to all baccalaureate degrees in music.
>
> Basic musicianship is developed in studies that prepare the student to function in a variety of musical roles that are supportive of his/her major concentration. All undergraduate curricula, therefore, provide the following:
>
> 1. A conceptual understanding of such musical properties as *sound, rhythm, melody, harmony, texture,* and *form* and opportunities for developing a comprehensive grasp of their interrelationships as they form the cognitive-affective basis for listening, composing and performing.
> 2. Repeated opportunities for enacting in a variety of ways the roles of listener (analysis), performer (interpretation), composer (creation), scholar (research), and teacher.
> 3. A repertory for study that embraces all cultures and historical periods.

All students registering in a School of Music major program enroll through the Herberger College of Fine Arts.

Audition/Admission Requirements. *All students who wish to enroll in an undergraduate music degree program are required to pass an entrance audition in their primary performing medium (instrument or voice) before being admitted to the School of Music.* Audition forms and specific audition requirements for each instrument or voice may be obtained upon request by contacting the School of Music. Official dates for these auditions are set for each academic year.

Until the audition process is finished, all students interested in majoring in Music at ASU enter the university in the preprofessional program. The preprofessional program is designed to prepare students who have performance deficiencies and/or music academic deficiencies for entry into the major degree program. Upon successful completion of the audition, the student is admitted to his or her specified degree option.

Students who wish to be Music majors who do not successfully complete the audition are allowed to remain in the preprofessional program for two semesters (excluding summer and winter sessions). They are allowed to reaudition two times in addition to the initial audition; these additional auditions may take place either during or at the end of each fall or spring semester that the student is enrolled under this program. During these semesters, students are allowed to enroll in music ensembles, concert attendance, and general studies courses to be chosen through consultation with a School of Music academic advisor. Students are also encouraged to obtain private instruction on their major instrument through either the School of Music preparatory program or with private instructors. These private instructions are not required and do not generate university course credit hours. The re-auditions are heard and evaluated by School of Music faculty.

Admission to the composition concentration is subject to the approval of the composition faculty based upon an evaluation of the student's compositions and/or interview.

Diagnostic Examinations. All transfer students and entering freshmen with a background in piano must take a diagnostic examination in piano during orientation week of their first semester on campus. All students are required to attain a minimum level of piano proficiency.

Continuation in the composition program is subject to review in the sophomore or junior year.

All Music Education majors, including transfer and post-baccalaureate students, must perform an additional audition before being admitted to the teacher education program. Normally, this audition occurs during the sophomore year.

All students majoring in Music Therapy must pass MUE 211 Music in Recreation and a music therapy faculty review and screening interview before being passed into upper-division study.

MUSIC—B.A.

The Bachelor of Arts degree requires a minimum of 120 semester hours for graduation.

The Music major consists of 50 semester hours and includes the requirements that follow for each area of study.

In addition to fulfilling the major requirements, students must meet all university graduation requirements and college degree requirements. See "University Graduation Requirements," page 81, and "College Degree Requirements," page 259.

Music Theory. The following music theory courses are required:

MTC	125 Basic Music Theory	3
MTC	221 Music Theory: 18th Century	3
MTC	222 Music Theory: 19th Century	3
MTC	223 Music Theory: 20th Century	3
MTC	320 Modal Counterpoint	2
	or MTC 321 Tonal Counterpoint (2)	
MTC	327 Intermediate Form and Analysis	3
MTC	422 Musical Acoustics	3
Total		20

Music History. Three semester hours of MHL 341 Music History and three semester hours of MHL 342 Music History are required. Nine elective upper-division hours in music history and/or theory are required.

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction or MUP 311 Studio Instruction are required. At least four of these hours must be at ASU.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

The remaining semester hours in music are selected by the student in consultation with an advisor. Areas of study may include ethnomusicology, music education, music history, music theory, and performance. At least 23 semester hours, 12 in the field of specialization, must be in the upper division. Students must select sufficient elective courses to complete the 120 hours required for graduation.

BACHELOR OF MUSIC DEGREE

All Bachelor of Music (B.M.) degree programs require 120 semester hours for graduation excluding Music Education (125 to 130 semester hours) and Music Therapy (129 semester hours). The B.M. curriculum offers majors in Music Education, Music Therapy, Performance, and Theory and Composition.

The curricula for the Music Education and Music Therapy majors require more than 120 semester hours. A student wishing to complete these programs in four years is required to take more than 15 semester hours per semester or to attend summer sessions.

The music curriculum for the B.M. majors on the pages which follow consists of 79 semester hours. The requirements for each major are listed on this page. In addition, the Music Education major provides certification to students interested in teaching in the public schools.

In addition to fulfilling the major requirements, students must meet all university graduation requirements and college degree requirements. See "University Graduation Requirements," page 81, and "College Degree Requirements," page 259.

MUSIC EDUCATION—B.M.

Choral-General Concentration

This degree program may include instrumental music as a minor teaching field.

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
Total	12

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
Total	9

Conducting. The following conducting courses are required:

MUP 209 Beginning Choral Conducting	1
MUP 339 Choral Conducting	2
Total	3

Music Education. The following music education courses are required:

MUE 110 Introduction to Music Education	1
MUE 313 Elementary Music Methods	3
MUE 315 General Music in the Secondary Schools	2
MUE 480 Choral Methods	3
Total	9

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction and eight semester hours of MUP 311 Studio Instruction are required to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 Performance completes the requirement.

Minor Performing Medium. A proficiency equal to six semesters of study in keyboard or voice (whichever is not the major performing medium) is required. Students wishing to extend their proficiency beyond this level may continue to study in MUP 321 Studio Instruction.

Ensemble. Eight different semesters of participation, including at least six semesters of MUP 352 Concert Choir and/or MUP 353 University Choir, four of which must be at ASU, are required.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Instrumental Concentration

It is strongly recommended that this degree program include courses in choral music or courses in jazz education.

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
Total	12

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
Total	9

Conducting. The following conducting courses are required:

MUP 210 Beginning Instrumental Conducting	1
MUP 340 Instrumental Conducting	2
Total	3

Music Education. The following music education courses are required:

MUE 110 Introduction to Music Education	1
MUE 315 General Music in the Secondary Schools	2

MUE 317 Educational Methods for Violin and Viola	1
MUE 318 Educational Methods for Cello and String Bass	1
MUE 327 Educational Methods for Trumpet and Horn	1
MUE 328 Educational Methods for Trombone, Euphonium, and Tuba	1
MUE 336 Educational Methods for Percussion	1
MUE 337 Educational Methods for Flute, Clarinet, and Saxophone	1
MUE 338 Educational Methods for Double Reed Instruments	1
MUE 481 Instrumental Practicum/Methods	5
MUE 482 Instrumental Practicum/Methods	5
Total	20

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction and eight semester hours of MUP 311 Studio Instruction are required to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 Performance completes the requirement.

Ensemble. Eight different semesters of participation in an ensemble are required, four of which must be at ASU. Two of the four ASU semesters must be in marching band. Wind and percussion players must have a minimum of six semesters of MUP 361 Marching and Concert Bands or equivalent large ensemble.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

String Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
Total	12

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
Total	9

Conducting. The following conducting courses are required:

MUP 210 Beginning Instrumental Conducting	1
MUP 340 Instrumental Conducting	2
Total	3

Music Education. The following music education courses are required:

MUE 110 Introduction to Music Education	1
MUE 315 General Music in the Secondary Schools	2
MUE 317 Educational Methods for Violin and Viola	1
or MUE 318 Educational Methods for Cello and String Bass (1)	
MUE 327 Educational Methods for Trumpet and Horn	1
or MUE 328 Educational Methods for Trombone, Euphonium, and Tuba (1)	
MUE 335 Educational Methods for Guitar	1
MUE 336 Educational Methods for Percussion	1
MUE 337 Educational Methods for Flute, Clarinet, and Saxophone	1
or MUE 338 Educational Methods for Double Reed Instruments (1)	
MUE 482 Instrumental Practicum/Methods	5
MUE 485 String Practicum/Methods	5
Total	18

Also required are three semesters of MUP 121 Studio Instruction and one semester in each of the three stringed instruments other than the major instrument.

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction and eight semester hours of MUP 311 Studio Instruction are required to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 Performance completes the requirement.

Ensemble. Eight different semesters of participation in an ensemble are required, four of which must be at ASU. Six semesters of MUP 345 Symphony Orchestra or equivalent are required.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Recommended Elective. MUE 313 Elementary Music Methods is recommended.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

MUSIC THERAPY—B.M.

Students are eligible to apply for the Certification Exam offered by the Certification Board for Music Therapists upon completion of the requirements for graduation.

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
Total	12

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 201 MacLiteracy for Musicians *CS*	3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MHL 341 Music History	3
MHL 342 Music History	3
Total	12

Conducting. One of the following two courses is required:

MUP 209 Beginning Choral Conducting	1
MUP 210 Beginning Instrumental Conducting	1

Music Education. The following music education courses are required:

MUE 211 Music in Recreation	2
MUE 313 Elementary Music Methods	3
MUE 335 Educational Methods for Guitar	1
MUE 336 Educational Methods for Percussion	1
MUE 389 Repertoire for Music Therapy	3
Total	10

Music Therapy. The following music therapy courses are required:

MUE 161 Introduction to Music Therapy	2
MUE 261 Music Therapy as a Behavioral Science	2
MUE 361 Music Therapy Theory and Practice in Psychopathology	3
MUE 362 Music Therapy Techniques	3
MUE 381 Music Therapy Research *L*	3
MUE 384 Therapy Preclinical I	1
MUE 385 Therapy Preclinical II	1
MUE 386 Therapy Preclinical III	1
MUE 387 Therapy Preclinical IV	1
MUE 388 Therapy Preclinical V (elective)	1
MUE 441 Psychology of Music	3
MUE 475 Group Process and Music Therapy	1
MUE 476 Internship in Music Therapy	1
Total	23

Major Performing Medium. A minimum of twelve semester hours are required in the major performing medium, which must include at least four semester hours of MUP 311 Studio Instruction.

Voice. Two semesters of study in voice are required.

Ensembles. Six semesters of ensemble participation are required with at least four semesters in large groups.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Additional Requirements. These courses are also required:

CDE 232 Human Development *SB*	3
BIO 201 Human Anatomy and Physiology I *SG*	4
PGS 101 Introduction to Psychology *SB*	3
PGS 466 Abnormal Psychology *SB*	3
PSY 230 Introduction to Statistics *CS* or STP 226 Elements of Statistics *CS* (3)	3
SOC 101 Introductory Sociology *SB*	3
SPE 311 Orientation to Education of Exceptional Children *SB*	3
DAN dance	3–4
Total	25–26

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required. Music therapy competencies (as established by the American Music Therapy Association) are evaluated before and after the music therapy internship, to determine entry-level skill acquisition before graduation.

PERFORMANCE—B.M.

Guitar Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 320 Modal Counterpoint or MTC 321 Tonal Counterpoint (2)	2
Total	14

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Repertoire and Pedagogy. The following courses are required:

MUP 451 Repertoire	2
MUP 481 Performance Pedagogy and Materials	2
Total	4

Conducting. MUP 210 Beginning Instrumental Conducting is required.

Major Performing Medium. Sixteen semester hours of MUP 127 Studio Instruction and 16 semester hours of MUP 327 Studio Instruction are required to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495 Performance) and a full recital (MUP 496 Performance) are also required.

Ensemble. Eight semester hours of ensemble are required within a minimum of six different semesters. Four of the eight semester hours must be MUP 379 Chamber Music Ensembles: Guitar.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

Jazz Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 315 Modern Arranging	2
MTC 316 Modern Arranging	2
MTC 440 Jazz Theory and Ear Training	2
MTC 441 Jazz Composition	2
Total	20

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL 352 The Evolution of Jazz *H*	3
Total	12

Conducting. MUP 210 Beginning Instrumental Conducting is required.

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction and eight semester hours of MUP 311 Studio Instruction are required to obtain a proficiency level necessary to meet the graduation recital requirements. Two half recitals (MUP 495 Performance) are required, with one in the jazz idiom.

Improvisation. The following courses are required:

MUP 141 Jazz Fundamentals	1
MUP 142 Jazz Listening Lab	1
MUP 217 Improvisation Workshop	2
MUP 218 Improvisation Workshop	2
MUP 417 Advanced Improvisation	2
MUP 418 Advanced Improvisation	2
Total	10

Workshops. The following courses are required:

MUP 319 Recording Studio Techniques	2
MUP 235 Jazz Piano	1
MUP 236 Jazz Piano	1
Total	4

Ensemble. Eight semesters of ensemble are required, including six semesters of MUP 379 Chamber Music Ensembles and two semesters of MUP 386 Jazz Band.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Two semesters of class piano (MUP 131, 132), unless waived by a diagnostic examination at the time of entrance, are required.

Keyboard Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 320 Modal Counterpoint	2
or MTC 321 Tonal Counterpoint (2)	
MTC 425 Studies in 20th-Century Theory	3
or MTC 428 Form and Analysis (3)	
Total	17

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Repertoire and Pedagogy. The following courses are required:

MUP 451 Repertoire	2
MUP 481 Performance Pedagogy and Materials	2
or MUP 482 Piano Pedagogy (2)	
Total	4

Conducting. One of the following two courses is required:

MUP 209 Beginning Choral Conducting	1
MUP 210 Beginning Instrumental Conducting	1

Harpsichord. One semester hour of harpsichord is required.

Major Performing Medium. Sixteen semester hours of MUP 127 Studio Instruction and 16 semester hours of MUP 327 Studio Instruction are required to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495 Performance) and a full recital (MUP 496 Performance) are required.

Ensemble. Eight semester hours of ensemble within a minimum of six different semesters are required, including two semesters of accompanying and two semesters of chamber music.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Music Theatre Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
Total	12

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
Total	9

Major Performing Medium. Eight semester hours of MUP 111 Studio Instruction and eight semester hours of MUP 311 Studio Instruction are required to attain a proficiency level necessary to meet the graduation requirement of a public performance of two roles, both of which must be of major proportion.

Music Theatre. Five semesters of MUP 370 Music Theatre: Techniques; four semesters of MUP 371 Music Theatre: Workshops; eight semesters of MUP 373 Music Theatre: Performance; two semesters of MUP 374 Music Theatre: Production; and one semester of MUP 451 Repertoire: Broadway Musicals are required.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Conducting. MUP 209 Beginning Choral Conducting is required.

Additional Requirements. Six semester hours in theatre and 11 semester hours in dance are required.

Diagnostic Examination. Three semesters of class piano (MUP 131, 132, 231), unless waived by a diagnostic examination at the time of entrance, are required.

Opera Option. For those students whose goal is opera performance, the following substitutions to the course of study may be made: MUP 451 Repertoire: Opera instead of MUP 451 Repertoire: Broadway Musicals, and two semesters of MUP 371 Music Theatre: workshops (Aria Preparation) and three semesters of MUP 250 Diction for Singers instead of five semester hours of dance. Permission of the director of the music theatre program is required.

Orchestral Instrument Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 321 Tonal Counterpoint	2
Total	14

Music History. The following courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Repertoire and Pedagogy. The following courses are required:

MUP 451 Repertoire	2
MUP 481 Performance Pedagogy and Materials	2
Total	4

Conducting. The following courses are required:

MUP 210 Beginning Instrumental Conducting	1
MUP 340 Instrumental Conducting	2
Total	3

Major Performing Medium. Sixteen semester hours of MUP 127 Studio Instruction and 16 semester hours of MUP 327 Studio Instruction are required to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495 Performance) and a full recital (MUP 496 Performance) are required.

Ensemble. Eight semester hours of large ensembles within a minimum of six different semesters are required plus four semester hours of small ensembles within a minimum of four different semesters.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

Piano Accompanying Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 321 Tonal Counterpoint	2
MTC 428 Advanced Form and Analysis	3
Total	17

Music History. The following courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Diction and Repertoire. The following courses are required:

MUP 250 Diction for Singers	1
MUP 451 Repertoire	2
MUP 453 Song Literature	2
MUP 454 Song Literature	2
Total	7

Conducting. One of the following two courses is required:

MUP 209 Beginning Choral Conducting	1
MUP 210 Beginning Instrumental Conducting	1

Major Performing Medium. The following courses are required:

MUP 127 Studio Instruction	16
MUP 311 Studio Instruction	8
MUP 337 Studio Instruction: Piano Accompanying	8
Total	32

In addition, each student accompanies two half recitals (MUP 495 Performance), one for a singer and one for an instrumentalist, during his or her junior year. (A half solo recital may be substituted for either of the above.) During the senior year, the student accompanies two full recitals (MUP 496 Performance), one vocal and one instrumental.

Ensemble. Two semesters of MUP 379 Chamber Music Ensembles, one semester of MUP 379 Chamber Music Ensembles: Piano, four semesters of MUP 388 Piano Accompanying, one semester of MUP 487 Piano Accompanying, and two semesters of ensemble elective (minimum of six different semesters) are required.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Voice Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 321 Tonal Counterpoint	2
Total	14

Music History. The following music history courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Repertoire and Pedagogy. Two semester hours of MUP 451 Repertoire and two semester hours of MUP 481 Performance Pedagogy and Materials are required.

Also required are two semester hours selected from MUP 453 Song Literature or 454 Song Literature or a repeated enrollment of MUP 451 Repertoire.

Diction. Three semester hours of MUP 250 Diction for Singers is required, which includes one hour each of Italian, German, and French.

Conducting. MUP 209 Beginning Choral Conducting is required.

Major Performing Medium. Sixteen semester hours of MUP 127 Studio Instruction and 16 semester hours of MUP 327 Studio Instruction are required to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495 Performance) and a full recital (MUP 496 Performance) are required.

Ensemble. Four different semesters of large vocal ensembles are required plus four semester hours of ensembles within four different semesters to be selected from large and/or small ensembles.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Language. Sixteen semester hours are required in more than one foreign language, chosen from French, German, and Italian. A student may select one year of one language and one semester of the others, chosen in conference with the advisor.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

THEORY AND COMPOSITION—B.M.

Composition Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 320 Modal Counterpoint	2
MTC 321 Tonal Counterpoint	2
MTC 432 Instrumentation	2
MTC 433 Orchestration	2
MTC 436 Electronic Studio Techniques I	2
Total	22

An additional five hours, to be selected from MTC 422, 425, 428, 429, 430, 437, and 441 are required.

Three semesters of MTC 123 Beginning Composition and four semesters of MTC 323 Composition are also required. At least three semesters of MTC 323 Composition must be taken at ASU.

Music History. The following courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Conducting. Choose between the two combinations of courses: MUP 209 Beginning Choral Conducting and MUP 339 Choral Conducting *or* MUP 210 Beginning Instrumental Conducting and MUP 340 Instrumental Conducting.

Applied Music. Ten semester hours of study in applied music are required, at least eight of which must be in MUP 111 Studio Instruction.

Ensemble. Six semesters of participation in an ensemble are required.

Final Project. MTC 495 Final Project is required.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science--general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

Additional Requirements. At least four hours of electives to be chosen from MTC, MHL, or MUP (excluding courses taken to meet Class Piano proficiency) are required. MHL 447 Music Since 1900 may be used to satisfy the General Studies L requirement.

Theory Concentration

Music Theory. The following music theory courses are required:

MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
MTC 222 Music Theory: 19th Century	3
MTC 223 Music Theory: 20th Century	3
MTC 320 Modal Counterpoint	2
MTC 321 Tonal Counterpoint	2
MTC 323 Composition	2–3
MTC 422 Musical Acoustics	3
MTC 425 Studies in 20th-Century Theory	3
MTC 428 Advanced Form and Analysis	3
MTC 496 Theory Project	3
Total	30–31

Also required are 10 semester hours of electives in MTC courses at the 300 level or above, to be chosen in consultation with an advisor.

Music History. The following courses are required:

MHL 194 ST: Music and Culture	3
MHL 341 Music History	3
MHL 342 Music History	3
MHL upper division	3
Total	12

Conducting. Choose between the two combinations of courses: MUP 209 Beginning Choral Conducting and MUP 339 Choral Conducting *or* MUP 210 Beginning Instrumental Conducting and MUP 340 Instrumental Conducting.

Applied Music. Twelve semester hours of study in applied music are required, eight of which must be in MUP 111 Studio Instruction.

Ensemble. Eight semesters of participation in an ensemble are required.

Final Project. MTC 496 Theory Project is required.

Recital Attendance. Six semesters of MUP 100 Concert Attendance are required.

Diagnostic Examination. Four semesters of class piano (MUP 131, 132, 231, 232), unless waived by a diagnostic examination at the time of entrance, are required.

Additional Requirements. MHL 447 Music Since 1900 may be used to satisfy the General Studies L requirement.

MUSIC MINOR

The School of Music offers a minor in Music consisting of 20 semester hours of course work. A minimum grade of "C" is required in all courses.

MHL 341 Music History	3
MHL 342 Music History	3
MTC 125 Basic Music Theory	3
MTC 221 Music Theory: 18th Century	3
Electives*	8
Total	20

* Electives may be chosen from MUS, MHL, MTC, and selected MUP courses. The minor does not include Studio Instruction.

Diagnostic Examination. Students pursuing a minor in music must first take a Theory Diagnostic Exam. This exam may be taken in the Music Building's Electronic Classroom, room W-225.

Interested students should contact the School of Music for specific requirements and admission procedures.

B.I.S. CONCENTRATION

A concentration in music is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAMS

The faculty in the School of Music offer graduate programs leading to the following degrees: Master of Arts, Master of Music, and Doctor of Musical Arts. Refer to the "Herberger College of Fine Arts Graduate Degrees and Majors" table, page 260, for a list of majors and concentrations. A document on graduate degree programs in music may be obtained by contacting the School of Music. See the *Graduate Catalog* for information on all graduate degrees.

MUSIC HISTORY/LITERATURE (MHL)

MHL 194 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Music and Culture. (3)

MHL 201 MacLiteracy for Musicians. (3)
fall, spring, summer
Instruction in basic Macintosh computer literacy, including generic applications and music-specific programs with hands-on experience. Lecture, lab.
General Studies: CS

MHL 341 Music History. (3)
fall and spring
Western music from the Greeks to the present day. Need not be taken in sequence with MHL 342. Prerequisite: MTC 221.

MHL 342 Music History. (3)
fall and spring
See MHL 341. Prerequisite: MTC 221.

MHL 344 Music in World Cultures. (3)
spring
Examines the relations among music, dance, theatre, religion, and social status in Asia, Africa, Oceania, Europe, and the United States.
General Studies: HU, G

MHL 352 The Evolution of Jazz. (3)
selected semesters
Origin, development, and styles of jazz music and its exponents. Prerequisite: MTC 223.
General Studies: H

MHL 363 Survey of Russian Music. (3)
fall in odd years
Examines music and musical life in Russia, the Soviet Union, and the post-Soviet C.I.S. from the Middle Ages to the present. Lecture, discussion. Prerequisite: MHL 342 or instructor approval.
General Studies: HU

MHL 438 Music in the Classic Era. (3)
fall in even years
Development of the classic style of the 18th century; major works of Haydn, Mozart, and Beethoven. Prerequisites: MHL 341, 342; MTC 327.
General Studies: H

MHL 439 Music in the 19th Century. (3)
spring
European art music after Beethoven. Prerequisites: MHL 341, 342; MTC 327.
General Studies: L, H

MHL 441 Music of the Baroque Era. (3)
fall in odd years
Works of major composers and stylistic tendencies of the period. Prerequisites: MHL 341, 342; MTC 327.
General Studies: L

MHL 447 Music Since 1900. (3)
fall and summer
Survey of the works by major composers and stylistic trends. Prerequisites: MHL 341, 342; MTC 327.
General Studies: L

MHL 456 History of Opera. (3)
spring in odd years
Development of opera from its creation ca. 1600 to present. Emphasis placed on major stylistic developments and representative works. Prerequisites: MHL 341, 342; MTC 222.

MHL 466 North American Indian Music. (3)
spring in odd years
Various styles of Indian music in the United States, Canada, and Mexico. Open to Music majors and nonmajors.
General Studies: L/HU, C

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MUSIC THEORY AND COMPOSITION (MTC)

MTC 123 Beginning Composition. (1)
fall and spring
Intended for freshmen and sophomores in the composition concentration. Introduces composing. May be repeated for credit. Prerequisite: instructor approval.

MTC 125 Basic Music Theory. (3)
fall and spring
Notation, scales, keys, modes, intervals, chords, basic part writing and composition. Development of related aural skills through sightsinging and dictation. Prerequisite: any music major or instructor approval.

MTC 221 Music Theory: 18th Century. (3)
fall and spring
Styles, techniques, and idioms of 18th-century music; emphasizes analysis, composition (part writing), and related aural skills, with applications for performance. Prerequisite: MTC 125.

MTC 222 Music Theory: 19th Century. (3)
fall and spring
Styles, techniques, and idioms of 19th-century music; emphasizes analysis, composition (part writing), and related aural skills, with applications for performance. Prerequisite: MTC 221.

MTC 223 Music Theory: 20th Century. (3)
fall and spring
Styles, techniques, and idioms of 20th-century music; emphasizes innovative treatments of musical elements, analysis, and composition; related aural skills. Prerequisite: MTC 222.

MTC 315 Modern Arranging. (2)
fall
Techniques in arranging for the contemporary jazz, radio, television, and studio orchestra. Prerequisite: MTC 223.

MTC 316 Modern Arranging. (2)
spring
Continuation of MTC 315. Prerequisite: MTC 315.

MTC 320 Modal Counterpoint. (2)
fall
Counterpoint based on 16th-century vocal polyphonic style. Prerequisite: MTC 221.

MTC 321 Tonal Counterpoint. (2)
spring
Counterpoint based on 18th-century polyphonic style. Prerequisite: MTC 221.

MTC 323 Composition. (2–3)
fall and spring
Writing music compositions, with emphasis on basic techniques and smaller structures. May be repeated for credit. Prerequisite: 3 semesters of MTC 123 or instructor approval.

MTC 327 Intermediate Form and Analysis. (3)
fall and spring
Organizing elements in the most important contrapuntal and homophonic musical forms from the Renaissance through the 19th century. Prerequisite: MTC 222.

MTC 422 Musical Acoustics. (3)
fall
Properties of sound and tone. Harmonic series, instruments, the ear, auditorium acoustics, and the reproduction of sound. Assumes a thorough knowledge of musical notation, intervals, scales, and harmony, or 2 years of music theory.

MTC 425 Studies in 20th-Century Theory. (3)
fall
Continued development of analytical techniques and aural skill, with an examination of theoretical systems applicable to 20th-century music. Prerequisite: MTC 223.

MTC 428 Advanced Form and Analysis. (3)
spring
Organizing principles of the large forms of musical composition in the 19th and 20th centuries. Prerequisite: MTC 327.

MTC 429 Canon and Fugue. (2)
fall in odd years
Writing of canons and fugues in tonal style. Prerequisite: MTC 321.

MTC 430 20th-Century Counterpoint. (2)
spring in even years
Counterpoint studies utilizing 20th-century idioms. Prerequisite: MTC 223.

MTC 432 Instrumentation. (2)
fall in even years
Study of the characteristics and performance techniques of individual orchestral instruments. Prerequisite: MTC 223.

MTC 433 Orchestration. (2)
spring in odd years
Theoretical and practical study of scoring music for orchestra. Prerequisite: MTC 432.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MTC 436 Electronic Studio Techniques I. (2)
fall
Principles of analog electronic music systems and their application in the composition of electronic music. Assumes a thorough knowledge of music notation and intervals.

MTC 437 Electronic Studio Techniques II. (2)
spring
Principles of digital electronic music systems and their applications in the composition of electronic music. Prerequisite: MTC 436.

MTC 440 Jazz Theory and Ear Training. (2)
fall
Advanced study of jazz harmonic systems. Daily oral drills. Prerequisite: MTC 223.

MTC 441 Jazz Composition. (2)
fall
Creative writing in the smaller forms and in the idiom of jazz. Prerequisite: MTC 321.

MTC 495 Final Project. (0)
fall and spring
Half recital of compositions or approval of a large-scale composition or a research paper.

MTC 496 Theory Project. (3)
fall and spring
Supervised individual writing project dealing with music theory.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MUSIC EDUCATION (MUE)

MUE 110 Introduction to Music Education. (1)
spring
Overview of music education. Orientation to student characteristics, teacher roles, and foundations of philosophy and history. Requires school observations.

MUE 161 Introduction to Music Therapy. (2)
fall
Overview of the profession of music therapy and its applications in mental health, rehabilitation, and special education.

MUE 211 Music in Recreation. (2)
fall
Materials, methods, and organizational structures appropriate for recreational music. Prerequisite: ability to read music, as determined by the instructor.

MUE 261 Music Therapy as a Behavioral Science. (2)
fall
Orientation to preclinical experience with emphasis on observation skills, assessment, goal setting, and professional ethics. Requires off-campus observations. Prerequisite: MUE 161.

MUE 310 Music in Early Childhood Education. (3)
spring
Identifying and understanding musical needs of young children. Methods and materials for program development for classroom teachers.

MUE 311 Music for the Classroom Teacher. (3)
fall and spring
Development of the classroom music program in the elementary school. Requires no previous music experience or course work. Prerequisite: non-music major or minor.

MUE 313 Elementary Music Methods. (3)
fall
Methods of instruction, planning, and presentation of appropriate contents in music. For music educators and music therapists. Prerequisite: any music major.

MUE 315 General Music in the Secondary Schools. (2)
fall and spring
Curriculum, student characteristics, and teaching strategies for general music. Prerequisite: any music major.

MUE 317 Educational Methods for Violin and Viola. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 318 Educational Methods for Cello and String Bass. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 327 Educational Methods for Trumpet and Horn. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 328 Educational Methods for Trombone, Euphonium, and Tuba. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 335 Educational Methods for Guitar. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 336 Educational Methods for Percussion. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 337 Educational Methods for Flute, Clarinet, and Saxophone. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 338 Educational Methods for Double Reed Instruments. (1)
fall and spring
Teaching and playing skills for music teachers. 3 hours per week.

MUE 361 Music Therapy Theory and Practice in Psychopathology. (3)
fall
Influence of music on behavior; principles and practices of music therapy and psychiatric clients. Prerequisites: MUE 211, 261; Music Therapy major.

MUE 362 Music Therapy Techniques. (3)
spring
Organization, administration, and use of music in rehabilitation with various client populations. Prerequisites: MUE 361; Music Therapy major.

MUE 381 Music Therapy Research. (3)
spring
Statistics and research design appropriate for investigations in music therapy.
General Studies: L

MUE 384 Therapy Preclinical I. (1)
fall and spring
Paired students provide music therapy for small groups at a community agency for mentally retarded, geriatric, or physically disabled clients for a minimum of 10 clock hours. Prerequisites: MUE 211, 261.

MUE 385 Therapy Preclinical II. (1)
fall and spring
Individual placement in ASU Music Therapy Clinic.

MUE 386 Therapy Preclinical III. (1)
fall and spring
See MUE 385.

MUE 387 Therapy Preclinical IV. (1)
fall and spring
Individual clinical work in a community mental health facility.

MUE 388 Therapy Preclinical V. (1)
fall and spring
See MUE 387.

MUE 389 Repertoire for Music Therapy. (3)
spring
Music skills repertoire for music therapy, including units on brass, strings, woodwinds, electronic instruments, computer music, and improvisation techniques. Lab. Prerequisites: MUE 211; Music Therapy major.

MUE 441 Psychology of Music. (3)
spring
Psychological and physiological aspects of music emphasizing musical behavior, function, perception, and learning. Prerequisite: junior standing or instructor approval.

MUE 475 Group Process and Music Therapy. (1)
fall
Principles of group process, verbal counseling, professional writing, as related to music therapy practice. Prerequisites: MUE 362; Music Therapy major.

MUE 476 Internship in Music Therapy. (1)
fall and spring
Full-time, 6-month, off-campus residency in an approved clinical institution.

MUE 480 Choral Methods. (3)
spring
Methods of instruction, organization, and presentation of appropriate content in choral music classes. Prerequisite: Secondary Education major.

MUE 481 Instrumental Practicum/Methods. (5)
fall
Instrumental music as a means of developing music skills, understandings, and attitudes in elementary and secondary school students. Prerequisite: Secondary Education major.

MUE 482 Instrumental Practicum/Methods. (5)
spring
See MUE 481. Prerequisites: MUE 481 (or 485); Secondary Education major.

MUE 485 String Practicum/Methods. (5)
fall
For students preparing to administer a string program and teach strings at the elementary level. Lecture, lab.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MUSIC PERFORMANCE (MUP)

MUP 100 Concert Attendance. (0)
fall and spring
6 semesters required for all music majors. A total of 4 convocations and 6 approved recitals required each semester.

MUP 111 Studio Instruction. (2)
fall and spring
Bassoon, cello, clarinet, contrabass, cornet, euphonium, flute, guitar, harp, harpsichord, horn, oboe, organ, percussion, piano, saxophone, trombone, trumpet, tuba, viola, violin, voice. Minimum contact of 1 hour plus studio class weekly. May be repeated for credit. May not be taken for audit. Fee. Prerequisites: any music major; placement examination; audition.

MUP 121 Studio Instruction. (1)
fall, spring, summer
Secondary or minor instrument instruction. Bassoon, cello, clarinet, contrabass, cornet, euphonium, flute, guitar, harp, harpsichord, horn, oboe, organ, percussion, piano, saxophone, trombone, trumpet, tuba, viola, violin, voice. Minimum contact of 1/2 hour per week. May be repeated for credit. May not be taken for audit. Fee. Prerequisites: any music major; instructor approval.

MUP 127 Studio Instruction. (4)
fall and spring
Bassoon, cello, clarinet, contrabass, cornet, euphonium, flute, guitar, harp, harpsichord, horn, oboe, organ, percussion, piano, saxophone, trombone, trumpet, tuba, viola, violin, voice. Minimum contact of 1 hour plus studio class weekly. May be repeated for credit. May not be taken for audit. Fee. Prerequisites: Performance major; placement examination; audition.

MUP 130 Beginning Group Piano. (1)
fall and spring
Provides a basic introduction to playing piano through music reading, chords, rhythmic, and written activities. Prerequisite: non-music major.

MUP 131 Class Piano. (1)
fall and spring
4-semester sequence (with MUP 132, 231, and 232) designed for those with little or no piano experience. Emphasizes keyboard technique, sight reading, simple accompaniments, and improvisation. 2 hours per week. May not be taken for audit. Prerequisite: any music major.

MUP 132 Class Piano. (1)
spring
See MUP 131.

MUP 133 Class Voice. (1)
fall and spring
4-semester sequence (MUP 134, 233, and 234) open to all students. 2 hours per week. May not be taken for audit.

MUP 134 Class Voice. (1)
fall and spring
See MUP 133. Prerequisite: MUP 133 or instructor approval.

MUP 141 Jazz Fundamentals. (1)
fall
Principles, methods, and theory of jazz performance and pedagogy.

MUP 142 Jazz Listening Lab. (1)
spring
Focuses on the development of jazz through classic performances and recordings.

MUP 209 Beginning Choral Conducting. (1)
fall and spring
Essentials of choral conducting techniques. 2 hours per week.

MUP 210 Beginning Instrumental Conducting. (1)
spring
Essentials of instrumental conducting techniques. 2 hours per week.

MUP 217 Improvisation Workshop. (2)
fall and spring
Emphasizes basic jazz literature, chord symbol reading, melodic patterns, ear training, melodic concepts, analysis of improvised solos, and pedagogical issues. Prerequisites: MTC 125; MUP 111 (1 semester).

MUP 218 Improvisation Workshop. (2)
fall and spring
Continuation of MUP 217. Prerequisite: MUP 217.

MUP 231 Class Piano. (1)
fall
See MUP 131.

MUP 232 Class Piano. (1)
spring
See MUP 131.

MUP 233 Class Voice. (1)
fall and spring
See MUP 133. Prerequisite: MUP 134 or instructor approval.

MUP 234 Class Voice. (1)
fall and spring
See MUP 133. Prerequisite: MUP 233 or instructor approval.

MUP 235 Jazz Piano. (1)
fall
2-semester sequence (with MUP 236) designed for jazz keyboard experience. Emphasizes chord symbol reading, simple improvisation, and voicing. 2 hours per week. Prerequisite: MUP 132.

MUP 236 Jazz Piano. (1)
spring
See MUP 235. Prerequisite: MUP 132.

MUP 237 Fretboard Harmony. (1)
fall and spring
Scales, chords, harmony, basic improvisation for the guitar. 2 hours per week.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MUP 250 Diction for Singers. (1)
fall and spring
Use of phonetics in the study of song and opera literature. Language emphasis differs each semester. May be repeated for credit.

MUP 301 Advanced Class Piano. (1)
fall
Required for the choral-general concentration of the Music Education major. Open to other music majors who have completed MUP 232. Emphasizes accompaniments, ensemble playing, score reading, advanced harmonizations, repertoire, technique, and improvisation. 2 hours per week. May not be taken for audit. Prerequisites: MUP 232 (or proficiency); any music major; placement examination.

MUP 302 Advanced Class Piano. (1)
spring
Required for the choral-general concentration of the Music Education major. Open to other music majors who have completed MUP 301. A sequential continuation of MUP 301 skills that include both group and studio instruction. 2 hours per week. May not be taken for audit. Prerequisites: MUP 301 (or proficiency); any music major; placement examination.

MUP 311 Studio Instruction. (2)
fall and spring
See MUP 111. Fee.

MUP 319 Recording Studio Techniques. (2)
spring
Study of both analog and digital recording methods. Includes lab time on recording console and tape machines. Lab.

MUP 320 MIDI Workshop. (2)
fall
Presents hardware and software applications for sequencing and music printing. Lab.

MUP 321 Studio Instruction. (1)
fall, spring, summer
See MUP 121. Fee.

MUP 327 Studio Instruction. (4)
fall and spring
See MUP 127. Fee.

MUP 337 Studio Instruction: Piano Accompanying. (2)
spring
Repertoire to be selected from vocal and instrumental literature. 1 hour lesson per week. May be repeated for credit. Prerequisites: Performance major with a concentration in piano accompanying; placement examination.

MUP 339 Choral Conducting. (2)
fall and spring
Elements of choral conducting technique and interpretation. 3 hours per week. Prerequisite: MUP 209.

MUP 340 Instrumental Conducting. (2)
fall
Fundamentals of score reading and interpretation of instrumental music. 3 hours per week. Prerequisite: MUP 210.

MUP 344 Chamber Orchestra. (1)
fall and spring
Important masterpieces from all periods of music are performed throughout the year. May be repeated for credit. Prerequisite: audition with director.

MUP 345 Symphony Orchestra. (1)
fall and spring
Over a 4-year period, the student is introduced to the masterpieces of symphony orchestra literature. 3 times per week. May be repeated for credit. Prerequisite: audition with director.

MUP 346 Sinfonietta. (1)
fall and spring
Symphonic orchestra that presents approximately six concerts annually, performing masterpieces of the classical repertoire. 3 times per week. May be repeated for credit. Prerequisite: audition with director.

MUP 350 Choral Union. (1)
fall and spring
Open to all students in the university and to interested singers in the community by audition. Preparation and performance of the larger choral works. 2 hours per week. May be repeated for credit. Prerequisite: audition with director.

MUP 352 Concert Choir. (1)
fall and spring
Important masterpieces from all periods of music are performed. May be repeated for credit. Prerequisite: instructor approval.

MUP 353 University Choir. (1)
fall and spring
4 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 355 Sun Devil Singers. (1)
fall and spring
Rehearsal and performance of music for mixed voices. 3 hours per week. May be repeated for credit. Prerequisites: audition with director; instructor approval.

MUP 357 Women's Chorus. (1)
fall and spring
2 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 361 Marching and Concert Bands. (1)
fall and spring
Staging of formations and drills for football games and other events (fall); masterpieces of symphonic band literature (spring). Meets daily. May be repeated for credit. Prerequisite: audition with director.

MUP 362 Wind Ensemble. (1)
fall and spring
Rehearsal and performance of literature for wind ensemble. 2 hours per week in fall, 4 hours in spring. Performing ensemble. May be repeated for credit. Prerequisite: instructor approval.

MUP 363 Chamber Winds. (1)
fall and spring
Rehearsal and performance of advanced literature for chamber winds. 2 hours per week. Performing ensemble. May be repeated for credit. Prerequisite: instructor approval.

MUP 370 Music Theatre: Techniques. (1)
fall and spring
Exercises and improvisations for the singer/actor emphasizing body awareness, basic music theater performance skills, and freedom of the vocal and breath mechanisms. Section 1 (Movement for Singers); Section 2 (Expression); Section 3 (Interpretation); Section 4 (Advanced Expression); Section 5 (Advanced Interpretation). Sections 2 through 5 must be taken in sequence. Each section: 3 hours per week. May be repeated for credit.

MUP 371 Music Theatre: Workshops. (1)
fall and spring
Development of specific skills for musical-dramatic interpretation. Section 1 (Aria Preparation); Section 2 (Broadway I); Section 3 (Broadway II). Each section: 1 hour lecture, demonstration, 1 lab per week. May be repeated for credit.

MUP 372 Music Theatre: Orchestras. (1)
fall and spring
Participation in Lyric Opera Theatre productions. Section 1 (Orchestra); Section 2 (Chamber Orchestra); Section 3 (Chamber Ensemble). May be repeated for credit. Prerequisites: audition with director; instructor approval.

MUP 373 Music Theatre: Performance. (1)
fall and spring
Participation in Lyric Opera Theatre productions. Section 1 (Principal Roles); Section 2 (Chorus). May be repeated for credit. Prerequisites: audition with director; instructor approval.

MUP 374 Music Theatre: Production. (1)
fall and spring
Participation in Lyric Opera Theatre productions. Section 1 (Vocal Performance); Section 2 (Technical Music Theatre); Section 3 (Problems in Production) to be taken concurrently with MUP 373, Section 2. May be repeated for credit.

MUP 376 New Music Ensemble. (1)
fall and spring
Rehearsal and performance of music written in the last 20 years. May be repeated for credit. Prerequisite: instructor approval.

MUP 377 Brass Choir. (1)
fall and spring
Specializing in public performance of music written for brass instruments. 2 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 379 Chamber Music Ensembles. (1)
fall and spring
Brass, guitar, keyboard, mixed, percussion, string, vocal, and woodwinds ensembles. 2 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 382 Collegium Musicum. (1)
selected semesters
Singers and instrumentalists specializing in the performance of early and unusual music. 2 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 385 Percussion Ensemble. (1)
fall and spring
Rehearsal and performance of standard and original repertoire for the percussion ensemble and related instruments. 2 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 386 Jazz Band. (1)
fall and spring
Rehearsal and performance of new, traditional, and Latin literature for jazz bands. 4 hours per week. May be repeated for credit. Prerequisite: instructor approval.

MUP 387 Ethnomusicology Ensembles. (1)
fall and spring
Performance learning experience for the music of various cultures of the world. May be repeated for credit. Prerequisite: knowledge of instrument or instructor approval.

MUP 388 Piano Accompanying. (1)
fall and spring
Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. 2 hours per week. May be repeated for credit. Prerequisite: Performance major with a concentration in piano accompanying or instructor approval.

MUP 417 Advanced Improvisation. (2)
fall and spring
Emphasizes analysis and performance of advanced jazz literature; composition in contemporary styles. Must be taken in sequence with MUP 418. May not be taken for audit. Prerequisite: MUP 218.

MUP 418 Advanced Improvisation. (2)
fall and spring
Continuation of MUP 417. Prerequisite: MUP 417.

MUP 440 Keyboard Harmony. (1)
fall
Performance-oriented class emphasizing chord progressions, harmonization, figured bass realization, stylistic improvisation, transposition, open score reading, and sight reading. Prerequisite: Performance major with a concentration in keyboard or instructor approval.

MUP 451 Repertoire. (2)
fall and spring
Literature available for performance in all performing media. May be repeated for credit. Prerequisite: junior standing in major performance field.

MUP 453 Song Literature. (2)
once a year
Early Italian, English, German, and French art song.

MUP 454 Song Literature. (2)
once a year
American, Russian, Spanish, Scandinavian, and contemporary song.

MUP 481 Performance Pedagogy and Materials. (2)
fall and spring
Principles and methods of performance techniques for each performance field. May be repeated for credit. Prerequisite: senior standing or instructor approval.

MUP 482 Piano Pedagogy. (2)
selected semesters
Continuation of MUP 481 (Piano). Problems and techniques of teaching intermediate to advanced piano students. Prerequisites: junior standing in Performance (keyboard or piano accompanying concentration); instructor approval.

MUP 487 Piano Accompanying. (1)
fall and spring
Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. 2 hours per week. May be repeated for credit. May not be taken for audit. Prerequisite: Performance major with a concentration in keyboard or piano accompanying.

MUP 495 Performance. (0)
fall
For candidates of a B.M. degree in which 1/2 recital is a requirement. Prerequisite: B.M. degree candidate.

MUP 496 Performance. (0)
fall
For candidates of a B.M. degree in which a full recital is a requirement. Prerequisites: B.M. degree candidate; MUP 495.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MUSIC (MUS)

MUS 100 Fundamentals of Music Notation. (3)
fall and spring
Provides non-music majors with sufficient symbol literacy to begin work in the field of musical learning. Credit not applicable toward any music degree.

MUS 340 Survey of Music History. (3)
fall, spring, summer
Major composers, compositions, and periods in the history of music. Credit not applicable toward any music degree.
General Studies: HU, H

MUS 347 Jazz in America. (3)
fall, spring, summer
Current practices employed by contemporary jazz musicians; the historical development of jazz techniques. Credit not applicable toward any music degree. Lecture, discussion. Cross-listed as AFH 347. Credit is allowed for only AFH 347 or MUS 347.
General Studies: HU

MUS 354 Popular Music. (3)
fall, spring, summer
Emphasizes historical, cultural, and performance patterns in a variety of popular idioms such as, but not limited to, rock, folk, jazz, and Afro-American music. May be repeated for credit. Credit not applicable toward any music degree.
General Studies: HU

MUS 355 Survey of American Music. (3)
fall, spring, summer
Growth and development of American music. Credit not applicable toward any music degree.
General Studies: HU, H

MUS 356 Survey of the Musical Theatre. (3)
once a year
Music's place in the theatre, viewed in terms of historical importance and relative function. Credit not applicable toward any music degree.
General Studies: HU

MUS 410 History of Women in Music. (3)
fall
Surveys musical achievements of women as well as the historical contexts that shaped and defined their artistic development. Cross-listed as WST 410. Credit is allowed for only MUS 410 or WST 410. Pre- or corequisite: ENG 102 or 105.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Department of Theatre

herbergercollege.asu.edu/theatre
480/965-5337
GHALL 232

Professors: Barker, Bedard, Eckard, Giner, Knapp, Mason, Saldaña, Thomson, Wills

Associate Professors: Acker, Edwards, Holloway, Reyes, Riske, Vining

Assistant Professors: Furr-Soloman, Gharavi, Steenerson, Sterling, Underiner, Woodson

Senior Lecturer: McMahon

Lecturers: Irvine, Tongret

For advising purposes, all students registering in a Theatre degree program enroll through the Herberger College of Fine Arts. Special advising check sheets, providing complete information regarding requirements and suggested electives, are available in the Department of Theatre office for the B.A. degree program.

Freshman and sophomores who meet university and departmental standards must receive a grade of "C" or higher in all major courses and a 2.50 cumulative GPA during their first semester to continue in the B.A. Theatre program. Students failing to meet these requirements will have one semester of departmental probation to receive a "C" or higher in major courses and raise their cumulative GPA to 2.50. Students failing to meet the above requirements by the end of the first year (two semesters) are asked to seek advising regarding other majors.

THEATRE—B.A.

The major in Theatre consists of 57 or 58 semester hours. The following 33 or 34 semester hours of core courses are required of all B.A. degree candidates:

THE	125 Orientation to Theatre	1
THE	220 Principles of Dramatic Analysis *L*	3
THE	320 History of the Theatre I *HU, H*	3
THE	321 History of the Theatre II *HU, H*	3
THE	440 Theatre Forms and Contexts	3
THP	102 Acting: Fundamentals	3
THP	218 The Director's Vision	3
THP	301 Theatre Production: Running Crew	1
THP	301 Theatre Production*	1
THP	313 Fundamentals of Design	3
THP	428 Theatre and the Future	3
Total		27

* One semester hour in a different production option is required.

One of the following two courses (three or four semester hours) is required:

THP	213 Introduction to Technical Theatre	4
THP	214 Introduction to Costuming	3

Three semester hours of departmental approved course work in developing new work is also required (e.g., playwriting, solo performance, theatre for social change). Check the department advising office for a list of eligible courses.

Twenty-four semester hours of THE and THP electives are selected by the student and advisor to complete the 57 or 58 semester hours required in the major. These 24 semester hours can constitute an optional focus area for the student, which involves enrolling in related course work from one of five specialty areas in Theatre: directing and stage management; playwriting; history, theory, and criticism; film; and theatre for youth. A list of recommended courses appropriate to each area is available from the department advising office. Undergraduate students interested in pursuing Arizona teacher certification or endorsement for Theatre are encouraged to pursue the focus area in theatre for youth, then obtain postbaccalaureate teacher certification through the ASU College of Education or another Arizona educational institution. General Studies courses make up 35 semester hours of the total courses required. Additional elective courses are selected with an advisor to meet the total 120 semester hours required for the degree.

Within the major only courses with a grade of "C" or higher may be applied toward graduation.

Students who transfer 55 semester hours or more are required to enter with and retain a 2.50 GPA in theatre courses and a 2.00 cumulative GPA.

Acting Concentration

The major in Theatre with a concentration in acting prepares students for both advanced graduate study in the field and independent career pursuits in performance. In addition to required core courses, the acting concentration consists of 23 or 24 semester hours. The following six semester hours are required:

THP	272 Acting: Introduction to Movement	3
THP	277 Acting: Introduction to Voice	3

One of the following two courses (three semester hours) is also required:

THP	207 Acting: The Creative Imagination	3
THP	285 Acting: Beginning Scene Study	3

One of the following two courses (two or three semester hours) is also required towards the end of the program of study:

THP	388 Acting: Audition Techniques	3
THP	489 Acting: Career Development	2

Twelve semester hours in acting elective course work completes the concentration.

Students are strongly encouraged to apply for admission to the concentration at the end of the freshman year to allow for three academic years of supervision. Transfer students should apply for the concentration at the end of their first semester at ASU. Admission requirements include: an inter-

view with a committee of acting faculty members (conducted at the end of each semester); plus the submission of a one-page letter of intent, a résumé, and an unofficial transcript (minimum 2.50 overall GPA and a minimum 3.00 Theatre GPA required). Retention in the concentration is based on satisfactory artistic work and growth, production participation, evidence of a strong work ethic, and maintenance of a minimum 2.50 overall GPA and a 3.00 Theatre GPA.

Scenography Concentration

The major in Theatre with a concentration in scenography prepares students for advanced graduate study in the field and entry-level careers in performance design and technology. In addition to core course requirements, the concentration in scenography consists of 24 or 25 semester hours. The following 12 semester hours are required:

THP	340 Scene Design	3
THP	345 Lighting Design	3
THP	430 Costume Design	3
THP	442 Drawing	3

One of the following two courses (three or four semester hours), not taken as part of the core, is also required:

THP	213 Introduction to Technical Theatre	4
THP	214 Introduction to Costuming	3

Nine semester hours in theatre design or theatre technology elective course work completes the concentration.

Admission into the concentration is suggested at the end of the freshman year to allow three years of academic supervision. Transfer students should apply for the concentration during their first semester at ASU. Admission requirements include an interview with scenography faculty (conducted at the end of each semester) and submission of a letter of intent, a portfolio, and an unofficial transcript (a minimum GPA of 2.50 is required). A résumé is optional. Scenography faculty will meet monthly with students as a group to monitor personal progress, to assess portfolio development, and to develop a cadre. Retention in the program is based on satisfactory artistic growth, production participation, and maintenance of a 2.50 GPA.

GRADUATION REQUIREMENTS

In addition to fulfilling the major requirements, students must meet all university graduation requirements. See "University Graduation Requirements," page 81.

MINOR

The department offers a minor in Theatre consisting of 23 semester hours of course work. The following courses are required:

THE	100 Introduction to Theatre *HU*	3
THE	300 Film: The Creative Process I *HU*	3
THE	320 History of the Theatre I *HU, H*	3
THP	101 Acting: An Introduction	3
THP	213 Introduction to Technical Theatre	4
THP	301 Theatre Production	1
	Concentration area*	6
	Total	23

* Also required are two three-hour courses in the same area of concentration. Contact the department for options and course requirements.

Courses ordinarily limited to majors only are available to minors on a second-priority basis; that is, minors may not preregister for these courses, but are allowed to register after all majors' needs have been met. All prerequisites for the minor courses must be met (see course listings). Transfer students may transfer up to nine semester hours toward their minor.

B.I.S. CONCENTRATION

A concentration in theatre is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAMS

The faculty in the Department of Theatre offer programs leading to the M.A. degree in Theatre; the Master of Fine Arts degree in Theatre with concentrations in performance, scenography, and theatre for youth; the Ph.D. degree in Theatre with a concentration in theatre for youth; and, in conjunction with the Department of English, an interdisciplinary Master of Fine Arts degree in Creative Writing (playwriting). See the *Graduate Catalog* for details.

THEATRE (THE)

THE 100 Introduction to Theatre. (3)
fall, spring, summer
Surveys theatre production from the Greeks to contemporary theatre. Taught in conjunction with distance learning. Lecture, discussion, guest artists. Prerequisite: nonmajor.
General Studies: HU

THE 125 Orientation to Theatre. (1)
fall
Orientation to university and department resources and procedures. Career planning and guidance. Attendance and written responses to theatre productions. Required for B.A. Theatre majors. Prerequisite: Theatre major.

THE 220 Principles of Dramatic Analysis. (3)
fall and spring
Analysis, evaluation, and interpretation of dramatic literature for theatrical production. Emphasizes the traditional canon of dramatic literature and traditional structures and forms of drama. Prerequisites: ENG 101 (or 105); Theatre major.
General Studies: L

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

THE 300 Film: The Creative Process I. (3)
fall, spring, summer
Elements of theatrical film: cinematography, sound, editing, directing, acting, scriptwriting, producing, and criticism. 3 hours lecture, demonstration via film and videotape.
General Studies: HU

THE 301 Film: The Creative Process II. (3)
fall and spring
Advanced study of selected films, analyzing cinematography, sound, editing, directing, acting, screenwriting, producing, and criticism. Prerequisite: THE 300.
General Studies: HU

THE 320 History of the Theatre I. (3)
fall
Traces major developments in theatre production and dramatic literature from their beginnings to the mid-17th century. Lecture, student presentations.
General Studies: HU, H

THE 321 History of the Theatre II. (3)
spring
Traces major developments in theatre production and dramatic literature from the mid-17th century to the 20th century. Lecture, student presentations.
General Studies: HU, H

THE 325 Play Reading for Educational Theatre. (1)
fall and spring
Assigned independent readings in plays for secondary school play production. Prerequisite: theatre education concentration or written instructor approval.

THE 400 Focus on Film. (3)
fall, spring, summer
Specialized study of prominent film artists, techniques, and genres. Emphasizes the creative process. May be repeated for credit. Topics may include the following:
- Film Production Part I
  Fee.
- Film Production Part II
  Fee.

Prerequisite: ENG 101 or 105.

THE 402 Gender Identity in Film. (3)
selected semesters
Examines the representation of gender in Hollywood cinema with particular focus on films from 1970 to the present. Prerequisite: THE 300.

THE 403 Independent Film. (3)
once a year
Examines independent films and filmmakers in the United States, 1968 to the present.
General Studies: HU

THE 404 Foreign Films and Filmmakers. (3)
once a year
Films and filmmakers from Europe, Asia, Australia, Far East, South America, and Caribbean. Emphasizes cultural content and filmmaking philosophies.
General Studies: G

THE 405 Film: Great Performers and Directors. (3)
fall, spring, summer
Examines processes and influences of one or more great film performers and/or directors. May be repeated for credit. Prerequisite: THE 300.
General Studies: HU

THE 406 American Multicultural Film. (3)
fall and spring
Examines Native, African, Asian, and Latina and Latino American films and film artists in cinema history and production. Internet course. Prerequisite: ENG 102 or 105.
General Studies: HU, C

THE 421 History of the English Theatre. (3)
selected semesters
History of the artists, events, and plays in the development of English theatre from medieval times to the present. Lecture, group and independent work. Prerequisite: THE 100 or 220.
General Studies: L/HU

THE 422 Latina and Latino Theatre. (3)
selected semesters
Readings, discussion, video of dramatic literature and production styles of Latina and Latino playwrights and theatre companies in the United States. Prerequisites: both ENG 101 and 102 or only ENG 105.

THE 423 African American Theatre. (3)
fall and spring
Readings, discussion, video of the history and dramatic literature of African American playwrights and theatre companies in the United States. Prerequisite: ENG 102 or 105.
General Studies: C

THE 424 Trends in Theatre for Youth. (3)
selected semesters
Surveys the history, literature, and contemporary practices in theatre for youth.

THE 426 Theatre of the Americas. (3)
fall and spring
Selected studies in pre-Columbian theatre forms and texts of the Aztecs, Mayans, Caribbean islands, and North American Indians. Internet course. Prerequisite: ENG 102.

THE 430 History of Costume: Western Tradition. (3)
selected semesters
Studies major costume styles throughout history of Western civilization and how these fashions reflected society. Explores how styles can be used by theatrical costumers.

THE 440 Theatre Forms and Contexts. (3)
fall and spring
Explores 20th-century modernist theatrical forms and movements and development of alternative strategies for analyzing contemporary theatre and performance. Prerequisites: THE 220, 320, 321; Theatre major.

THE 480 Methods of Teaching Theatre. (4)
spring
Applies materials, techniques, and theories for theatre with 9th- through 12th-grade students. Emphasizes curriculum development and praxis. Prerequisite: theatre education concentration or written instructor approval.

THE 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Performance Technology I
  Fee.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

THEATRE PERFORMANCE AND PRODUCTION (THP)

THP 101 Acting: An Introduction. (3)
fall, spring, summer
Introduces basic principles of acting. Topics include terminology, scene and character analysis, exercises and improvisation, audition preparation. Studio. Prerequisite: nonmajor.

THP 102 Acting: Fundamentals. (3)
fall and spring
Explores and applies basic principles of acting. Topics include terminology, scene and character analysis, exercises and improvisation, audition preparation. Studio. Prerequisite: Theatre major.

THP 113 Techniques of Theatrical Makeup. (3)
selected semesters
Techniques of theatrical makeup: age, corrective, masks, and special effects. 1 hour lecture, 2 hours lab. Fee.

THP 207 Acting: The Creative Imagination. (3)
fall
Develops the actor as an artist, introducing the use of the creative imagination through sensory experience as led by Stanislavski. Studio. Prerequisites: Theatre major; interview. Prerequisite with a grade of "B" or higher: THP 101 or 102. Pre- or corequisite: THE 220.

THP 208 Acting: The Reality of Doing. (3)
spring
Continuation of the inner process, applying the techniques of Meisner to discover the creativity in the spontaneous experience. Prerequisite: written instructor approval. Prerequisite with a grade of "B" or higher: THP 207.

THP 213 Introduction to Technical Theatre. (4)
fall and spring
Procedures of technical theatre production and demonstration. Topics include design and construction of scenery, lighting, and properties. 2 hours lecture, 3 hours lab. Fee. Prerequisite: Theatre major or minor.

THP 214 Introduction to Costuming. (3)
fall and spring
Basic principles of costume design, construction, and survey of selected historical periods, including makeup styles. Costume design project and production experience. 3 hours lecture, 2 hours lab. Fee. Pre- or corequisites: THE 220; Theatre major.

THP 218 The Director's Vision. (3)
fall and spring
History, theory, and principles of directing. Examines director's role and responsibilities, play selection, conceptualizing, ground plans, blocking. Prerequisites: THE 220; THP 102.

THP 260 Introduction to Playwriting. (3)
selected semesters
Basic skills of playwriting, including exercises in monologues, scenes, and conflict and resolution, leading to completion of a one-act play. Prerequisite: ENG 101 or 105 or 107.

THP 261 Introduction to Screenwriting. (3)
once a year
Basic skills of screenwriting, including exercises in conflict and resolution, plot points, and theories of three-act structure and design. Prerequisite: ENG 101 or 105 or 107.

THP 272 Acting: Introduction to Movement. (3)
fall and spring
Movement vocabulary and physical training in relaxation, alignment, conditioning, and stage presence. Application to performance. Studio. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval. Pre- or corequisite: THP 102.

THP 277 Acting: Introduction to Voice. (3)
fall and spring
Exercises and techniques to free the voice and improve quality and projection. Application to performance. Studio. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval.

THP 285 Acting: Beginning Scene Study. (3)
fall and spring
Rehearsal techniques and application of action to dramatic text. Emphasizes realistic drama. Studio. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval. Pre- or corequisite: THE 220.

THP 301 Theatre Production. (1–4)
fall, spring, summer
Participation in university mainstage theatre productions (acting, running crew, etc.). May be repeated for credit. Prerequisites: application; written instructor approval.

THP 307 Acting: Research and Performance. (1–3)
once a year
Acting in theatre projects, productions, or collaborative performances in directing classes. May be repeated for credit. Studio. Prerequisite: written instructor approval.

THP 311 Improvisation with Youth. (3)
fall, spring, summer
Basic materials, techniques, and theories for facilitating improvisational drama with children and youth. Not open to freshmen.

THP 312 Puppetry and Children. (3)
fall, spring, summer
Construction and manipulation of puppets; practice in performance skills. Emphasizes educational and recreational uses of puppetry by and with children. Fee. Prerequisite: junior standing or above.

THP 313 Fundamentals of Design. (3)
fall and spring
Art and practice of scenic, costume, and lighting design for the theatre and the media. Prerequisite: THP 213 or 214.

THP 317 Stage Management. (3)
fall and spring
Readings in stage management and participation as a stage manager in a university theatre production. Prerequisite: written instructor approval. Prerequisite with a grade of "C" or higher: THE 220.

THP 318 Directing for the Stage. (3)
fall and spring
Director's approach to text analysis and articulation of ideas. Basic tools, rehearsal schedules, staging, rehearsal and audition techniques, scene work. Prerequisites: THP 213, 218; instructor approval.

THP 320 Acting: Solo and Collaborative Performance. (3)
once a year
Creation and development of original performance art works combining text, movement, multimedia, visual art; the actor as writer, designer, performer. Studio. Prerequisite: written instructor approval.

THP 331 Costume Construction. (3)
selected semesters
Uses of materials and techniques for stage costumes with actual construction of period apparel. Prerequisite: THP 214 or instructor approval.

THP 340 Scene Design. (3)
once a year
Studio projects in designing realistic scenery for the contemporary proscenium stage. Fee. Prerequisite: THP 213 or written instructor approval. Prerequisite with a grade of "C" or higher: THE 220.

THP 345 Lighting Design. (3)
once a year
Principles and theory of stage lighting design, including design process and execution, equipment, and light plots. Lecture, lab. Fee. Prerequisite: THP 213 or written instructor approval. Prerequisite with a grade of "C" or higher: THE 220.

THP 350 Sound Design. (3)
once a year
Introduces the equipment, process, and recording techniques used in sound design for the theatre. Lecture, studio. Fee. Prerequisite with a grade of "C" or higher: THE 220.

THP 360 Intermediate Playwriting. (3)
once a year
Continued development of skills in playwriting through specific exercises and completion of a full-length play. Prerequisite: ENG 210 Introduction to Creative Writing (drama) or THP 260.

THP 372 Acting: Advanced Movement. (3)
once a year
Movement techniques for the classical and nonrealistic theatre. Studio. Prerequisite: THP 272 or written instructor approval.

THP 377 Acting: Voice and Speech. (3)
once a year
Introduces phonetic alphabet, exercises, and techniques for voice and speech improvement. Application to performance. Studio. Prerequisite: THP 277.

THP 378 Acting: Stage Dialects. (3)
fall
Major dialects needed for actors; techniques for researching and learning dialects; phonetic analysis of dialects. Studio. Prerequisite: THP 377 or written instructor approval.

THP 385 Acting: Classical Scene Study. (3)
once a year
Rehearsal and performance of Shakespeare and other classical playwrights. Emphasizes understanding poetic language, vocal and physical skills. Studio. Prerequisites: THP 377; written instructor approval.

THP 386 Acting: The Meisner Approach. (3)
fall and spring
Improvisations and exercises developed by Sanford Meisner applied to scene work. Studio. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval.

THP 387 Acting: TV and Film. (3)
fall and spring
Professional television and film acting techniques, terminology, and on-camera experience. Studio. Fee. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval.

THP 388 Acting: Audition Techniques. (3)
once a year
Techniques and preparation for stage, commercial, and TV/film auditions utilizing monologues, cold readings, and personal style. Studio. Prerequisite with a grade of "B" or higher: THP 101 or 102 or written instructor approval.

THP 394 Special Topics. (1–4)
fall and spring

THP 401 Theatre Practicum. (1–3)
fall and spring
Production assignments for advanced students of technical production, stage and business management, and design. May be repeated for credit. Prerequisites: THP 301; written instructor approval.

THP 406 Advanced Scenography. (3)
selected semesters
Process of production collaboration among scenographers, directors, and playwrights. Taught in conjunction with THP 519. Prerequisites: a combination of THP 214 and 340 and 345 or both THP 313 and 340.

THP 411 Methods of Teaching Drama. (3)
fall
Applies materials, techniques, and theories with grades K–8 youth. Regular participation with children. Prerequisite: THP 311 or written instructor approval.

THP 418 Directing the Actor. (3)
once a year
Practical applications of directing for the stage. Rehearsal and presentation of scenes and short plays. Prerequisites: THP 318; instructor approval.

THP 428 Theatre and the Future. (3)
fall and spring
Capstone course exploring visions of the future of theatre. Results in a project in creative or scholarly form. Prerequisites: THE 440; senior standing; Theatre major.

THP 430 Costume Design. (3)
selected semesters
Principles of costume design with projects in both modern and period styles. Includes budgets and fabric/pattern estimates. Lecture, studio. Prerequisite: THP 214.

THP 431 Advanced Costume Construction. (3)
selected semesters
Specialized training in costume construction problems and crafts with projects in tailoring, millinery, and period accessories. Prerequisites: both THP 214 and 331 or only instructor approval.

THP 435 Advanced Technical Theatre. (3)
selected semesters
Selection of materials, drafting of working drawings, tool operation, and construction techniques. 2 hours lecture, 2 hours lab. Prerequisites: both THP 340 and 345 or only written instructor approval.

THP 440 Advanced Scene Design. (3)
selected semesters
Advanced studio projects in designing scenery for a variety of stage forms. Fee. Prerequisite: THP 340 or written instructor approval.

THP 441 Scene Painting. (3)
selected semesters
Studio projects in painting stage scenery. Fee. Prerequisite: THP 340 or written instructor approval.

THP 442 Drawing. (3)
selected semesters
Techniques in drawing and rendering for scenic, costume, and lighting design. Prerequisite: written instructor approval.

THP 444 Drafting for the Stage. (3)
selected semesters
Fundamentals of and practice in graphic techniques for the stage. Introduces computer-aided design for the stage. 2 hours lecture, 3 hours studio. Fee. Prerequisites: THP 213; written instructor approval.

THP 445 Advanced Lighting Design. (3)
selected semesters
Specialized techniques in stage lighting. Advanced application of design process, graphic techniques of design presentation, and use of qualities of light. Lecture, class workshops. Fee. Prerequisite: THP 345 or written instructor approval.

THP 450 Theatre Organization and Management. (3)
once a year
Overview of nonprofit arts: organizational design, strategic planning, financial management, and leadership. Prerequisite: THE 220.

THP 460 Playwright's Workshop. (3)
fall and spring
Practice and study of creating characters, dialogue, scenes, plays, and monologues for the stage. May be repeated for credit. Studio, lecture. Prerequisite: written instructor approval.

THP 461 Scripts in Progress. (3)
fall and spring
Studio work with the instructor, centered on revisions of original plays. May be repeated for credit. Studio. Prerequisite: THP 460 or written instructor approval.

THP 481 Secondary School Play Production. (3)
fall
Methods of directing, designing, and coordinating play production experiences at the secondary school level. Off-campus practicum. Prerequisites: both THP 318 and theatre education concentration or only instructor approval.

THP 482 Theatre for Social Change. (3)
fall and spring
Interactive theatre techniques (e.g., Boal, drama therapy, playback theatre) to examine and combat institutional, social, cultural, interpersonal, and personal oppressions. Lecture, lab.
General Studies: C

THP 483 Acting: Viewpoints and Composition. (3)
spring
Training in Anne Bogart's viewpoints and composition techniques; application to rehearsal and performance, and creating new work. Studio. Prerequisite: THP 207 or 285 or written instructor approval.

THP 484 Internship. (1–4)
selected semesters

THP 489 Acting: Career Development. (2)
selected semesters
Familiarization with the business of acting: self-promotional tools and techniques, marketing strategies, finances, interview skills, and actor unions. Studio. Prerequisites with a grade of "B" or higher: both THP 101 (or 102) and junior (or senior) standing or only written instructor approval.

THP 494 Special Topics. (1–4)
once a year
Topics may include the following:
- Advanced Screenwriting
- Performance and Technology
- Problems in Directing
- Storytelling
- Student Production Board
- Theory and Practice of Performance

THP 498 Pro-Seminar. (1–7)
once a year
Topics may include the following:
- Directing. (1–6)
- Theatre-for-Youth Tour. (1–6)
- Theatre in Education. (1–6)

Prerequisite: written instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

College of Law

www.law.asu.edu **Patricia D. White, J.D., Dean**

Purpose **301**
Organization **301**
Admission **302**
Accreditation **303**
More Information **303**
Juris Doctor Degree **303**

PURPOSE

The prime function of the College of Law is to train men and women for the practicing legal profession and related professional assignments. In addition, the college has the responsibility to contribute to the quality of justice administered in our society.

ORGANIZATION

Law Building and Law Library

The John S. Armstrong Law Building is located near other colleges on the university's main campus. The Law Building provides every modern facility for legal education and has been described by experts involved in the planning of law buildings as setting a new standard in functional design.

The award-winning John J. Ross–William C. Blakley Law Library, named in memory of two prominent Phoenix attorneys, is one of the finest law libraries in the Southwest. The library houses a collection of more than 351,000 volumes and microform volume equivalents. The collection includes a broad selection of Anglo-American case reports and statutes as well as legal treatises, periodicals, encyclopedias, digests, citators, and administrative materials. The collection also includes a growing selection of special materials dealing with international law, Indian law, Mexican law, and law and technology.

The library, housed in a dramatic and functional building that opened in August 1993, is also a selective U.S. government depository. The building provides accessible shelving for the expanding collections and comfortable study space at carrels, tables, and lounge seating located throughout the library. Additionally, the law library has a 30-station computer lab as well as LEXIS and WESTLAW rooms which contain 10 stations each; 27 meeting and study rooms; a microforms facility; and a classroom.

Students also have ready access to the other campus libraries, including the Charles Trumbull Hayden Library, the Daniel E. Noble Science and Engineering Library, the Architecture and Environmental Design Library, and the Music Library. The collections maintained in all university libraries comprise more than 3 million volumes.

Special Programs

Center for the Study of Law, Science, and Technology. The ASU Center for the Study of Law, Science, and Technology is a multidisciplinary research center founded by the Arizona Board of Regents in 1984. The center publishes research studies, sponsors seminars and symposia, and houses visiting scholars and teachers. Through these programs, the center seeks to contribute to

1. the formulation and improvement of law and public policy affecting science and technology; and
2. the wise application of science and technology in the legal system.

The College of Law offers a substantial number of courses in the law, science, and technology area including bioethics, law and psychiatry, environmental law, health care law, intellectual property, land use regulation, law and evolutionary biology, law and medicine, law and social science, mass communication, natural resources law, patent law, regulatory problems in law, science and technology, and water law. Each semester, the center publishes a student guide to other less obvious courses that contain science and technology issues. In recent semesters this guide has listed courses in AIDS and the law, commercial law, employment law, law and the handicapped, antitrust, statistical proof in employment discrimination litigation, and several courses offered by other departments on campus available for registration by law students. In addition to regular course offerings, students can arrange independent studies with supervising faculty on topics of special interest to them. The center also invites guest speakers from legal or scientific fields to visit with interested law students, generally during the noon hour.

In cooperation with the American Bar Association Section on Science and Technology and under the leadership of a faculty editor, second- and third-year students edit *Jurimetrics: The Journal of Law, Science and Technology.* Student editors both edit submitted works and write original articles for publication in the journal.

Clinical Programs. The College of Law's Clinical Program is a rigorous in-house program that provides third-year students, under the close supervision of an ASU faculty member, the opportunity to represent clients in court. Four live-client clinics, the Civil Practice Clinic, the Criminal Practice Clinic, the Public Defender Clinic, and the Mediation Clinic, provide students with an opportunity to choose from civil or criminal representation or to serve as mediators in disputes that are resolved outside the court system.

The Civil Practice Clinic operates as a functioning law firm within the college, while Criminal Practice and Public Defender Clinic students work in offices located within agencies or courthouses. Second-year students are offered "simulation-based" courses in Lawyering Theory and Practice in preparation for enrollment in a live-client clinic. Other simulation courses include Trial Advocacy, Pre-Trial Practice, and Negotiation.

Indian Legal Program. The College of Law offers an Indian Legal Program intended to serve tribal courts and governments by providing information on legal issues. The program also provides education and generates scholarship on Indian law. Through a Certificate in Indian Law, the college provides its students with a quality legal education and an opportunity to gain specific knowledge and expertise in Indian law.

Students at the College of Law have the opportunity to participate in all phases of the Indian Legal Program and gain an in-depth understanding of the legal issues affecting Indian tribes and people. Courses on Federal Indian law and seminars on advanced Indian law topics such as tribal law, economic development, American Indian cultural resources protection, and tribal environmental law are part of the curriculum. Students also have the opportunity to participate in internships with local tribal courts, the Native American Rights Fund, the U.S. Department of the Interior, or the Senate Committee on Indian Affairs in Washington, D.C. This variety of academic and work experience provides the students with an outstanding legal education and a firm grounding in both the theoretical and practical aspects of Indian law.

ASU Main features more than 300 diverse species and varieties of trees and plants. Tim Trumble photo

ADMISSION

First-year students are admitted only for the fall semester. The formal requirements for admission to the College of Law are (1) an undergraduate degree from an accredited four-year college or university and (2) a score on the Law School Admission Test (LSAT), administered by Law Services, Box 2000, Newtown, Pennsylvania 18940, in centers throughout the country.

For more information regarding admission, call 480/965-1474 or write

ADMISSIONS OFFICE
COLLEGE OF LAW
ARIZONA STATE UNIVERSITY
PO BOX 877906
TEMPE AZ 85287-7906

Retention Standards

To be eligible to continue in the College of Law, students must maintain a cumulative weighted GPA of 70 or higher at the end of each semester or summer session. Any student who fails to achieve a 70 GPA in any one semester, regardless of the cumulative GPA, is automatically placed on probation. Continuation of enrollment by probationary students is upon such terms and conditions as the college may impose.

A student whose cumulative GPA falls below the required level or whose semester GPA is less than 70 in two consecutive semesters is dismissed but may apply to the Office of the Dean for readmission. The Office of the Dean refers the application to a faculty Committee on Readmission. Cases in which the GPA deficiency is slight and evidence of extenuating circumstances is convincing, readmission may be granted on a probationary status after a review of the reasons contributing to unsatisfactory performance and a finding that there is substantial prospect for acceptable academic performance. Continuation in school thereafter may be conditioned on achieving a level of performance higher than the overall 70 GPA. Further detailed information concerning the college's retention standards can be found in the *Bulletin of the College of Law*.

Honor Code. The legal profession, a self-regulating association, depends on the integrity, honor, and personal morality of each member. Similarly, the integrity and value of an ASU College of Law degree depends on a reputation for fair competition. The college's *Honor Code* is intended as a measure to preserve the integrity of the school's diploma and to create an arena in which students can compete fairly and confidently. Copies of the *Honor Code* are available from the assistant dean in the college's Student Services Office.

ACCREDITATION

The college is fully accredited by the American Bar Association and is a member of the Association of American Law Schools.

JURIS DOCTOR DEGREE

The College of Law offers a three-year program of professional studies at the graduate level leading to the degree of Juris Doctor.

For more information on the degree and courses, see the *Graduate Catalog.*

Course of Study

The program of study in the College of Law is designed for full-time students. In the first year of the three-year program, the course of study is prescribed and incorporates the time-proven techniques of legal education. This first year gives students—by the "case method," by the "problem method," by "moot court," and through other techniques—an intensive exposure to the basic legal processes.

As a part of the program, first-year students are assigned to small sections. In the Legal Research and Writing program, first-year students prepare legal briefs and memoranda and receive feedback through the use of practice examinations. The program focuses on the development of writing and organizational skills necessary for success in law school and in the practice of law. The second and third years cover a wide range of courses varying in format as well as subject matter, allowing students to pursue both the basic subjects of law study and more specialized interests. By offering great freedom in the selection of subjects, the educational experience of the second and third years is in sharp contrast to the curriculum of the first year. In addition, the college offers a number of faculty-supervised clinical education programs and a program of supervised externships.

MORE INFORMATION

Further detailed information concerning the course of study, admission practices, expenses, and financial assistance can be found in the *Bulletin of the College of Law.* To request the bulletin or application forms, call 480/965-7207 or write

ADMISSIONS OFFICE
COLLEGE OF LAW
ARIZONA STATE UNIVERSITY
PO BOX 877906
TEMPE AZ 85287-7906

For general information about the College of Law, call 480/965-1474 or access the college's Web site at www.law.asu.edu.

Law

law.asu.edu
480/965-6181
LAW 201

Patricia D. White, Dean

Regents' Professors: Kaye, Murphy

Professors: Bartels, Bender, Berch, Brennan, Calleros, Clinton, Ellman, Feller, Furnish, Gorman, Grey, Guerin, Herrera, Jones, Kader, Karjala, Lowenthal, Lynk, Matheson, O'Grady, Rose, Saks, Schatzki, Schroeder, Stanton, Strouse, Tsosie, Weinstein, White, Winer, Woodley

Associate Professors: Marchant, Sylvester

Senior Clinical Professional: Dauber

Clinical Professional: Dallyn

Directors

Center for the Study of Law, Science, and Technology: Marchant

Clinical Programs: O'Grady

Indian Legal Program: Tsosie

Legal Research and Writing and Academic Support: Stinson

LAW (LAW)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

College of Liberal Arts and Sciences

www.asu.edu/clas

David A. Young, Ph.D., Dean

Department of Aerospace Studies 320
African American Studies Program 322
Department of Anthropology 325
Biology 331
Department of Chemistry and Biochemistry 336
Department of Chicana and Chicano Studies 342
Economics 344
Department of English 346
Department of Family and Human Development 352
Department of Geography 354
Department of Geological Sciences 360
Department of History 363
Interdisciplinary Humanities Program 370
Department of Kinesiology 372
Department of Languages and Literatures 376
Department of Mathematics and Statistics 393
Microbiology 401
Department of Military Science 404
Molecular and Cellular Biology 406
Molecular Biosciences and Biotechnology ...407
Department of Philosophy 408
Department of Physics and Astronomy 411
Plant Biology 417
Department of Political Science 421
Department of Psychology 428
Department of Religious Studies 432
Department of Sociology 435
Department of Speech and Hearing Science ..438
Women's Studies Program 440

PURPOSE

Like all major research universities, Arizona State University provides the means for 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 (CLAS). 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.

As a consequence of the wide range of subjects CLAS offers in the humanities, the natural sciences and mathematics, and the social and behavioral sciences, instruction is provided 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 CLAS for basic foundation courses. CLAS also offers the majority of courses meeting the General Studies requirement.

CLAS initiated and continues to participate actively with the Barrett Honors College. It also offers advising to undergraduates who are working out their undergraduate programs or are planning for graduate studies.

Most of the university faculty's engagement in the discovery and creation of knowledge and its dissemination occurs in CLAS. As an integral part of this activity, CLAS offers a wide range of graduate training programs leading to a master's or doctoral degree. For graduate degree application information, see the *Graduate Catalog* and contact either the Graduate College or the academic unit in which the degree of interest would be earned, the latter in order to receive detailed information on particular degree requirements.

ORGANIZATION

CLAS consists of a School of Life Sciences (beginning in July 2003), 20 academic departments, several interdisciplinary programs, seven centers, and several research institutes and laboratories. The college offers 36 programs leading to a bachelor's degree, 31 programs leading to a master's degree, 21 programs leading to a doctoral degree, and interdisciplinary graduate programs in cooperation with other colleges. Undergraduate customized interdisciplinary degrees are also available in the college.

For more information, access the college's Web site at www.asu.edu/clas.

ADMISSION

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

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 could result in added time and cost in the completion of requirements.

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 CLAS and to follow a program of study in the major may transfer into the college. (Students wishing to transfer into the major of Economics must have an ASU cumulative GPA of at least 2.50.) The student transfers by applying and being initially advised in the Office for Academic Programs in SS 111. Students admitted from other ASU colleges are under mandatory advising during the first semester and must take courses leading directly to a degree in CLAS. 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 under "Transfer Credit," page 62. All students who meet the university standards are admissible to CLAS, but students desiring to major in Economics must have transfer GPAs of at least 2.50. Transfer students are urged to contact the relevant academic department or the Office for Academic Programs in SS 111, to ensure a smooth transition to CLAS. 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 performed 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 45 semester hours of work taken at the university must be upper-division credit (see "Community Colleges," page 63).

ADVISING

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* each semester for information regarding enrollment, adding/dropping classes, and withdrawals.

In addition to information provided by an advisor, students must read the requirements for university General Studies, college graduation, and major degree requirements in this edition of the ASU *General Catalog*. See "General Studies," page 85, "University Graduation Requirements," page 81, "CLAS Graduation Requirements," page 309, and the section of the department offering the major. The ASU *General Catalog* is the governing source for all degree requirements.

Regular Advising. All students are strongly urged to seek advising in the appropriate college unit before registration.

Advising Locations. CLAS students should seek routine advising at the locations shown in the "Advising Locations" table, on this page.

The Office for Academic Programs, 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.

Advising Locations

Student	Location
Declared majors	Department of major
No preference, prelaw	SS 111 (480/965-6506)
No preference, premedical	Pre-Health Professions, LSC 206C (480/965-2365)

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

1. students in their first semester at ASU;
2. students on probation;
3. students with a cumulative GPA of less than 2.00;
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 and winter sessions only and must be advised in the Office for Academic Programs in SS 111).

Students in the above mandatory advising categories should consult an advisor in the appropriate advising location listed in the previous section. Students with admission deficiencies are carefully monitored to ensure that they take courses that eliminate their deficiencies. Students are encouraged to check their mandatory advising status each semester before attempting registration transactions.

Advising for Preprofessional Programs. Special advising is available for students planning to enter the fields listed in the "Advising for Preprofessional Programs" table, page 306. The professional programs shown in the table are not majors in themselves; that is, there are no majors called "premedical," "prelaw," etc. In each program, the student must eventually select an established major in CLAS or in one of the other colleges.

Pre-Health Professions. Students pursuing professional schools in the health professions must choose a major offered by ASU. However, certain specific courses must be taken to prepare the student to take the MCAT or other

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Advising for Preprofessional Programs

Professional Field	Office Where Advisor Is Located
Dentistry[1,2]	Pre-Health Professions, LSC 206C
Foreign service	Department of chosen major
Health physics	Pre-Health Professions, LSC 206C
Law	Office for Academic Programs, SS 111
Medicine[1]	Pre-Health Professions, LSC 206C
Ministry	Department of Religious Studies, ECA 377
Occupational therapy[1]	Pre-Health Professions, LSC 206C
Optometry[1,2]	Pre-Health Professions, LSC 206C
Osteopathy[1]	Pre-Health Professions, LSC 206C
Pharmacy[1]	Pre-Health Professions, LSC 206C
Physical therapy[1]	Pre-Health Professions, LSC 206C
Podiatry[1,2]	Pre-Health Professions, LSC 206C

[1] Students preparing for a career in these areas should register in the Pre-Health Professions office, 480/965-2365.

[2] No school in Arizona offers a program in dentistry, optometry, 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.

entrance examinations and to succeed in postbaccalaureate training. Therefore, students who plan to pursue a health profession should meet regularly with the Pre-Health Professions office for guidance. While this guidance does not replace the need to meet with an advisor in the department of the student's major, pre-health advising is a necessary supplement. To schedule a meeting with Pre-Health Professions, located in LSC 206, call 480/965-2365.

Prelaw. The American Bar Association does not recommend any specific major for students who wish to apply to law school upon graduation. ASU does not have a "prelaw" degree program. Therefore, students should select a major that interests them. Recent surveys of law school graduates indicate that students would be well advised to take one or two semesters of accounting as a supplement to their major curriculum. In addition, the American Bar Association recommends a variety of courses in the classics, in economics, and in mathematical reasoning. Courses that engage the student in intense critical analysis and a substantial amount of writing are also recommended. As the student approaches the second semester of his or her junior year, the student should contact the prelaw advisor in the college or department of his or her major to obtain information regarding the procedure to apply to law school.

DEGREES

Majors. Programs leading to the B.A. and B.S. degrees are offered by CLAS, with majors in the subjects listed in the "College of Liberal Arts and Sciences Baccalaureate Degrees and Majors" table, page 307. Each major is administered by the academic department indicated.

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 at least 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 at ASU Main.

University policies prohibit the "double-counting" of courses from the major for 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 Office for Academic Programs in SS 111.

Refer to the CLAS portion of the "ASU Minors" table, page 111.

ASU EXTENDED CAMPUS

The College of Extended Education was created in 1990 to extend the resources of ASU throughout Maricopa County, the state, and beyond. The College of Extended Education is a university-wide college that oversees the ASU Extended Campus and forms partnerships with other ASU colleges, including the College of Liberal Arts and Sciences, to meet the instructional and informational needs of a diverse community.

The ASU Extended Campus goes beyond the boundaries of the university's three physical campuses to provide access to quality academic credit and degree programs for working adults through flexible schedules; a vast network of off-campus sites; classes scheduled days, evenings, and weekends; and innovative delivery technologies including television, the Internet, and Independent Learning. The Extended Campus also offers a variety of professional continuing education and community outreach programs.

For more information, see "ASU Extended Campus," page 671, or access the Web site at www.asu.edu/xed.

UNIVERSITY GRADUATION REQUIREMENTS

In addition to fulfilling college and major requirements, students must meet all university graduation requirements. For complete information, see "University Graduation Requirements," page 81.

General Studies Requirement

All students enrolled in a baccalaureate degree program must satisfy a university requirement of a minimum of 35 hours of approved course work in General Studies, as described in "General Studies," page 85. Note that all three General Studies awareness areas are required. Consult an advisor for an approved list of courses.

General Studies courses are listed in the "General Studies Courses" table, page 88, in the course descriptions, in the *Schedule of Classes*, and in the *Summer Sessions Bulletin.*

COLLEGE DEGREE REQUIREMENTS

CLAS degree requirements are more extensive than the General Studies requirement. Additional course work in the humanities, natural sciences and mathematics, and social and behavioral sciences is required. Students are encouraged to consult with an academic advisor in planning a program to ensure that they meet all necessary requirements.

College of Liberal Arts and Sciences Baccalaureate Degrees and Majors

Major	Degree	Concentration	Administered By
African American Studies	B.A.	Humanities/arts, politics and society, social and behavioral sciences	African American Studies Program
Anthropology	B.A.	—	Department of Anthropology
Asian Languages (Chinese/Japanese)	B.A.	—	Department of Languages and Literatures
Biochemistry	B.S.	—	Department of Chemistry and Biochemistry
Biology	B.S.	Biology and society	School of Life Sciences
Chemistry	B.A., B.S.	—	Department of Chemistry and Biochemistry
Chicana and Chicano Studies	B.A.	Humanities/cultural sciences, social sciences/policy	Department of Chicana and Chicano Studies
Clinical Laboratory Sciences	B.S.	—	School of Life Sciences
Computational Mathematical Sciences	B.S.	—	Department of Mathematics and Statistics
Conservation Biology	B.S.	—	School of Life Sciences
Economics	B.A., B.S.	—	Department of Economics*
English	B.A.	Linguistics, literature	Department of English
Family and Human Development	B.S.	Family studies/child development	Department of Family and Human Development
French	B.A.	—	Department of Languages and Literatures
Geography	B.A., B.S.	Meteorology-climatology, urban studies	Department of Geography
Geological Sciences	B.S.	—	Department of Geological Sciences
German	B.A.	—	Department of Languages and Literatures
History	B.A.	—	Department of History
Humanities	B.A.	—	Interdisciplinary Humanities Program
Integrated Studies	B.A., B.S.	—	College of Liberal Arts and Sciences
Italian	B.A.	—	Department of Languages and Literatures
Kinesiology	B.S.	Exercise science, movement science, teacher preparation	Department of Kinesiology
Mathematics	B.A.	—	Department of Mathematics and Statistics
	B.S.	Statistics	Department of Mathematics and Statistics
Microbiology	B.S.	—	School of Life Sciences
Molecular Biosciences/ Biotechnology	B.S.	—	School of Life Sciences
Philosophy	B.A.	—	Department of Philosophy
Physics	B.S.	—	Department of Physics and Astronomy
Plant Biology	B.S.	Environmental science and ecology, plant biochemistry and molecular biology, urban horticulture	School of Life Sciences
Political Science	B.A.	—	Department of Political Science
	B.S.	Public policy advocacy and lobbying, public policy analysis	Department of Political Science
Psychology	B.A., B.S.	—	Department of Psychology
Religious Studies	B.A.	—	Department of Religious Studies
Russian	B.A.	—	Department of Languages and Literatures

* The department is in the W. P. Carey School of Business, which also offers this major, with different requirements.

College of Liberal Arts and Sciences Baccalaureate Degrees and Majors (continued)

Major	Degree	Concentration	Administered By
Sociology	B.A.	—	Department of Sociology
Spanish	B.A.	—	Department of Languages and Literatures
Speech and Hearing Science	B.S.	—	Department of Speech and Hearing Science
Women's Studies	B.A.	—	Women's Studies Program

* The department is in the W. P. Carey School of Business, which also offers this major, with different requirements.

To graduate from CLAS, a student must satisfy college requirements in addition to university General Studies requirements. These requirements consist of *major requirements* which involve concentrated course work in a selected field; and CLAS *graduation requirements* which ensure that the student demonstrates proficiency in a second language while exposing the student to other liberal arts and sciences outside the major field.

I. Major Requirements. Each student is required to select a major from among the fields of study offered by CLAS. 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 15 additional hours may be required in related courses and prerequisites. No more than 60 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 60-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." In CLAS, the assignment of a grade of "Y" indicates a level of performance that would have resulted in a grade of at least "C" had the normal grading scheme been used.

See the individual departments for other minimum grade requirements.

C. Major fields of study are classified into the following three divisions:

1. Humanities:
   - African American Studies (AFH)
   - Asian Languages (Chinese/Japanese) (CHI/JPN)
   - Chicana and Chicano Studies (CSH)
   - English (ENG)
   - French (FRE)
   - German (GER)
   - Humanities (HUM)
   - Italian (ITA)
   - Philosophy (HPS, PHI)
   - Religious Studies (REL)
   - Russian (Only meets CLAS graduation requirements in humanities if at least two upper-division literature or civilization courses are taken.) (RUS)
   - Spanish (SPA)
   - Women's Studies (WSH)
2. Natural sciences and mathematics:
   - Biochemistry (BCH)
   - Biology (BIO)
   - Chemistry (CHM)
   - Clinical Laboratory Sciences (CLS)
   - Computational Mathematical Sciences (MAT)
   - Conservation Biology (BIO)
   - Geological Sciences (GLG)
   - Mathematics (MAT)
   - Microbiology (MIC)
   - Molecular Biosciences/Biotechnology (MBB)
   - Physics (AST, PHS, PHY)
   - Plant Biology (PLB)
3. Social and behavioral sciences:
   - African American Studies (AFS)
   - Anthropology (ASB)
   - Chicana and Chicano Studies (CSS)
   - Economics (ECN)
   - Family and Human Development (Students majoring in this field must satisfy the CLAS graduation requirements in all three divisions.) (CDE, FAS)
   - Geography (GCU)
   - History (HST)
   - Kinesiology (Students majoring in this field must satisfy the CLAS graduation requirements in all three divisions.) (KIN)
   - Political Science (POS)
   - Psychology (PGS, PSY)
   - Sociology (SOC)
   - Speech and Hearing Science (Students majoring in this field must satisfy the CLAS graduation requirements in all three divisions.) (SHS)
   - Women's Studies (WST)

II. CLAS Graduation Requirements. The purpose of the CLAS graduation requirements 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.C.

Unless the major field notes otherwise in I.C., students are considered to have fulfilled the CLAS graduation requirements in the division of the major.

Students majoring in Family and Human Development, Kinesiology, and Speech and Hearing Science must satisfy CLAS graduation requirements in social behavioral sciences as well as in the other two divisions.

Students majoring in African American Studies or Chicana and Chicano Studies satisfy the CLAS graduation requirements in either the humanities or the social and behavioral sciences, depending upon their concentrations; that is, these students fill the CLAS requirements within the concentration of their major only. They may not use courses in the department to fill the CLAS requirements outside their major concentration.

Students majoring in Women's Studies may choose to fill CLAS requirements using courses from the department for either the Humanities or Social and Behavioral Sciences but not both.

Students majoring in Anthropology, Geography, or 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 CLAS graduation requirements in the natural sciences and mathematics.

Note: Courses used to fill the university General Studies requirement in Humanities and Fine Arts (HU), Social and Behavioral Sciences (SB), or laboratory sciences (SQ or SG) may not be used to fill CLAS graduation requirements in the humanities, social and behavioral sciences, and the natural sciences and mathematics.

A. Humanities (six semester hours). Each student is required to complete two upper-division courses of at least three semester hours each. Course prefixes are identified in the following section.

Course prefixes for the CLAS graduation requirement in the Humanities:

1. AFH (African American Studies Program)
2. CSH (Department of Chicana and Chicano Studies)
3. ENG (Department of English)
4. CHI, FLA, FRE, GER, GRK, HEB, ITA, JPN, KOR, LAT, POR, RUS, SCA, SPA (Department of Languages and Literatures; literature or "civilization" courses at the 300 level or above that are not also used to meet the minimum language proficiency requirement)
5. HUM (Interdisciplinary Humanities Program)
6. HPS, PHI (Department of Philosophy)
7. REL (Department of Religious Studies) religion, Bible, or theology courses from sectarian institutions may not be used to fill any CLAS Humanities requirement. Such courses may be used only for elective credit toward a student's graduation.
8. WSH (Women's Studies Program)

B. Natural sciences and mathematics (six semester hours). Each student is required to complete two courses of at least three semester hours each.

Course prefixes for the CLAS graduation requirements in the natural sciences and mathematics:

1. ASM (Department of Anthropology)
2. BIO (Biology)
3. BCH, CHM (Department of Chemistry and Biochemistry)
4. CSE (Department of Computer Science and Engineering)
5. GPH (Department of Geography)
6. GLG (Department of Geological Sciences)
7. MAT, STP (Department of Mathematics and Statistics)

   Note: Only mathematics courses for which MAT 117 or a higher-level mathematics course is a prerequisite may be used to satisfy the CLAS graduation requirements in Natural Sciences and Mathematics.
8. MIC (Microbiology)
9. AST, PHS, PHY (Department of Physics and Astronomy)
10. PLB, MBB (Plant Biology)
11. PSY (Department of Psychology)

C. Social and behavioral sciences (six semester hours). Each student is required to complete two upper-division courses of at least three semester hours each. Course prefixes of approved courses are identified in the following section.

Course prefixes for the CLAS graduation requirements in the social and behavioral sciences:

1. AFS (African American Studies Program)
2. ASB (Department of Anthropology)
3. CSS (Department of Chicana and Chicano Studies)
4. ECN (Department of Economics)
5. GCU (Department of Geography)
6. HST (Department of History)
7. PGS (Department of Psychology)
8. POS (Department of Political Science)
9. SOC (Department of Sociology)

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

10. WST (Women's Studies Program)
Note: Before the 1999–2000 edition of the *General Catalog,* all Women's Studies courses were listed as WST. Consult an advisor to verify if an earlier WST course should be considered WSH or WST.

D. Bridge course requirement (three semester hours). Each student is required to complete one CLAS bridge course of at least three semester hours. Bridge courses contain substantial content that bridges at least two of the areas of inquiry noted in sections *A.*, *B.*, and *C.* Bridge courses cannot be double-counted to fill any other CLAS graduation requirement or the HU, SB, SQ, or SG portions of the General Studies requirement. Bridge courses may be double-counted with the major or Literacy and Critical Inquiry, Mathematical Studies, or any of the awareness areas when applicable.

The following courses have been approved as CLAS bridge courses (see an advisor for any additional bridge courses approved after the *General Catalog* was published):

ASB 240 Introduction to Southeast Asia (Cross-listed as GCU 240/ HST 240/POS 240/REL 240)
ASB 326 Human Impacts on Ancient Environments
ASB 350 Anthropology and Art
ASB 353 Death and Dying in Cross-Cultural Perspective
ASB 462 Medical Anthropology: Culture and Health
ASM 248 Bioarchaeology of Cannibalism, Violence, and Social Pathology
ASM 345 Disease and Human Evolution
BIO 311 Biology and Society (Cross-listed as HPS 340)
BIO 316 History of Biology: Conflicts and Controversies (Cross-listed as HPS 330)
BIO 318 History of Medicine (Cross-listed as HPS 331)
BIO 319 Environmental Science (nonmajor only) (Cross-listed as PLB 320)
BIO 427 Fire
ENG 312 English in Its Social Setting
ENG 469 Science and Literature
GCU 344 Geography of Hispanic Americans
GPH 210 Society and Environment
GPH 314 Global Change
GPH 405 Energy and Environment
GPH 422 Plant Geography (Cross-listed as PLB 422)
HPS 322 History of Science
HPS 330 History of Biology: Conflicts and Controversies (Cross-listed as BIO 316)
HPS 331 History of Medicine (Cross-listed as BIO 318)
HPS 340 Biology and Society (Cross-listed as BIO 311)
HST 460 History of Fire
HUM 294 ST: Introduction to Southeast Asia
HUM 420 Interpreting Latin America
KIN 422 Motor Control in Special Populations
KIN 452 Exercise Psychology
MIC 394 ST: HIV Disease and AIDS in America
PGS 394 ST: Disease and AIDS in America
PLB 320 Environmental Science (nonmajor only) (Cross-listed as BIO 319)
PLB 322 Environmental Science (majors only)
PLB 422 Plant Geography (Cross-listed as GPH 422)
POS 305 Politics and Film
PSY 424 Genetic Psychology
PSY 425 Biological Bases of Behavior
PSY 426 Neuroanatomy
PSY 470 Psychopharmacology
REL 379 Religion, Nationalism, and Ethnic Conflict
REL 382 Religion, Magic, and Science
REL 390 Women and Religion
REL 480 Religion and Global Politics
SCA 250 Introduction to Scandinavian Culture
SHS 394 ST: Brain, Memory, and Language
SOC 334 Technology and Society
SOC 420 Sociology of Religion
SOC 451 Comparative Sociology
SOC 483 History of Social Thought
WST 394 ST: Women and Religion

E. Second Language Requirement. Each student is required to demonstrate proficiency by completing courses in a second language. Each student must demonstrate proficiency by completing the courses specified below with a grade of "C" or higher in each course. Second language course requirements consist of

1. completion of second language course work at the intermediate level (202 or equivalent, those students completing this requirement in Ancient Greek must take both GRK 301 and 302; students completing the requirements in Portuguese or Romanian must complete POR 314 or ROM 314);
2. a foreign language course at the 300 level or higher taught in the foreign language and having 202 or its equivalent as a prerequisite;
3. completion of secondary education at a school in which the language of instruction is not English; or
4. completion of SHS 202 American Sign Language IV or its equivalent.

F. Students are required to take a minimum of MAT 114 or higher. A grade of "C" or higher must be earned in the chosen Mathematics course.

III. General Electives. Most CLAS majors can meet all of the above requirements with fewer than 120 semester hours required for graduation. The remaining hours are general electives that may be selected from any of the departments of CLAS and from the offerings of the other colleges.

Declaration of Graduation. The declaration of graduation, which is required by university regulations during the semester in which an undergraduate earns the 87th hour, must be filed and approved at least two weeks before the preregistration period for the subsequent semester. Students should run a new DARS report every semester to gauge how well they are meeting all requirements for graduation. Students should contact the Office for Academic Programs, in SS 111, regarding college graduation rules and deadlines. Deadlines for filing the declaration of graduation after enrolling in the 87th hour are March 1 and October 1 of each year. Students with 87 hours must have a college-approved declaration of graduation before registering for the next semester.

Credit Requirement. All candidates for graduation in the B.A. and B.S. degree curricula are required to complete at least 120 semester hours, of which at least 45 hours must consist of upper-division courses. A minimum ASU cumulative GPA of 2.00 is required for graduation.

Concurrent Degrees. Students who wish to obtain concurrent degrees must realize that there are certain combinations that would not be approved because there is too great an overlap between the courses required for each major. For example, students may not obtain concurrent degrees in two life sciences. Students who wish to obtain concurrent degrees may not double-count courses from one major to the next, but must have at least 30 different semester hours in each major.

Course Load. The normal course load is 15 to 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, in SS 111, before registration. Any petition for an overload in excess of 21 hours must be presented to the Standards Committee of the college. No student should assume that his or her petition will be granted for overload.

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 CLAS 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 second language or First-Year Composition requirements;
2. those in the student's major, minor, or certificate program;
3. those counted toward or required to supplement the major;
4. those counted as 499 Individualized Instruction;
5. those taken for honors credits; or
6. those counted toward satisfying the CLAS graduation requirements or the General Studies requirement.

Audit Grade Option. A student may choose to audit a course in which he or she attends regularly scheduled class sessions but earns no credit. The student should obtain the instructor's approval before registering for the course. For more information, see "Grading System," page 74.

Note: This grade option may not be changed after the drop/add period.

Independent Learning. Study by Independent Learning is not a normal part of a degree program; special circumstances must exist for a degree-seeking student to take Independent Learning courses. Any enrollment in such courses must have the 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 under "Retention and Academic Standards," page 78, except that the disqualified student in CLAS is suspended for at least two regular semesters at the university. When students are placed on probation, one of three things can happen:

1. the student may raise his or her cumulative GPA to a 2.00 or better by taking new classes and be removed from probation after the fall or spring semester;
2. the student may receive the required semester GPA, but not raise the cumulative GPA to the 2.00 level in which case, the student may continue on probation, earning the required semester GPA, for as many

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

College of Liberal Arts and Sciences Graduate Degrees and Majors

Major	Degree	Concentration	Administered By
Anthropology	M.A.[1]	Archaeology, bioarchaeology, linguistics, museum studies, physical anthropology, social-cultural anthropology	Department of Anthropology
	Ph.D.	Archaeology, physical anthropology, social-cultural anthropology	Department of Anthropology
Asian Languages and Civilizations—Chinese/Japanese	M.A.	—	Department of Languages and Literatures
Biology[2]	M.S., Ph.D.	Ecology	School of Life Sciences
Chemistry	M.S., Ph.D.	Analytical chemistry, biochemistry, geochemistry, inorganic chemistry, organic chemistry, physical chemistry, solid-state chemistry	Department of Chemistry and Biochemistry
Communication Disorders	M.S.	—	Department of Speech and Hearing Science
Computational Biosciences	M.S.	—	College of Liberal Arts and Sciences
Creative Writing[3]	M.F.A.	—	Creative Writing Committee
English	M.A.	Comparative literature, English linguistics, literature and language, rhetoric and composition	Department of English
	Ph.D.	Literature, rhetoric/composition and linguistics	Department of English
Exercise Science[3]	Ph.D.	Biomechanics, motor behavior/sport psychology, physiology of exercise	Committee on Exercise Science
Family and Human Development	M.S.	Family studies	Department of Family and Human Development
Family Science[2]	Ph.D.	Marriage and family therapy	Department of Family and Human Development
French	M.A.	Comparative literature, linguistics, literature	Department of Languages and Literatures
Geography	M.A., Ph.D.	—	Department of Geography
Geological Sciences	M.S., Ph.D.	—	Department of Geological Sciences
German	M.A.	Comparative literature, language and culture, literature	Department of Languages and Literatures
History	M.A.	Asian history, British history, European history, Latin American history, public history, U.S. history, U.S. Western history	Department of History
	Ph.D.	Asian history, British history, European history, Latin American history, U.S. history	Department of History
Humanities	M.A.	—	Graduate Committee on Humanities
Kinesiology	M.S.	—	Department of Kinesiology
Materials Science[3]	M.S.	—	Committee on the Science and Engineering of Materials
Mathematics	M.A., Ph.D.	—	Department of Mathematics and Statistics
Microbiology	M.S., Ph.D.	—	School of Life Sciences
Molecular and Cellular Biology	M.S., Ph.D.	—	Interdisciplinary Committee on Molecular and Cellular Biology

[1] Graduate students in the Department of Anthropology and the School of Justice Studies are able to receive a concurrent M.A. degree in Anthropology and M.S. degree in Justice Studies.

[2] This major has formalized concentration(s); other areas of study are available.

[3] This program is administered by the Graduate College.

College of Liberal Arts and Sciences Graduate Degrees and Majors (continued)

Major	Degree	Concentration	Administered By
Natural Science	M.N.S.	Biology	School of Life Sciences
		Chemistry	Department of Chemistry and Biochemistry
		Geological sciences	Department of Geological Sciences
		Mathematics	Department of Mathematics and Statistics
		Microbiology	School of Life Sciences
		Physics	Department of Physics and Astronomy
		Plant biology	School of Life Sciences
Philosophy	M.A., Ph.D.	—	Department of Philosophy
Physical Education	M.P.E.	—	Department of Kinesiology
Physics	M.S., Ph.D.	—	Department of Physics and Astronomy
Plant Biology[2]	M.S., Ph.D.	Ecology, photosynthesis	School of Life Sciences
Political Science	M.A., Ph.D.	American politics, comparative politics, international relations, political theory	Department of Political Science
Psychology	Ph.D.	Behavioral neuroscience, clinical psychology, cognitive/behavioral systems, developmental psychology, quantitative research methods, social psychology	Department of Psychology
Religious Studies	M.A.	—	Department of Religious Studies
Science and Engineering of Materials	Ph.D.[3]	High-resolution nanostructure analysis, solid-state device materials design	Committee on the Science and Engineering of Materials
Sociology	M.A., Ph.D.	—	Department of Sociology
Spanish	M.A.	Comparative literature, language and culture, linguistics, literature	Department of Languages and Literatures
	Ph.D.	Cultural studies, literature	Department of Languages and Literatures
Speech and Hearing Science[3]	Ph.D.	Developmental neurolinguistic disorders, neuroauditory processes, neurogerontologic communication disorders	Committee on Speech and Hearing Science
Statistics[3]	M.S.	—	Committee on Statistics
Teaching English as a Second Language	M.TESL	—	Department of English

[1] Graduate students in the Department of Anthropology and the School of Justice Studies are able to receive a concurrent M.A. degree in Anthropology and M.S. degree in Justice Studies.

[2] This major has formalized concentration(s); other areas of study are available.

[3] This program is administered by the Graduate College.

semesters as it takes to raise the cumulative GPA above 2.00; or

3. the student may fail to achieve the required semester GPA and be disqualified.

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 in 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 enhanced. Academic discipline is one of the functions of the Office for Academic Programs. 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

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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 CLAS is expected to follow the rules and deadlines specified in this 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 Office for Academic Programs, in SS 111, regarding the academic rules of the college and the university.

SPECIAL PROGRAMS

Barrett Honors College. CLAS works closely with the Barrett Honors College, which affords qualified undergraduates opportunities for enhanced educational experiences. For a complete description of requirements and opportunities, see "The Barrett Honors College," page 120.

Integrated Studies. An Integrated 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 at ASU 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, visit the Office for Academic Programs in 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. For more information, call the Department of Political Science at 480/965-6551.

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 more information, see the appropriate department descriptions in this catalog.

Certificate Programs and Areas of Emphasis

Certificates are available from numerous units in CLAS, and one collegewide Enriched College Degree Certificate is available to any major in the college as shown in the "CLAS Certificates" table, page 315. Areas of emphasis are also available in some of the same subjects (e.g., Latin American Studies).

Enriched College Degree. CLAS offers an Enriched College Degree Certificate, available to any student within the university.

The Enriched College Degree Certificate consists of a minimum of 15 semester hours of a minimum of "C" grade credit. The certificate consists of

1. a theme requirement composed of a three-course sequence outside the student's major, characterized by an identifiable theme of intellectual relevance for students (courses used for the theme requirement cannot be from one's major, minor, or another certificate);
2. an approved upper-division bridge course selected to address the relationships among areas of inquiry and means of acquiring knowledge; and
3. an approved upper-division course in spoken English to provide a meaningful opportunity for substantive oral presentations.

For more information, visit the CLAS Office for Academic Programs, in SS 111, or call 480/965-6506.

American Public Policy. See "Certificate in American Public Policy," page 422.

Asian Studies. An Asian Studies Certificate is offered through the Center for Asian Studies.

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, Indonesian, Japanese, Korean, Thai, and Vietnamese.

An East Asian Studies Certificate is also available. Students must complete two years (20 semester hours) of Chinese, Japanese, or Korean plus 30 additional semester hours of East Asian area studies courses; these courses must be selected from the core East Asian curriculum or must be courses with a significant focus on East Asia chosen in consultation with the Center for Asian Studies advisor.

Note: 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.

For more information, contact the Center for Asian Studies in WHALL 105, or call 480/965-7184.

B.I.S. Concentrations. Concentrations in Asian studies and East Asian studies are available under the Bachelor of Inter-

CLAS Certificates

Certificate Program	Administered By	Page
College of Liberal Arts and Sciences Enriched Certificate	CLAS	314
African American Studies Certificate	African American Studies Program	323
American Public Policy Certificate	Department of Political Science	422
Asian Studies Certificate[1]	Center for Asian Studies	314
Atmospheric Sciences Certificate[2]	CLAS	—
Civic Education Certificate	Department of Political Science	423
Classical Studies Certificate	Department of Languages and Literatures and Interdisciplinary Humanities Program	315
East Asian Studies Certificate	Center for Asian Studies	314
Ethics Certificate	Department of Philosophy	316
Health Physics Certificate	Pre-Health Professions Office	316
History and Philosophy of Science Certificate	Department of Philosophy	316
International Studies Certificate	Department of Political Science	423
Islamic Studies Certificate	Department of Religious Studies	317
Jewish Studies Certificate	Jewish Studies Committee	317
Latin American Studies Certificate[1]	Latin American Studies Center	317
Medieval and Renaissance Studies Certificate	Arizona Center for Medieval and Renaissance Studies (ACMRS)	317
Medieval Studies Certificate[2]	ACMRS	—
Museum Studies Certificate[2]	Department of Anthropology	—
Renaissance Studies Certificate[2]	ACMRS	—
Russian and East European Studies Certificate[1]	Russian and East European Studies Consortium	318
Scandinavian Studies Certificate	Department of Languages and Literatures	318
Scholarly Publishing Certificate[2]	Department of History	—
Southeast Asian Studies Certificate	Program for Southeast Asian Studies	318
Symbolic Systems, Certificate in	Department of Philosophy	319
Translation Certificate	Department of Languages and Literatures	379
Women's Studies Certificate	Women's Studies Program	319
Writing Certificate	Department of English	347

[1] Emphases are also available in these programs.

[2] For more information, see the *Graduate Catalog.*

disciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Civic Education. See "Certificate in Civic Education," page 423.

Classical Studies. Students admitted to undergraduate degree programs in any field are eligible for the Classical Studies certificate program. In addition to the course work and examinations required in the student's major, the student is responsible for fulfilling the following minimum requirements:

1. Five semesters of ancient Greek (17 semester hours; GRK 301 and 302 may be repeated for credit) or Latin (19 semester hours) language and literature instruction;
2. Two semesters (six semester hours), in courses related to classical studies (to be approved by coordinators of the certificate);
3. a thesis (three semester hours), a Barrett Honors College thesis (six semester hours) or two additional courses at or above the 300 level (six semester hours); and
4. a minimum of a 2.00 average in all course work leading to the certificate.

Students interested in the Classical Studies certificate program need to submit an application before being accepted into the program. For further information call the program coordinators at 480/965-1110 or 727-6512.

B.I.S. Concentration. A concentration in classical studies—Greek or classical studies—Latin is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Ethics. This certificate is designed to give students a richer understanding of systematic philosophical thinking about ethics. Students with majors in business, nursing, journalism, and public administration, among others, may well find that training in ethics is beneficial for their career goals. The certificate program permits some flexibility about course selection, thereby facilitating the interests of many students. For more information, visit the Department of Philosophy in PS A524, or call 480/965-3394.

B.I.S. Concentration. A concentration in ethics is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Health Physics. The curriculum of health physics involves work in CLAS 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.

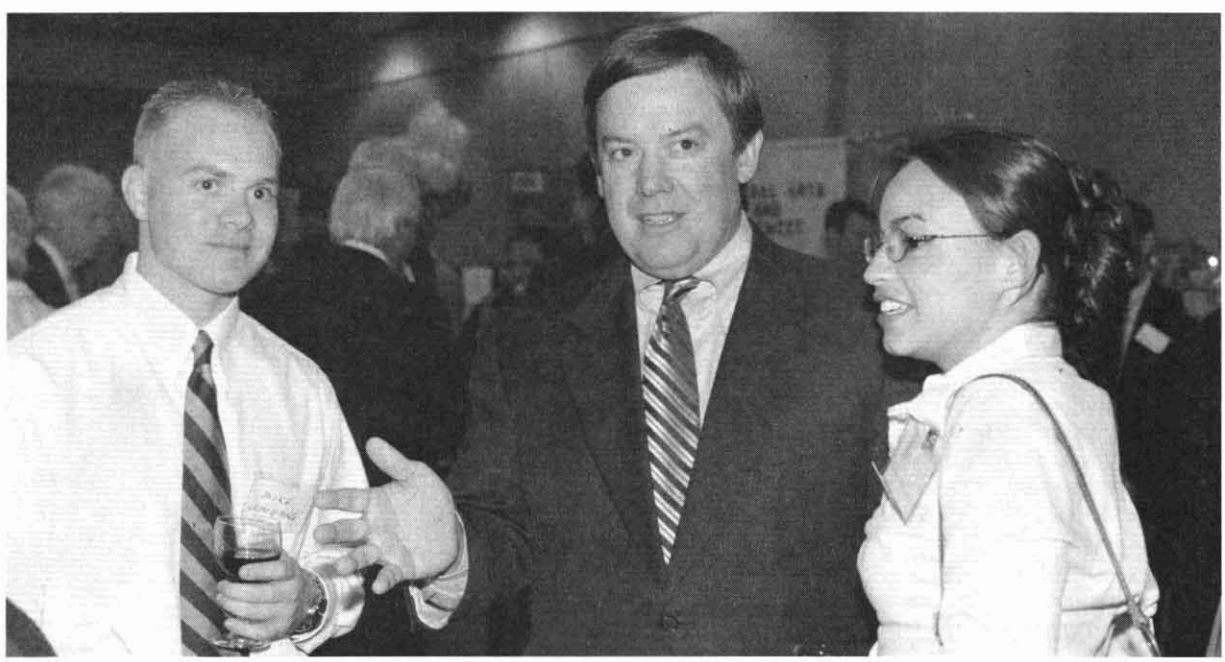
A Certificate of Concentration in Health Physics is awarded for the successful completion of a B.S. degree in a physical or life science that follows a prescribed program. For more information, visit the Pre-Health Professions Office in LSC 206C, or call 480/965-2365, where academic advising is available.

History and Philosophy of Science. The Department of Philosophy offers an undergraduate History and Philosophy of Science Certificate. The certificate program is designed to give students an understanding of both traditional philosophic issues surrounding science and the historical development of concrete scientific theories and ideas. The philosophic questions, of the belief-worthiness and interpretation of scientific claims as well as norms within or about science, both enrich and are enriched by their combination with historical study. Such philosophic and historical study will also often include the examination of contemporary sciences and their place within the larger society.

The certificate requires 18 semester hours bearing a PHI or HPS prefix of which 12 semester hours must be upper-division. Included within the 18 semester hours, at least nine must bear the HPS prefix. PHI 314 Philosophy of Science is also required. All courses counting toward the certificate must be approved for this purpose by a Department of Philosophy undergraduate advisor and passed with a grade of "C" or higher.

For more information, visit the Department of Philosophy in PS A524, or call 480/965-3394.

International Studies. See "Certificate in International Studies," page 423.



ASU President Michael Crow (center) chats with Associated Students of ASU President Mike Leingang and Yolanda Sanchez, president of the Associated Students of ASU West.

Tim Trumble photo

Islamic Studies Certificate. Students admitted to undergraduate degree programs in any field are eligible for the Islamic Studies Certificate program. Students who complete all the requirements of their major, their college, and the certificate program will receive the certificate plus transcript recognition of their particular emphasis. The certificate program is designed to prepare students for graduate programs in Religious Studies, Islamic Studies and area studies or for any academic discipline (such as professional programs in international law and business) that focus on global Muslim societies. Students must complete a minimum total of 26 semester hours, chosen in consultation with the Islamic Studies program coordinator. A minimum grade of "C" is required in each course. To earn the certificate, students must complete:

1. eight semester hours of Arabic, Indonesian, or another language approved by the program coordinator. Students who are native speakers of these languages or who otherwise have equivalent knowledge shall substitute two additional courses approved by the program coordinator;
2. nine semester hours from REL 260 Introduction to Islam (Cross-listed as HUM 260), REL 365 Islamic Civilization and REL 366 Islam in the Modern World;
3. three semester hours taken from REL 394 (topics may vary) or REL 460 Studies in Islamic Religion (topics may vary); and
4. six semester hours drawn from an approved list of courses in Arabic, Anthropology, French, Geography, History, Religious Studies and Spanish or from other courses approved by the program coordinator.

Direct inquiries about the program to the Department of Religious Studies, ECA 377, or call 480/965-7145.

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.

B.I.S. Concentration. A concentration in Jewish studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Latin American Studies. The Latin American Studies Certificate program is designed to give students an understanding of culture, economies, political structures, and the history of Latin American nations. The Departments of Anthropology, Economics, Geography, History, Languages and Literatures (Spanish and Portuguese), and Political Science and the W. P. Carey School of Business offer courses that combine to make up the interdisciplinary certificate. Students must complete 30 semester hours of upper-division courses from the above departments/colleges with a concentration in Latin America—15 semester hours in the major subject and 15 semester hours in other disciplines. The certificate requires Spanish or Portuguese proficiency through the 313 level of conversation and composition. Only language courses above 313 in literature and civilization count toward a major or interdisciplinary areas of preparation. Spanish and Portuguese courses above 313 in grammar and phonology do not count toward the major requirements. The Latin American Studies Center offers the area of emphasis for students who do not wish to attain a high level of language proficiency.

For more information, visit the Latin American Studies Center in SS 213, or call 480/965-5127.

B.I.S. Concentration. A concentration in Latin American studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Medieval and Renaissance Studies. An undergraduate Certificate in Medieval and Renaissance Studies is offered by the Arizona Center for Medieval and Renaissance Studies (ACMRS). In addition to the course work and examinations required in a student's major field of interest, the following minimum requirements must be fulfilled to earn the certificate:

1. six to eight semester hours of classical Latin and six to eight semester hours of Latin (classical and/or medieval) or of a vernacular language of the period (e.g., Old English, Old Norse, Old French, Renaissance Italian);
2. six to eight semester hours of course work in medieval and renaissance studies outside the major discipline;
3. three semester hours of thesis on a topic concerning the Middle Ages or Renaissance. The thesis may be

used to fulfill the Honors College thesis requirement for students enrolled in the Barrett Honors College; and

4. a minimum of a "C" average in all course work leading to the certificate.

Students interested in the certificate program need to complete an application form before being accepted into the program. Applications are available by calling ACMRS at 480/965-5900.

See the *Graduate Catalog* for information about the Certificate in Medieval Studies and the Certificate in Renaissance Studies, and "Arizona Center for Medieval and Renaissance Studies (ACMRS)," page 33, for information about the center.

B.I.S. Concentration. A concentration in medieval and Renaissance studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Museum Studies. See the *Graduate Catalog* or contact the Department of Anthropology for more information.

Russian and East European Studies. Undergraduate students may complete an interdisciplinary certificate program leading to a bachelor's degree with a major in the chosen field with an emphasis in Russian and East European studies. The requirements for the Russian and East European Studies Certificate comprise (1) three years (22 hours) of Russian or another Eurasian or East European language and (2) 30 upper-division semester hours in Russian/East European area-related course work.

At least three disciplines must be represented in the area-related course work, and at least 12 hours must be outside the Department of Languages and Literatures (i.e., non-RUS and non-FLA courses). Fulfillment of these requirements is certified by the Russian and East European Studies Consortium and is recognized on the transcript by a bachelor's degree with "Major in [Discipline], Emphasis in Russian and East European Studies." The purpose of this undergraduate certificate program is to encourage students majoring in a chosen discipline to develop special competency in Russian or East European language and area studies. A major in any department may elect this emphasis.

For further information, contact the program coordinator of the Russian and East European Studies Consortium at 480/965-4188.

B.I.S. Concentration. A concentration in Russian and East European studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Scandinavian Studies. Students admitted to undergraduate degree programs in any field are eligible for the Scandinavian Studies Certificate program. In addition to the course work and examinations required in the student's major, the student is responsible for fulfilling the following minimum requirements (21 semester hours) before the certificate is issued:

1. six semester hours of Norwegian or Swedish at the 200 level or above;
2. three semester hours in SCA 250 Introduction to Scandinavian Culture;
3. nine semester hours of upper-division course work in Scandinavian Studies outside the student's major discipline;
4. a minimum of a "C" average in all course work leading to the certificate; and
5. three semester hours in an independent study thesis on a topic concerning Scandinavian Studies. The thesis may be used to fulfill the Barrett Honors College thesis requirement for students enrolled in the Barrett Honors College.

Students who test out of the basic language courses would under advisement take other approved courses to fulfill the minimum requirement of 21 semester hours.

For more information, call the Department of Languages and Literatures at 480/965-6281.

B.I.S. Concentration. A concentration in Scandinavian studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Scholarly Publishing. See the *Graduate Catalog* for information on this certificate program.

Southeast Asian Studies. A Certificate in Southeast Asian Studies is available to any undergraduate student. 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 American Council of Teachers in Foreign Languages (ACTFL) guidelines.

The ASU curriculum includes

1. language instruction in Indonesian, Thai, or Vietnamese;
2. ASB/GCU/HST/POS/REL 240 Introduction to Southeast Asia;
3. HST 391 Modern Southeast Asia;
4. electives in the social sciences and humanities on the history, geography, culture, politics, and religion of the region; and
5. a culminating 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 CLAS.

For more information, contact the Program for Southeast Asian Studies in LL 9 (basement), 480/965-4232 or 480/965-0118.

B.I.S. Concentrations. Concentrations in Southeast Asian studies (area studies option or language option) are available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

Symbolic Systems. The Department of Philosophy offers a Certificate in Symbolic Systems. The certificate program takes an interdisciplinary approach to cognition, computation, and meaning. Course work is divided evenly between philosophy, psychology, and computer science in order to expose students to the subject matter from a conceptual, empirical, and practical point of view. The certificate may interest students with majors in any of the three disciplines on topics of common interest.

The certificate consists of 28 semester hours approved by an advisor in the Department of Philosophy and divided evenly between computer science and engineering, psychology, and philosophy as follows:

1. CSE 200, 210, and 240;
2. PSY 230 and 290 and either PSY 323, 324, or 437; and
3. either PHI 319, or 333, either PHI 315 or 317, and either PHI 312 or 314.

Students must satisfy the prerequisites for the listed courses. With written approval from the director of undergraduates studies in the Department of Philosophy, one substitution of a course from outside this list may be made. All courses must be passed with a minimum grade of "C."

For more information, visit the Department of Philosophy in PS A524, or call 480/965-3394.

Translation. See "Translation Certificate (Spanish/English)," page 379, for information about the Certificate in Translation.

Women's Studies. Women's Studies provides students with an intensive interdisciplinary liberal arts education that enables them to write well, think critically, and analyze problems effectively.

The certificate program is equivalent to an interdisciplinary minor, consisting of 18 credit hours, and is open to graduate as well as undergraduate students. Students pursuing a certificate in Women's Studies must consult with the Women's Studies advisor to select appropriate courses and fulfill requirements.

A Certificate of Concentration in Women's Studies is awarded for the successful completion of WST 100 (or 300) and WST 377 or 378 and an additional 12 semester hours from the list of approved Women's Studies courses.

Inquiries about the certificate program should be addressed to the Women's Studies Program academic advisor in ECA 209, 480/965-2358, where the current list of approved courses is available.

GENERAL INFORMATION

Research Centers. To expand educational horizons and to enrich the curriculum, CLAS maintains the following research centers:

Arizona Center for Medieval and Renaissance Studies
Cancer Research Institute
Center for Asian Studies
Center for Meteorite Studies
Center for Solid State Science
Center for the Study of Early Events in Photosynthesis
Exercise and Sport Research Institute
Hispanic Research Center
Institute of Human Origins
Joan and David Lincoln Center for Applied Ethics
Latin American Studies Center

CLAS also participates with the College of Education and the College of Engineering and Applied Sciences in maintaining the Center for Research on Education in Science, Mathematics, Engineering, and Technology. See "Research Centers, Institutes, and Laboratories," page 31, for more information.

Courses. The faculty also offer the following LIA course to familiarize students with available resources and services for research purposes.

For information on LIA courses, see the *Schedule of Classes*, visit the Office for Academic Programs in SS 111, or call 480/965-6506.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

LIBERAL ARTS AND SCIENCES (LIA)

LIA 191 First-Year Seminar. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Department of Aerospace Studies

Air Force ROTC

www.asu.edu/clas/afrotc
480/965-3181
TC 324

Col. Ronald Scott Jr., Chair

Professor: Scott

Assistant Professors: Blacklock, Greensfelder, Head

PURPOSE

The Department of Aerospace Studies curriculum consists of the general military course and history for freshmen and sophomores (AES 101, 103, 201, 203) and the professional officer course for juniors and seniors (AES 301, 303, 401, 403).

General Qualifications. Students entering the Air Force Reserve Officers' Training Corps (AFROTC) must meet the following requirements:

1. be a citizen of the United States (noncitizens may enroll but must obtain citizenship before commissioning);
2. be of sound physical condition; and
3. be at least 17 years of age for scholarship appointment or admittance to the Professional Officer Course (POC).

Additionally, scholarship recipients must be able to fulfill commissioning requirements by age 27. If designated for flying training, the student must be able to complete all commissioning requirements before age 29; persons in other categories must be able to complete all commissioning requirements before age 35.

FOUR-YEAR PROGRAM (GMC AND POC)

A formal application is not required for students entering the four-year program. A student may enter the program by simply registering for one of the general military course (GMC) classes at the same time and in the same manner as other courses. GMC students receive two semester hours for each AES 100- and 200-level class completed for a total of eight semester hours. GMC students not on AFROTC scholarship incur no military obligation. Each candidate for commissioning must pass an Air Force aptitude test and a physical examination and be selected by a board of Air Force officers. If selected, the student then enrolls in the POC the last two years of the AFROTC curriculum. Students attend a four-week field training course at an Air Force base normally between the sophomore and junior years. Upon successful completion of the POC and the college requirements for a degree, the student is commissioned in the U.S. Air Force as a second lieutenant. The new officer then enters active duty or may be granted an educational delay to pursue graduate work.

TWO-YEAR PROGRAM (POC)

The basic requirement for entry into the two-year program is that the student have two academic years of college work remaining, either at the undergraduate or graduate level. Applicants seeking enrollment in the two-year program must pass an Air Force aptitude and medical examination and be selected by a board of Air Force officers. After successfully completing a five-week field training course at an Air Force base, the applicant may enroll in the professional officer course (POC) in the AFROTC program. Upon completion of the POC and the college requirements for a degree, the student is commissioned.

Qualifications. The following requirements must be met for admittance to the POC:

1. The four-year student must successfully complete the general military course and the four-week field training course.
2. The two-year applicant must complete a five-week field training course.
3. All students must pass the Air Force Officer Qualifying Test (AFOQT).
4. All students must pass the Air Force physical examination.
5. All students must maintain the minimum GPA required by the college.
6. All students must meet the physical fitness requirements.

Pay and Allowances. POC members in their junior and senior years receive $350 and $400 respectively per month for a maximum of 20 months of POC attendance. Students are also paid to attend field training. In addition, uniforms, housing, and meals are provided during field training at no cost to the student. Students are reimbursed for travel to and from field training.

Scholarships. AFROTC offers scholarships annually to outstanding young men and women on a nationwide competitive basis. Scholarships can cover college tuition for nonresident students and provide an allowance for books, fees, supplies and equipment, and a monthly tax-free allowance of $250 to $400 depending on the year. Scholarships are available on a four-, three-, or two-year basis. To qualify for a four- or three-year scholarship, a student must be a U.S. citizen and submit an application before December 1 of the senior year in high school. Interested students should consult their high school counselors or contact AFROTC at ASU for application forms to be submitted to

HQ AFROTC
MAXWELL AFB
AL 36112-6663

Applications can also be submitted online at www.afrotc.com.

Students enrolled in AFROTC at ASU are eligible for a limited number of three- or two-year scholarships. Those students interested must apply through the Department of Aerospace Studies. Consideration is given to academic grades, the score achieved on the AFOQT, and physical fitness. A board of officers considers an applicant's personality, character, and leadership potential.

AEROSPACE STUDIES (AES)

AES 101 Air Force Today I. (2)
fall
Introduces U.S. Air Force and AFROTC. Topics include: the Air Force mission and organization, customs and courtesies, officer opportunities, officership, and professionalism.

AES 102 Leadership Lab. (0)
fall
Emphasizes common Air Force customs and courtesies, drill and ceremonies, health and physical fitness through group participation. Corequisite: AES 101.

AES 103 Air Force Today II. (2)
spring
Continuation of AES 101. Topics include: the Air Force mission and organization, customs and courtesies, officer opportunities, officership, and professionalism. Prerequisite: AES 101 or department approval.

AES 104 Leadership Lab. (0)
spring
Continuation of AES 102 with more in-depth emphasis on learning the environment of an Air Force officer. Corequisite: AES 103.

AES 201 The Evolution of USAF Air and Space Power I. (2)
fall
Further preparation of the AFROTC candidate. Topics include: Air Force heritage and leaders, communication skills, ethics, leadership, quality Air Force, and values. Prerequisite: AES 103 or department approval.

AES 202 Leadership Lab. (0)
fall
Application of advanced drill and ceremonies, issuing commands, knowing flag etiquette, and developing, directing, and evaluating skills to lead others. Corequisite: AES 201.

AES 203 The Evolution of USAF Air and Space Power II. (2)
spring
Continuation of AES 201. Topics include: the Air Force mission and organization, customs and courtesies, officership, and professionalism. Prerequisite: AES 201 or department approval.

AES 204 Leadership Lab. (0)
spring
Continuation of AES 202 with emphasis on preparation for field training. Corequisite: AES 203.

AES 301 Air Force Leadership Studies I. (3)
fall
Study of communication skills, leadership and quality management fundamentals, leadership ethics, and professional knowledge required of an Air Force officer. Prerequisite: AES 203 or department approval.
General Studies: L

AES 302 Leadership Lab. (0)
fall
Advanced leadership experiences applying leadership and management principles to motivate and enhance the performance of other cadets. Corequisite: AES 301.

AES 303 Air Force Leadership Studies II. (3)
spring
Continuation of AES 301. Topics include: communication skills, ethics, leadership, professional knowledge, and quality management required of an Air Force officer. Prerequisite: AES 203 or department approval.
General Studies: L

AES 304 Leadership Lab. (0)
spring
Continuation of AES 302 with emphasis on planning the military activities of the cadet corps and applying advanced leadership methods. Corequisite: AES 303.

AES 401 National Security Affairs. (3)
fall
Examines advanced ethics, Air Force doctrine, national security process, and regional studies. Special topics include: civilian control of the military, military justice, and officership. Prerequisite: AES 303 or department approval.
General Studies: L

AES 402 Leadership Lab. (0)
fall
Advanced leadership experience demonstrating learned skills in planning and controlling the military activities of the corps. Corequisite: AES 401.

AES 403 Preparation for Active Duty II. (3)
spring
Continuation of AES 401. Topics include: civilian control of the military, doctrine, ethics, military justice, the national security process, and officership. Prerequisite: AES 401 or department approval.

AES 404 Leadership Lab. (0)
spring
Continuation of AES 402 with emphasis on preparation for transition from civilian to military life. Corequisite: AES 403.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

African American Studies Program

www.asu.edu/clas/aframstu
480/965-4399
COWDN 227

Leanor Boulin Johnson, Director

CORE FACULTY

Professor: Reyes
Associate Professors: Bontemps, Boulin Johnson
Assistant Professors: Hinds, Usman
Clinical Associate Professor: Cox

AFFILIATED FACULTY

Anthropology
Senior Lecturer: Winkelman

Art
Professors: Sweeney, Young
Associate Professor: Umberger

Asian Pacific American Studies
Assistant Professor: Rosa

Education
Associate Professor: Hood

English
Professor: Lester
Associate Professors: Chancy, DeLamotte, Miller
Assistant Professor: Fuse

Family and Human Development
Associate Professor: Neff

History
Associate Professor: Barnes
Assistant Professor: Whitaker

Human Communication
Professors: Jain, Martin
Associate Professor: Davey
Assistant Professor: Davis

Humanities
Assistant Professor: Lund

Journalism and Mass Communication
Associate Professor: Bramlett-Solomon

Justice Studies
Professors: Figueria-McDonough, Jurik, Romero, Zatz

Life Sciences (ASU West)
Professor: Graves

Music
Professors: Pilafian, Solís, Sunkett
Associate Professor: Smith

Political Science
Professor: McGowan
Associate Professor: Mitchell

Recreation Management and Tourism
Associate Professor: Teye

Religious Studies
Associate Professor: Moore

Sociology
Professor: Cobas
Associate Professor: Keith
Instructor: Williams

Theatre
Associate Professor: Edwards

Women's Studies
Professor: Rothschild
Assistant Professors: Anderson, Leong

African American Studies (AAS) is interdisciplinary and focuses on people of African descent throughout the world. Focus is given to the diversity of past and present experiences of those who live in the United States as well as in Africa, the Caribbean, South America, and Central America. As an institutional program with a bidisciplinary emphasis, AAS is structured to

1. prepare students of all ethnicities to better understand, value, and more effectively participate in our increasingly diverse society;
2. combine knowledge of the African diaspora with intellectual and practical training in specific areas for the purpose of creating more effective community and global partnerships; and
3. provide students with a foundation for advanced studies in a variety of fields. While the program is dedicated to scholarly research, teaching, and creative activities, it also seeks to build partnerships with community based programs and organizations within Arizona and utilize channels for informing policies which affect the life of Blacks in the diaspora.

AFRICAN AMERICAN STUDIES—B.A.

Course Requirements. The major in African American Studies requires 45 semester hours of course work. A minimum of 30 semester hours must be AFH, AFR, and AFS courses. The remaining course work must be in a related field approved by an AAS advisor. All majors must take 21 hours in the following core courses:

AFH	353	African American Literature: Beginnings Through the Harlem Renaissance *L/HU, C*	3
AFH	354	African American Literature: Harlem Renaissance to the Present *L/HU, C*	3
AFR	210	Introduction to African American Studies *C*	3
AFR	429	African American Studies Theory and Methods	3
AFR	490	Field Studies in the Diaspora	3
		or AFR 498 Pro-Seminar (3)	

AFS 363 African American History to 1865 *SB, C, H* 3
AFS 364 African American History Since 1865 *SB, C, H* 3

Within the 45 semester hours, AAS majors must also take 12 semester hours in one of three concentrations: social and behavioral sciences, humanities/arts, or politics and society. These courses are in addition to the required 21 core course semester hours. Of the remaining course work, 12 hours must be taken in related courses (i.e., non-African American Studies' prefixes). In addition to course work within the student's chosen concentration, six additional hours are required. Students should consult with an advisor.

In addition, AAS majors are required to take a minor or a certificate program of a minimum of 18 hours in another academic field.

CERTIFICATE IN AFRICAN AMERICAN STUDIES

Course Requirements. The certificate requires 24 semester hours. Fifteen core hours must be taken from the following courses:

AFH 353 African American Literature: Beginnings Through the Harlem Renaissance *L/HU, C* 3
or AFH 354 African American Literature: Harlem Renaissance to the Present *L/HU, C* (3)
AFR 210 Introduction to African American Studies *C* 3
AFR 429 African American Studies Theory and Methods 3
AFS 363 African American History to 1865 *SB, C, H* 3
AFS 364 African American History Since 1865 *SB, C, H* 3

In addition, one course from each of the three concentrations (i.e., social and behavioral sciences, humanities/arts, politics and society) must be taken. These courses are in addition to the required core courses. Courses should be selected in consultation with the major advisor.

MINOR IN AFRICAN AMERICAN STUDIES

Course Requirements. The minor requires 18 semester hours. All African American Studies minors must take nine core hours from the following courses:

AFH 353 African American Literature: Beginnings Through the Harlem Renaissance *L/HU, C* 3
or AFH 354 African American Literature: Harlem Renaissance to the Present *L/HU, C* (3)
AFR 210 Introduction to African American Studies *C* 3
AFS 363 African American History to 1865 *SB, C, H* 3
or AFS 364 African American History Since 1865 *SB, C, H* (3)

In addition, one course from each of the three concentrations (i.e., social and behavioral sciences, humanities/arts, politics and society) must be taken. These courses are in addition to the required core courses. A minimum of 12 semester hours of upper-division courses is required. Courses should be selected in consultation with the major advisor.

B.I.S. Concentration. A concentration in African American studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

AFRICAN AMERICAN STUDIES HUMANITIES (AFH)

AFH Note 1. Completion of the First-Year Composition requirement (ENG 101 and 102 [or 105] or ENG 107 and 108 with a grade of "C" or higher) is a prerequisite for all English courses above the 100 level.

AFH Note 2. A term paper or equivalent out-of-class written work is required in all upper-division (300- and 400-level) ENG courses.

AFH Note 3. English majors and minors are expected to have completed ENG 200 before taking 400-level literature courses.

AFH 202 Art of Africa, Oceania, and the Americas. (3)
spring
History of art of Africa, Oceania, and the New World. Meets non-Western art history requirement. Lecture, discussion. Cross-listed as ARS 202. Credit is allowed for only AFH 202 or ARS 202.
General Studies: HU, G, H

AFH 225 African American Religion. (3)
selected semesters
Introduces the history and development of the African American religious tradition. Lecture, discussion. Cross-listed as REL 225. Credit is allowed for only AFH 225 or REL 225.
General Studies: HU, C

AFH 303 African and African American Art. (3)
fall, spring, summer
Anthropological perspective of African and African American visual art traditions from the past to 1970. Lecture, discussion, video and slide films.

AFH 322 Malcolm and Martin. (3)
selected semesters
Examines and contrasts the lives, ministries, contributions, and legacies of Malcolm X and Martin Luther King, Jr. Cross-listed as REL 322. Credit is allowed for only AFH 322 or REL 322.
General Studies: HU, C

AFH 323 Black Religion: A Biographical Approach. (3)
selected semesters
Examines the experiences, motivations, and contributions of a number of figures associated with African American religion. Cross-listed as REL 323. Credit is allowed for only AFH 323 or REL 323.
General Studies: HU, C

AFH 333 American Ethnic Literature. (3)
once a year
Examines America's multiethnic identity through works of literature that depict American ethnic, gender, and class sensibilities. Cross-listed as ENG 333. Credit is allowed for only AFH 333 or ENG 333. See AFH Notes 1, 2.
General Studies: L/HU, C

AFH 347 Jazz in America. (3)
fall, spring, summer
Current practices employed by contemporary jazz musicians; the historical development of jazz techniques. Credit not applicable toward any Music degree. Lecture, discussion. Cross-listed as MUS 347. Credit is allowed for only AFH 347 or MUS 347.
General Studies: HU

AFH 353 African American Literature: Beginnings Through the Harlem Renaissance. (3)
fall
Historical survey of African American literary traditions and cultural contexts from slavery through the 1930s. Cross-listed as ENG 353. Credit is allowed for only AFH 353 or ENG 353. See AFH Notes 1, 2.
General Studies: L/HU, C

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

AFH 354 African American Literature: Harlem Renaissance to the Present. (3)
spring
Historical survey of African American literary traditions and cultural contexts from the 1920s to the present. Cross-listed as ENG 354. Credit is allowed for only AFH 354 or ENG 354. See AFH Notes 1, 2.
General Studies: L/HU, C

AFH 401 Focus on Multiethnic Film. (3)
selected semesters
Specialized study of major ethnic films and prominent film artists. Emphasizes the creative process. Lecture, film viewing, papers. Prerequisite: ENG 101.

AFH 459 Studies in African American/Caribbean Literatures. (3)
selected semesters
Studies in African American or Caribbean literatures according to genre, period, theory, or selected authors. May be repeated for credit when topics vary. Cross-listed as ENG 459. Credit is allowed for only AFH 459 or ENG 459. See AFH Notes 1, 2, 3.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

AFRICAN AMERICAN STUDIES (AFR)

AFR Note 1. For Justice Studies students to take a nonrequired 300-level JUS course, they must have at least a "C" in each of the required JUS courses—JUS 105 (or 305), 301, 302, and 303—and a minimum average GPA of 2.50 for these four classes. For non-Justice Studies students to take a 300-level JUS course, they must have a minimum of 56 earned semester hours (junior status) and a minimum cumulative GPA of 2.00. Non-Justice Studies students may take JUS 301, 302, and 303 with school approval.

AFR 105 Introduction to Justice Studies. (3)
fall, spring, summer
Introductory overview to the study of justice from a social science perspective. Primary topics include justice theories and justice research. Credit is allowed for only AFR 105 or 305 (or JUS 305). Appropriate for freshmen and sophomores. Lecture, discussion. Cross-listed as JUS 105. Credit is allowed for only AFR 105 or JUS 105.

AFR 191 First Year Seminar. (1–3)
selected semesters

AFR 194 Special Topics. (1–4)
selected semesters

AFR 210 Introduction to African American Studies. (3)
fall
Examines the political, historical, and cultural origins of African American studies as an academic discipline. Lecture, discussion.
General Studies: C

AFR 263 Elements of Intercultural Communication. (3)
fall, spring, summer
Basic concepts, principles, and skills for improving communication between persons from different minority, racial, ethnic, and cultural backgrounds. Lecture, discussion. Cross-listed as COM 263. Credit is allowed for only AFR 263 or COM 263. Prerequisite: 2.25 GPA.
General Studies: SB, C, G

AFR 294 Special Topics. (1–4)
selected semesters

AFR 298 Honors Directed Study. (1–6)
selected semesters

AFR 305 Principles of Justice Studies. (3)
fall, spring, summer
Introductory overview to the study of justice from a social science perspective. Primary topics include justice theories and justice research. Credit is allowed for only AFR 305 or 105 (or JUS 105). Appropriate for juniors and seniors. Lecture, discussion. Cross-listed as JUS 305. Credit is allowed for only AFR 305 or JUS 305. See AFR Note 1.

AFR 317 Genes, Race, and Society. (3)
spring
Examines history of biological and social constructions of "race" in western society. Lecture, discussion.
General Studies: SB, C, H

AFR 321 Wealth Distribution and Poverty. (3)
once a year
Examines wealth and income distribution in the United States and analyzes ideological and political forces producing an increasingly unequal society. Lecture, discussion. Cross-listed as JUS 321. Credit is allowed for only AFR 321 or JUS 321. See AFR Note 1.
General Studies: SB, C

AFR 371 Language, Culture, and Communication. (3)
fall and spring
Cultural influences of language on communication, including social functions of language, bilingualism, biculturalism, and bidialectism. Lecture, discussion. Cross-listed as COM 371. Credit is allowed for only AFR 371 or COM 371. Prerequisites: COM 263 (or AFR 263); minimum cumulative ASU GPA of 2.50.
General Studies: SB, C, G

AFR 375 Race, Gender, and Sport. (3)
fall and spring
Interdisciplinary examination of the social concepts of race and gender and their economic impact on sports in America. Lecture, discussion. Prerequisite: ENG 102 (or its equivalent) or instructor approval.
General Studies: SB, C

AFR 394 Special Topics. (1–4)
selected semesters

AFR 428 Critical Race Theory. (3)
spring
Examines ways in which race has been historically utilized, constructed, and contested in American civil society. Lecture, discussion.

AFR 429 African American Studies Theory and Methods. (3)
spring
Examines social and behavioral science theories and methodological procedures pertaining to African Americans. Prerequisite: senior standing.

AFR 460 Race, Gender, and Media. (3)
spring
Reading seminar designed to give a probing examination of the interface between AHANA Americans and the mass media in the United States. Lecture, discussion. Cross-listed as MCO 460. Credit is allowed for only AFR 460 or MCO 460.
General Studies: C

AFR 463 Intercultural Communication Theory and Research. (3)
fall, spring, summer
Surveys and analyzes major theories and research dealing with communication between people of different cultural backgrounds, primarily in international settings. Lecture, discussion, small group work. Cross-listed as COM 463. Credit is allowed for only AFR 463 or COM 463. Prerequisites: COM 263 (or AFR 263), 308; minimum cumulative ASU GPA of 2.50.
General Studies: SB, G

AFR 484 Internship. (1–12)
selected semesters

AFR 490 Field Studies in the Diaspora. (3)
spring
Introduces methods and principles of research applied to Black communities within and outside Arizona. Involves working with field officer and faculty. Lecture, field study. Prerequisite: senior standing. Pre- or corequisite: AFR 429.

AFR 492 Honors Directed Study. (1–6)
selected semesters

AFR 493 Honors Thesis. (1–6)
selected semesters
General Studies: L

AFR 494 Special Topics. (1–4)
selected semesters

AFR 497 Honors Colloquium. (1–6)
selected semesters

AFR 498 Pro-Seminar. (3)
spring
Topic is selected by instructor in consultation with the student. Designed to integrate and develop research skills. Required for majors. Prerequisite: senior standing. Pre- or corequisite: AFR 429.

AFR 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

AFRICAN AMERICAN STUDIES SOCIAL SCIENCE (AFS)

AFS 202 Ethnic Relations in the United States. (3)
fall and spring
Processes of intercultural relations; systems approach to history of U.S. interethnic relations; psychocultural analysis of contemporary U.S. ethnic relations. Lecture, discussion. Cross-listed as ASB 202. Credit is allowed for only AFS 202 or ASB 202.
General Studies: C, H

AFS 210 Introduction to Ethnic Studies in the U.S. (3)
fall and spring
Covers diversity of experiences and relations among racial and ethnic groups in the United States. Lecture, discussion. Cross-listed as APA 210/CCS 210. Credit is allowed for only AFS 210 or APA 210 or CCS 210.
General Studies: C

AFS 310 African/African American Psychology. (3)
fall and spring
Historical and contemporary overview of the development of African/Black psychology and African American frame of reference. Lecture, discussion.

AFS 363 African American History to 1865. (3)
once a year
The African American in American history, thought, and culture from slavery to 1865. Cross-listed as HST 333. Credit is allowed for only AFS 363 or HST 333.
General Studies: SB, C, H

AFS 364 African American History Since 1865. (3)
once a year
The African American in American history, thought, and culture from 1865 to the present. Cross-listed as HST 334. Credit is allowed for only AFS 364 or HST 334.
General Studies: SB, C, H

AFS 366 African Archaeology: Precolonial Urban Culture. (3)
fall and spring
Overview of African civilization from the last 10,000 years up to 1850 via archaeological, documentary, and oral data. Lecture, discussion. Cross-listed as ASB 366. Credit is allowed for only AFS 366 or ASB 366.
General Studies: SB, G, H

AFS 370 Family, Ethnic, and Cultural Diversity. (3)
fall and spring
Integrative approach to understanding historical and current issues related to the structure and internal dynamics of diverse American families. Lecture, discussion. Cross-listed as FAS 370. Credit is allowed for only AFS 370 or FAS 370. Prerequisite: PGS 101 or SOC 101.
General Studies: SB, C

AFS 466 Peoples and Cultures of Africa. (3)
fall and spring
Survey of African peoples and their cultures, external contact, and changes. Meets non-Western requirement. Lecture, discussion. Cross-listed as ASB 466. Credit is allowed for only AFS 466 or ASB 466.
General Studies: SB, G, H

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Department of Anthropology

www.asu.edu/clas/anthropology
480/965-6213
ANTH 233

John K. Chance, Chair

Regents' Professors: Clark, Turner

Professors: Bahr, Barton, Brandt, Carr, Chance, Cowgill, Eder, Hudak, Johanson, Kimbel, Kintigh, Koss-Chioino, Marean, Martin, Marzke, Merbs, Nash, B. Nelson, M. Nelson, Redman, Spielmann, Stark, Williams

Associate Professors: Baker, Falconer, Hegmon, Reed, Rice, Welsh

Assistant Professors: Haenn, Isaac, Jonsson, Lockwood, Steadman

Senior Lecturer: Winkelman

Associate Research Professors: Simon, Sugiyama

ANTHROPOLOGY—B.A.

Course Requirements. The Anthropology major consists of a minimum of 39 or 40 semester hours in anthropology and a minimum of six semester hours in related fields in other departments. At least 18 of the semester hours must be in upper-division courses (300–400 level). Three of the six hours in related fields must be in statistics. Related fields are determined by the students in consultation with their advisor. No ASU course is automatically classified as being either related or unrelated. Course requirements for the major are distributed as follows:

Required Introductory Courses

ASB 102 Introduction to Cultural and Social Anthropology *SB, G* 3
ASB 222 Buried Cities and Lost Tribes: Our Human Heritage *HU/SB, G, H* 3
or ASB 223 Buried Civilizations of the Americas *HU/SB, G, H* (3)
ASM 104 Bones, Stones, and Human Evolution *SB/SG* 4

Distribution Requirements

Archaeology 6
Geographic area course in archaeology or physical anthropology 3
Geographic area course in ethnography 3
Upper-division linguistics 3
Physical anthropology 6
Social/cultural 6

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Elective
Anthropology 2–3
Total 39–40

Related Fields
Statistics 3
Approved course 3
Total 45–46

Consultation with the undergraduate advisor and a faculty mentor in the Department of Anthropology is recommended each semester. The anthropology undergraduate advising office is located in ANTH 208.

Course work in anthropology completed at other institutions is evaluated by the undergraduate advisor. The College of Liberal Arts and Sciences requires that transfer students complete at least 12 semester hours of upper-division course work at ASU in the department of their major in order to be eligible for graduation.

In addition to a cumulative GPA of 2.00 or higher, all anthropology students must obtain a minimum grade of "C" in all upper- and lower-division anthropology courses and all related fields.

Each student's Declaration of Graduation and Degree Audit Report, or Program of Study, must be reviewed and approved by the anthropology undergraduate advisor.

Introductory, Distribution, and Related Fields Requirements

Consult with an anthropology undergraduate advisor for semester course description booklets and semester schedules, which indicate the regular and omnibus courses being offered. No courses may be used to fulfill more than one Anthropology major or minor requirement.

Required Introductory Courses
ASB 102 Introduction to Cultural and Social Anthropology *SB, G* 3
ASB 222 Buried Cities and Lost Tribes: Our Human Heritage *HU/SB, G, H* 3
or ASB 223 Buried Civilizations of the Americas *HU/SB, G, H* (3)
ASM 104 Bones, Stones, and Human Evolution *SB/SG* 4

Distribution Requirements
Linguistics
One course chosen from the following list* 3
- ASB 480 Introduction to Linguistics *SB* (3)
- ASB 481 Language and Culture *SB* (3)
- ASB 483 Sociolinguistics and the Ethnography of Communication *SB* (3)

Sociocultural
Two courses chosen from the following list* (minimum hours) 6
- ASB 202 Ethnic Relations in the United States *C, H* (3)
- ASB 211 Women in Other Cultures *HU/SB, G* (3)
- ASB 311 Principles of Social Anthropology *SB* (3)
- ASB 314 Comparative Religion (3)
- ASB 350 Anthropology and Art (3)
- ASB 351 Psychological Anthropology *SB* (3)
- ASB 353 Death and Dying in Cross-Cultural Perspective *HU/SB, G* (4)
- ASB 412 History of Anthropology *L/SB* (3)
- ASB 416 Economic Anthropology *L/SB* (3)
- ASB 417 Political Anthropology (3)

Archaeology
Two courses chosen from the following list* (minimum hours) 6
- ASB 231 Archaeological Field Methods *SG* (4)
- ASB 326 Human Impacts on Ancient Environments *SB, H* (3)
- ASB 330 Principles of Archaeology *SB* (3)
- ASB 335 Prehistory of the Southwest *SB, C, H* (3)
- ASB 337 Pre-Hispanic Civilization of Middle America *HU/SB, G, H* (3)
- ASB 338 Archaeology of North America *SB, H* (3)
- ASB 361 Old World Prehistory I *H* (3)
- ASB 362 Old World Prehistory II *H* (3)
- ASM 338 Anthropological Field Session (2–8)
- ASM 365 Laboratory Methods in Archaeology (4)
- ASM 435 Archaeological Pollen Analysis (3)
- ASM 472 Archaeological Ceramics (3)

Physical Anthropology
Two courses chosen from the following list* (minimum hours) 6
- ASM 246 Human Origins (3)
- ASM 301 Peopling of the World *SB* (3)
- ASM 341 Human Osteology (4)
- ASM 342 Human Biological Variation *SG* (4)
- ASM 343 Primatology (3)
- ASM 344 Fossil Hominids *H* (3)
- ASM 345 Disease and Human Evolution (3)
- ASM 348 Social Issues in Human Genetics *SB* (3)
- ASM 452 Dental Anthropology *SG* (4)
- ASM 454 Comparative Primate Anatomy (4)
- ASM 455 Primate Behavior Laboratory *L* (3)

Geographic Area Courses

Archaeology or Physical Anthropology
One course chosen from the following list* 3
- ASB 333 New World Prehistory *L/SB* (3)
- ASB 335 Prehistory of the Southwest *SB, C, H* (3)
- ASB 337 Pre-Hispanic Civilization of Middle America *HU/SB, G, H* (3)
- ASB 338 Archaeology of North America *SB, H* (3)
- ASB 361 Old World Prehistory I *H* (3)
- ASB 362 Old World Prehistory II *H* (3)
- ASM 301 Peopling of the World *SB* (3)

Ethnographic
One course chosen from the following list* 3
- ASB 319 The North American Indian (3)
- ASB 321 Indians of the Southwest *L/SB, C, H* (3)
- ASB 322 Peoples of Mesoamerica *SB, G* (3)
- ASB 323 Indians of Latin America *SB, G* (3)
- ASB 324 Peoples of the Pacific *G* (3)
- ASB 325 Peoples of Southeast Asia *G* (3)
- ASB 485 U.S.-Mexico Border in Comparative Perspective (3)

Anthropology Elective
Any anthropology course (minimum) 2–3
Total 39–40

Related Fields (six semester hours)
One lower- or upper-division statistics course in mathematics, sociology, psychology, political science, or history 3
One course from a field related to but outside of anthropology chosen with advisor 3

* Consult with an anthropology undergraduate advisor for courses not listed above that may fulfill distribution requirements.

MINOR IN ANTHROPOLOGY

The Anthropology minor requires a minimum of 18 semester hours. Two of the introductory courses—from ASB 102, ASM 104, and ASB 222 or 223—are required. The particular introductory courses selected may limit the anthropology courses available in the upper division however. Twelve semester hours must be upper division and represent at least two of the three subfields of anthropology. The three subfields are:

1. sociocultural anthropology (with linguistics);
2. archaeology; and
3. physical anthropology.

The courses chosen to represent two of the three subfields must be drawn from the "Distribution Requirements" table, page 325, of those two subfields. A minimum grade of "C" is required for all courses taken for the minor in Anthropology.

The minor in Anthropology provides students with a great deal of flexibility in selecting courses. The program has been designed to allow students to focus on areas within the discipline which articulate well with their major. All students interested in the Anthropology minor are encouraged to discuss the options available with an anthropology undergraduate advisor.

B.I.S. CONCENTRATION

For students pursuing the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a concentration in anthropology requires 24 or 25 semester hours. All three of the introductory courses—ASB 102, ASM 104, and ASB 222 or 223—are required. Fifteen semester hours must be upper division and represent two of the three subfields:

1. sociocultural anthropology (with linguistics);
2. archaeology; and
3. physical anthropology.

The courses chosen to represent the two subfields must be drawn from the "Distribution Requirements" table, page 325. A minimum grade of "C" is required for all courses taken for the minor in Anthropology for B.I.S. students.

CERTIFICATES

Latin American Studies Certificate or Emphasis. Students majoring in Anthropology may elect to pursue a Latin American Studies Certificate or emphasis, combining courses from the major with selected outside courses of wholly Latin American content. For more information, see "Latin American Studies," page 317.

Certificate in Museum Studies. See the *Graduate Catalog* or contact the Department of Anthropology for more information.

GRADUATE PROGRAM

The faculty in the Department of Anthropology offer programs leading to the M.A. and Ph.D. degrees. See the *Graduate Catalog* for requirements.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

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.

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 or 25 semester hours in anthropology. Courses ASB 102 and ASM 104 and two upper-division courses in each subfield (archaeology, physical anthropology, and sociocultural anthropology) are required.

For more information, call the Office of Student Services in the College of Education at 480/965-5555.

ANTHROPOLOGY (SOCIAL AND BEHAVIORAL) (ASB)

ASB 102 Introduction to Cultural and Social Anthropology. (3)
fall and spring
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

ASB 202 Ethnic Relations in the United States. (3)
fall and spring
Processes of intercultural relations; systems approach to history of U.S. interethnic relations; psychocultural analysis of contemporary U.S. ethnic relations. Lecture, discussion. Cross-listed as AFS 202. Credit is allowed for only AFS 202 or ASB 202.
General Studies: C, H

ASB 210 Sex, Marriage, and Evolution. (3)
selected semesters
Examines the sexual nature and behavior of humans from both a biological and an anthropological point of view.

ASB 211 Women in Other Cultures. (3)
selected semesters
Cross-cultural analysis of the economic, social, political, and religious factors that affect women's status in traditional and modern societies.
General Studies: HU/SB, G

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ASB 222 Buried Cities and Lost Tribes: Our Human Heritage. (3)
spring
Archaeology through its most important discoveries: human origins, Pompeii, King Tut, the Holy Land, Southwest Indians, and methods of field archaeology.
General Studies: HU/SB, G, H

ASB 223 Buried Civilizations of the Americas. (3)
fall and spring
Archaeology through examination of several ancient civilizations of Meso-, South, and North America.
General Studies: HU/SB, G, H

ASB 231 Archaeological Field Methods. (4)
spring
Excavation of archaeological sites and recording and interpretation of data. Includes local field experience. 2 hours lecture, 8 hours lab. Prerequisite: ASM 104 or instructor approval.
General Studies: SG

ASB 240 Introduction to Southeast Asia. (3)
fall
Interdisciplinary introduction to the cultures, religions, political systems, geography, and history of Southeast Asia. Cross-listed as GCU 240/HST 240/POS 240/REL 240. Credit is allowed for only ASB 240 or GCU 240 or HST 240 or POS 240 or REL 240.
General Studies: G

ASB 242 Asian American Experiences: An Anthropological Perspective. (3)
fall
Historical and contemporary experiences of Asian Americans in terms of the anthropological concepts of culture, ethnicity, and adaptation. Prerequisite: ENG 101 or 105.
General Studies: L, C

ASB 250 Anthropology Topics. (3)
selected semesters
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 104 (or its equivalent); completion of the First-Year Composition requirement.
General Studies: L

ASB 252 Anthropology of Sports. (3)
fall and spring
Cross-cultural examination of symbolic and social dimensions of sports past and present.

ASB 302 Ethnographic Field Study in Mexico. (3)
summer
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: SPA 101 (or its equivalent).
General Studies: L/SB, G

ASB 311 Principles of Social Anthropology. (3)
spring
Comparative analysis of domestic groups and economic and political organizations in primitive and peasant societies.
General Studies: SB

ASB 314 Comparative Religion. (3)
fall and spring
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.

ASB 319 The North American Indian. (3)
once a year
Archaeology, ethnology, and linguistic relationship of the Indians of North America. Does not include Middle America. Prerequisite: ASB 102 or instructor approval.

ASB 320 Indians of Arizona. (3)
selected semesters
Traditional cultures and the development and nature of contemporary political, economic, and educational conditions among Arizona Indians.

ASB 321 Indians of the Southwest. (3)
spring
Cultures of the contemporary Indians of the southwestern United States and their historic antecedents. Prerequisite: ASB 102 or instructor approval.
General Studies: L/SB, C, H

ASB 322 Peoples of Mesoamerica. (3)
once a year
Indigenous, mestizo, and national cultures, rural and urban peoples. Lecture, discussion, video. Prerequisite: ASB 102 or instructor approval.
General Studies: SB, G

ASB 323 Indians of Latin America. (3)
fall
Indigenous cultures of the Amazon, the Andean region, Central America, and southern Mexico. Lecture, discussion. Prerequisite: ASB 102 or instructor approval.
General Studies: SB, G

ASB 324 Peoples of the Pacific. (3)
selected semesters
Peoples and cultures of Oceania focusing particularly on societies of Melanesia, Micronesia, and Polynesia. Prerequisite: ASB 102 or instructor approval.
General Studies: G

ASB 325 Peoples of Southeast Asia. (3)
fall
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

ASB 326 Human Impacts on Ancient Environments. (3)
spring
World survey of successful and unsuccessful ancient societies and their impacts on the environment.
General Studies: SB, H

ASB 327 Action Anthropology. (3)
fall
Explores contemporary issues and problem solving in Cuna, Micronesia, Mayan, and U.S. Latino communities, through applied anthropology and community initiatives.

ASB 330 Principles of Archaeology. (3)
fall and spring
Methods and theories for reconstructing and explaining the lifeways of prehistoric peoples. Prerequisite: 3 hours in archaeology.
General Studies: SB

ASB 333 New World Prehistory. (3)
fall
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: L/SB

ASB 335 Prehistory of the Southwest. (3)
fall and spring
Anthropological understandings of major cultural processes and events in the prehistory of the American Southwest using evidence from archaeology.
General Studies: SB, C, H

ASB 337 Pre-Hispanic Civilization of Middle America. (3)
spring
Preconquest cultures and civilizations of Mexico. The Aztecs, Mayas, and their predecessors. Prerequisite: ASM 104 or instructor approval.
General Studies: HU/SB, G, H

ASB 338 Archaeology of North America. (3)
selected semesters
Origin, spread, and development of the prehistoric Indians of North America up to the historic tribes. Does not include the Southwest. Prerequisite: ASM 104 or instructor approval.
General Studies: SB, H

ASB 350 Anthropology and Art. (3)
once a year
Art forms of people in relationship to their social and cultural setting. Prerequisite: ASB 102 or instructor approval.

ASB 351 Psychological Anthropology. (3)
spring
Approaches to the interrelations between the personality system and the sociocultural environment. Prerequisite: ASB 102 or instructor approval.
General Studies: SB

ASB 353 Death and Dying in Cross-Cultural Perspective. (4)
fall
Humanistic and scientific study of aging, sickness, dying, death, funerals, and grief and their philosophy and ecology in non-Western and Western cultures. 3 hours lecture, 1 hour discussion.
General Studies: HU/SB, G

ASB 355 Shamanism, Healing, and Consciousness. (3)
spring
World views, practices, and roles of shamans and traditional and contemporary healers; explanatory biopsychological models of consciousness.
General Studies: HU/SB

ASB 361 Old World Prehistory I. (3)
fall
Biosocial evolution in the Pleistocene, emphasizing technological achievements and the relationship between technology and environment in western Europe, sub-Saharan Africa. Prerequisite: ASM 104 or instructor approval.
General Studies: H

ASB 362 Old World Prehistory II. (3)
spring
Transition from hunting and collecting societies to domestication economies; establishment of settled village life, emphasizing the Near East, Egypt, Southwest Europe. Prerequisite: ASM 104 or instructor approval.
General Studies: H

ASB 366 African Archaeology: Precolonial Urban Culture. (3)
fall and spring
Overview of African civilization from the last 10,000 years up to 1850 via archaeological, documentary, and oral data. Lecture, discussion. Cross-listed as AFS 366. Credit is allowed for only AFS 366 or ASB 366.
General Studies: SB, G, H

ASB 400 Cultural Factors in International Business. (3)
spring
Anthropological perspectives on international business relations; applied principles of cross-cultural communication and management; regional approaches to culture and business.
General Studies: G

ASB 412 History of Anthropology. (3)
fall
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: L/SB

ASB 416 Economic Anthropology. (3)
fall
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: L/SB

ASB 417 Political Anthropology. (3)
selected semesters
Comparative examination of the forms and processes of political organization and activity in primitive, peasant, and complex societies. Prerequisite: ASB 102 or instructor approval.

ASB 462 Medical Anthropology: Culture and Health. (3)
fall
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

ASB 466 Peoples and Cultures of Africa. (3)
fall and spring
Survey of African peoples and their cultures, external contact, and changes. Meets non-Western requirement. Lecture, discussion. Cross-listed as AFS 466. Credit is allowed for only AFS 466 or ASB 466.
General Studies: SB, G, H

ASB 471 Introduction to Museums. (3)
fall
History, philosophy, and current status of museums. Explores collecting, preservation, exhibition, education, and research activities in different types of museums. Prerequisites: both ASB 102 and ASM 104 or only instructor approval.
General Studies: L

ASB 480 Introduction to Linguistics. (3)
fall and spring
Descriptive and historical linguistics. Survey of theories of human language, emphasizing synchronic linguistics.
General Studies: SB

ASB 481 Language and Culture. (3)
spring
Applies linguistic theories and findings to nonlinguistic aspects of culture; language change; psycholinguistics. Prerequisite: ASB 102 or instructor approval.
General Studies: SB

ASB 483 Sociolinguistics and the Ethnography of Communication. (3)
selected semesters
Relationships between linguistic and social categories; functional analysis of language use, maintenance, and diversity; interaction between verbal and nonverbal communication. Prerequisites: both ASB 480 and ENG 213 (or FLA 400) or only instructor approval.
General Studies: SB

ASB 485 U.S.-Mexico Border in Comparative Perspective. (3)
spring in odd years
Explores the multicultural and social dimensions of communities along the U.S.-Mexico border, emphasizing social organization, migration, culture, and frontier ideology. Prerequisite: 6 hours in anthropology or instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ANTHROPOLOGY (SCIENCE AND MATHEMATICS) (ASM)

ASM 104 Bones, Stones, and Human Evolution. (4)
fall and spring
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. Lecture, lab.
General Studies: SB/SG

ASM 241 Biology of Race. (3)
fall and spring
Human variation and its interpretation in an evolutionary context.

ASM 246 Human Origins. (3)
fall
History of discoveries and changing interpretations of human evolution. Earliest ancestors to emergence of modern humans. Humanity's place in nature.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ASM 248 Bioarchaeology of Cannibalism, Violence, and Social Pathology. (3)
spring
Worldwide review of claims of severely abnormal behavior in prehistory based on perimortem bone taphonomy, analogues, and comparative cases. Lecture, class demonstrations.

ASM 301 Peopling of the World. (3)
fall
Reviews all evidence for human dispersal during the last 100,000 years, origins of language, cultures, races, and beginnings of modern humans. Prerequisite: ASM 104.
General Studies: SB

ASM 338 Anthropological Field Session. (2–8)
spring
Anthropological field techniques, analysis of data, and preparation of field reports. May be repeated for credit. Prerequisite: instructor approval.

ASM 341 Human Osteology. (4)
fall
Osteology, human paleontology, and osteometry. Description and analysis of archaeological and contemporary human populations. 3 hours lecture, 3 hours lab. Prerequisite: ASM 104 or instructor approval.

ASM 342 Human Biological Variation. (4)
spring
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: both ASM 104 and MAT 106 (or its equivalent) or only instructor approval.
General Studies: SG

ASM 343 Primatology. (3)
fall
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 104 or instructor approval.

ASM 344 Fossil Hominids. (3)
once a year
Ancient African, Asian, and European human and primate skeletal, dental, and cultural remains. Human biological, behavioral, and cultural evolution. Prerequisite: ASM 104 or instructor approval.
General Studies: H

ASM 345 Disease and Human Evolution. (3)
fall
Interaction of people and pathogens from prehistoric times to the present, with emphasis on disease as an agent of genetic selection. Prerequisite: ASM 104 or instructor approval.

ASM 348 Social Issues in Human Genetics. (3)
spring
Moral and social implications of developments in genetic science, particularly as they affect reproduction, medicine, and evolution.
General Studies: SB

ASM 365 Laboratory Methods in Archaeology. (4)
selected semesters
Techniques of artifact analysis. Basic archaeological research techniques; methods of report writing. May be repeated for credit for total of 8 hours. Prerequisite: ASM 104 or instructor approval.

ASM 435 Archaeological Pollen Analysis. (3)
selected semesters
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.

ASM 448 Geoarchaeology. (3)
fall and spring
Geologic context relevant to archaeological research. Topics include sediments, deposition environments, soils, anthropogenic and biogenic deposits, and quaternary chronology. Lecture, discussion, field experiences. Prerequisites: ASB 222 (or 223) or GLG 101 (or 103) or GPH 111; instructor approval.

ASM 450 Bioarchaeology. (3)
spring
Surveys archaeological and physical anthropological methods and theories for evaluating skeletal and burial remains to reconstruct biocultural adaptation and lifeways. Prerequisite: ASM 104 or instructor approval.

ASM 452 Dental Anthropology. (4)
fall
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: SG

ASM 454 Comparative Primate Anatomy. (4)
spring
Functional anatomy of the cranial, dental, and locomotor apparatus of primates, including humans, emphasizing the relation of morphology to behavior and environment. 3 hours lecture, 3 hours lab, dissections, demonstrations. Prerequisite: instructor approval.

ASM 455 Primate Behavior Laboratory. (3)
selected semesters
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: L

ASM 456 Infectious Disease and Human Evolution. (3)
once a year
Study of infectious disease and humanity, using evidence from anthropology, history, medicine, and ancient skeletons. Prerequisite: ASM 345.

ASM 465 Quantification and Analysis for Anthropologists. (3)
spring
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.

ASM 472 Archaeological Ceramics. (3)
selected semesters
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.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Biology

School of Life Sciences

lifesciences.asu.edu
480/965-3571
LSC 226

Regents' Professors: Alcock, Maienschein

Professors: Capco, Chandler, Church, Collins, Dowling, Elser, Faeth, Fisher, Grimm, Harrison, Hazel, Hedrick, Lawson, McGaughey, Moore, Ohmart, Pyne, Rutowski, Satterlie, Smith, Walsberg

Associate Professors: Deviche, Fewell, Fouquette, Goldstein, Kumar, Orchinik

Assistant Professors: Anderies, DeNardo, Gerber, Kaye, Kinzig, Laubichler, Newfeld, Rawls, Rosenberg, Sabo, Wilson-Rawls

Senior Research Professional: Kazilek

Research Professors: Davidson, Pearson

Assistant Research Professors: Hope, Neuer

Assistant Research Scientist: Lyubchenko

Effective July 2003, the Departments of Biology, Microbiology, and Plant Biology merge to become the School of Life Sciences.

BIOLOGY—B.S.

The major in Biology consists of a minimum of 37 semester hours in biology, and a minimum of 20 semester hours in related fields, plus a three-semester-hour mathematics proficiency. Required major courses are as follows:

BIO 187 General Biology I *SG* 4
BIO 188 General Biology II *SQ* 4
Choose one of the courses below 3–4
  BIO 320 Fundamentals of Ecology (3)
  BIO 331 Animal Behavior (3)
  BIO 370 Vertebrate Zoology (4)
  BIO 385 Comparative Invertebrate Zoology (4)
  MIC 220 Biology of Microorganisms (3)
  PLB 300 Comparative Plant Diversity *L/SG* (4)
BIO 340 General Genetics 4
  or BIO 341 Genetic Analysis (5)
BIO 345 Organic Evolution 3
Choose one of the courses below 3–4
  BIO 351 Developmental Anatomy (3)
  BIO 353 Cell Biology (3)
  MIC 360 Bacterial Physiology (3)
  PLB 308 Plant Physiology (4)
Total 21–24

The remaining hours to bring the total to 37 are selected from among upper-division courses, approved for major credit, in BIO, MIC, PLB, and approved BCH courses, in consultation with an advisor. The major must include at least three upper-division laboratory courses. Required courses in related fields plus math proficiency are as follows:

CHM 113 General Chemistry *SQ* 4
CHM 115 General Chemistry with Qualitative Analysis *SQ* 5
Choose between the combinations of organic chemistry courses below ..... 4 or 8
  CHM 231 Elementary Organic Chemistry *SQ*[1] (3)
  CHM 235 Elementary Organic Chemistry Laboratory *SQ*[1] (1)
  — *or* —
  CHM 331 General Organic Chemistry (3)
  CHM 332 General Organic Chemistry (3)
  CHM 335 General Organic Chemistry Laboratory (1)
  CHM 336 General Organic Chemistry Laboratory (1)
MAT 251 Calculus for Life Sciences *MA* 3
  or MAT 210 Brief Calculus *MA* (3)
  or any other calculus
Choose between the combinations of introduction to physics courses below ..... 4 or 8
  PHY 101 Introduction to Physics *SQ* (4)
  — *or* —
  PHY 111 General Physics *SQ*[2] (3)
  PHY 112 General Physics *SQ*[2] (3)
  PHY 113 General Physics Laboratory *SQ*[2] (1)
  PHY 114 General Physics Laboratory *SQ*[2] (1)
STP 226 Elements of Statistics *CS* 3
  or STP 294 ST: Statistics for Biosciences (3)
Total ..... 23 or 31

[1] Both CHM 231 and 235 must be taken to secure SQ credit.
[2] Both PHY 111 and 113 or PHY 112 and 114 must be taken to secure SQ credit.

CONSERVATION BIOLOGY—B.S.

The major in Conservation Biology consists of a minimum of 41 semester hours in the required major courses and a minimum of 16 hours in related fields, plus a three-semester-hour mathematics proficiency. Required courses are as follows:

BIO 187 General Biology I *SG* 4
BIO 188 General Biology II *SQ* 4
BIO 317 Conservation Biology 3
BIO 320 Fundamentals of Ecology 3
BIO 340 General Genetics 4
  or BIO 341 Genetic Analysis (5)
BIO 360 Animal Physiology 3
BIO 410 Techniques in Wildlife Conservation Biology *L* 3
BIO 411 Advanced Conservation Biology I 3
BIO 412 Advanced Conservation Biology II 3
Total ..... 30 or 31

The remaining hours to bring the total to 41 are selected from among relevant upper-division courses in BIO and PLB courses or in related departments, in consultation with

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

an advisor. Required courses in related fields plus math proficiency are as follows:

CHM	113	General Chemistry *SQ* 4
CHM	115	General Chemistry with Qualitative Analysis *SQ* 5
		Choose between the combinations of organic chemistry courses below ..... 4 or 8
		CHM 231 Elementary Organic Chemistry *SQ** (3)
		CHM 235 Elementary Organic Chemistry Laboratory *SQ** (1)
		— *or* —
		CHM 331 General Organic Chemistry (3)
		CHM 332 General Organic Chemistry (3)
		CHM 335 General Organic Chemistry Laboratory (1)
		CHM 336 General Organic Chemistry Laboratory (1)
MAT	251	Calculus for Life Sciences *MA* 3
		or MAT 210 Brief Calculus *MA* (3)
		or any other calculus
STP	226	Elements of Statistics *CS* 3
		or STP 294 ST: Statistics for Biosciences (3)
Total		..... 19 or 23

* Both CHM 231 and 235 must be taken to secure SQ credit.

Concentration in Biology and Society

The major in Biology with a concentration in biology and society is intended for students with a strong interest in life sciences and in the interaction between life sciences and the society within which science is done. This option consists of a minimum of 44 semester hours in life sciences and societal interface courses, and 12 hours in related fields, plus a three-semester-hour mathematics proficiency. Required courses are as follows:

BIO	187	General Biology I *SG* 4
BIO	188	General Biology II *SQ* 4
BIO	311	Biology and Society 3
BIO	314	Research Colloquium in Biology and Society I *L* 2
BIO	320	Fundamentals of Ecology 3
		or BIO 345 Organic Evolution (3)
BIO	340	General Genetics 4
		or BIO 341 Genetic Analysis (5)
BIO	414	Research Colloquium in Biology and Society II *L* 1
BIO	493	Honors Thesis 3
		or BIO 495 Undergraduate Thesis (3)
		or BIO 499 Individualized Instruction (3)
		or approved hours in research (3)
MAT	251	Calculus for Life Sciences *MA* 3
		or MAT 210 Brief Calculus *MA* (3)
		or any other calculus
Total		 27

The remaining courses to complete the major are determined by the student in consultation with an advisor and must be distributed in the following areas:

1. 12 hours of upper-division electives from BIO, MIC, PLB;
2. 12 hours of upper-division interface courses from an approved list. At least three semester hours in each of these areas: ethics, history and philosophy of science, and contemporary societal issues;
3. 11 hours of physical sciences (CHM recommended); and
4. three to four hours of an approved course in statistics.

MINOR IN BIOLOGY

The Biology minor consists of 24 semester hours, including BIO 187 General Biology I and BIO 188 General Biology II, and 16 hours selected with approval of an advisor; at least 12 hours must be in the upper division. Courses not available for credit in the Life Sciences major (BIO, MBB, MIC, and PLB) cannot be used for the minor (e.g., BIO 100 The Living World and BIO 201 Human Anatomy and Physiology I). This minor is not available to students majoring in the life sciences.

B.I.S. CONCENTRATION

A concentration in biology is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

Biological Sciences. 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	187	General Biology I *SG* 4
BIO	188	General Biology II *SQ* 4
BIO	320	Fundamentals of Ecology 3
BIO	340	General Genetics 4
		or BIO 341 Genetic Analysis (5)
BIO	345	Organic Evolution 3
BIO	360	Animal Physiology 3
BIO	370	Vertebrate Zoology 4
		or BIO 385 Comparative Invertebrate Zoology (4)
		or PLB 300 Comparative Plant Diversity *L/SG* (4)
		or PLB 310 The Flora of Arizona (4)
MIC	205	Microbiology *SG* 3
		or MIC 220 Biology of Microorganisms (3)
MIC	206	Microbiology Laboratory *SG** 1
PLB	308	Plant Physiology 4
Total		..... 33 or 34

* Both MIC 205 and 206 must be taken to secure SG credit.

The remaining courses in the major (six hours minimum) should be selected to reflect a balance between BIO, MIC, and PLB courses. Required supporting courses are as follows:

BIO	316 History of Biology: Conflicts and Controversies *H*	3
	or HPS 330 History of Biology: Conflicts and Controversies *H* (3)	
CHM	113 General Chemistry *SQ*	4
CHM	115 General Chemistry with Qualitative Analysis *SQ*	5
	or CHM 116 General Chemistry *SQ* (4)	
GLG	102 Introduction to Geology II (Historical) *SG*,[1] *H*	3
	or GLG 300 Geology of Arizona (3)	
MAT	170 Precalculus *MA*	3
PHY	101 Introduction to Physics *SQ*	4
	or PHY 111, 112 General Physics *SQ*[2] (6)	
	and PHY 113, 114 General Physics Laboratory *SQ*[2] (2)	
Minimum total		22

[1] Both GLG 102 and 104 must be taken to secure SG credit.

[2] Both PHY 111 and 113 or PHY 112 and 114 must be taken to secure SQ credit.

BIO 480 Methods of Teaching Biology and BIO 482 Advanced Methods of Teaching Biology are required in the professional education program.

The minor teaching field consists of 24 semester hours as follows: BIO 187, 188; 16 additional hours in BIO, MIC, and PLB 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.

GRADUATE PROGRAM

The Biology faculty offer programs leading to the degrees of Master of Natural Science, M.S., and Ph.D. (with a concentration in ecology for the M.S. and the Ph.D.). See the *Graduate Catalog* for requirements. A combined B.S.-M.S. degree in Biology is also available.

The department participates in the interdisciplinary program for the M.S. and Ph.D. degrees in Molecular and Cellular Biology. See the *Graduate Catalog* for more information.

DEPARTMENTAL ASSESSMENT

Biology faculty work continuously to assess and improve the effectiveness of the academic programs. To accomplish this, the department conducts, coordinates, and manages research designed to measure the degree to which courses, curricula, and academic programs impart knowledge to students. This research is conducted through student surveys, interviews, review of student records, and other common educational research methods. The results of these studies, or assessments, are used to enhance the intellectual integrity of a biology education.

BIOLOGY (BIO)

BIO 100 The Living World. (4)
fall, spring, summer
Principles of biology. Cannot be used for major credit in the biological sciences. 3 hours lecture, 3 hours lab.
General Studies: SQ

BIO 120 Human Physiology. (4)
selected semesters
Discusses basic concepts of general science using current issues and basic concepts of human physiology as a focus. Cannot be used for major credit in biological sciences. 3 hours lecture, 3 hours lab.
General Studies: SG

BIO 187 General Biology I. (4)
fall, spring, summer
Biological concepts emphasizing principles and interplay of structure and function at the organismal, population, and community levels; includes ecology, evolution. Lecture, lab. Fee. Prerequisite: life science or health-related sciences major.
General Studies: SG

BIO 188 General Biology II. (4)
fall, spring, summer
Biological concepts emphasizing principles and interplay of structure and function at the molecular, cellular, and organismal levels; includes genetics, cell biology, physiology. Lecture, lab. Fee. Prerequisite: BIO 187 recommended.
General Studies: SQ

BIO 193 The Nature of Biological Science. (4)
selected semesters
Creative and critical thinking skills in biological research; nature of biological knowledge; role of experimentation, predictions, hypotheses, theories, values. Lecture, lab, discussion. Fee. Prerequisite: high school biology.
General Studies: SQ

BIO 201 Human Anatomy and Physiology I. (4)
fall, spring, summer
Structure and dynamics of the human mechanism. Cannot be used for major credit in the biological sciences. 3 hours lecture, 3 hours lab. Fee.
General Studies: SG

BIO 202 Human Anatomy and Physiology II. (4)
fall, spring, summer
Continuation of BIO 201. Cannot be used for major credit in the biological sciences. 3 hours lecture, 3 hours lab. Fee. Prerequisite: BIO 201 or instructor approval.

BIO 218 Medical History. (1)
selected semesters
Brief survey of humankind's important inventions and discoveries in the art and science of medicine, illustrating interrelationships of medical ideas.

BIO 241 Human Genetics. (4)
fall
Introduces basic concepts in genetics as they are applied to human heredity. Cannot be used for major credit in the biological sciences. 3 hours lecture, 3 hours lab. Prerequisite: a course in the life sciences.
General Studies: SG

BIO 300 Natural History of Arizona. (3)
selected semesters
Plant and animal communities of Arizona. Cannot be used for major credit in the biological sciences. Prerequisite: junior standing.

BIO 301 Field Natural History. (1)
selected semesters
Organisms and their natural environment. Cannot be used for major credit in the biological sciences. 2 weekend field trips, field project. Fee. Pre- or corequisite: BIO 300.

BIO 302 Cancer and Heart Disease. (3)
fall
Incidence and mortality statistics for cancer and heart disease; host and environmental risk factors; diagnosis, treatment and prevention strategies. Cannot be counted toward a Biology major. Prerequisites: a combination of CHM 231 (or its equivalent) and 12 hours in life sciences and a General Studies L course or only instructor approval.
General Studies: L

BIO 303 Radiation and Life. (3)
spring
Benefits and risks of radiation exposure in society; medical applications, food irradiation, nuclear power, solar UV, population health effects. Cannot be counted toward a Biology major. Prerequisites: a combination of CHM 231 (or its equivalent) and 12 hours in life sciences and a General Studies L course or only instructor approval.
General Studies: L

BIO 304 Radiation Medicine and Biology. (3)
fall
Uses of radiation in medicine, including CT, diagnostic x rays, MRI, nuclear medicine, ultrasound; biological effects of radiation with emphasis on cancer. Prerequisites: a combination of PHY 112 and 12 hours in life sciences and a General Studies L course or only instructor approval.
General Studies: L

BIO 310 Special Problems and Techniques. (1–3)
fall and spring
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.

BIO 311 Biology and Society. (3)
fall
Explores interactions between biological sciences and society, e.g., biomedical, environmental, ethical, historical, legal, philosophical, political, and social issues. Lecture, discussion. Cross-listed as HPS 340. Credit is allowed for only BIO 311 or HPS 340. Prerequisites: both BIO 187 and 188 or only BIO 193 (or 100).

BIO 314 Research Colloquium in Biology and Society I. (2)
spring
Develops critical thinking abilities, research methods, and writing skills for research in the interactions between biological sciences and society. Lecture, discussion. Prerequisite: BIO 311 or instructor approval.
General Studies: L (if credit also earned in BIO 414)

BIO 316 History of Biology: Conflicts and Controversies. (3)
selected semesters
Focuses on 19th and 20th centuries, considering biology as a discipline. Evolution, problems of heredity, development, and cell theory. Cross-listed as HPS 330. Credit is allowed for only BIO 316 or HPS 330.
General Studies: H

BIO 317 Conservation Biology. (3)
fall
Scientific and technical means for management, maintenance, protection, and restoration of biological resources on this planet. Prerequisite: 8 hours in biology.

BIO 318 History of Medicine. (3)
once a year
Scientific study of the human body, changing theories of disease, evolution of practical opinions on treatment, and the emerging institutionalization of medical practice. Cross-listed as HPS 331. Credit is allowed for only BIO 318 or HPS 331.
General Studies: H

BIO 319 Environmental Science (Nonmajor). (3)
fall
Environmental and biological concepts used to understand ecological systems with specific references to problems caused by humans. Cannot be used for major credit in the biological sciences. Cross-listed as PLB 320. Credit is allowed for only BIO 319 or PLB 320.
General Studies: G

BIO 320 Fundamentals of Ecology. (3)
fall and spring
Organization, functioning, and development of ecological systems; energy flow; biogeochemical cycling; environmental relations; population dynamics. Prerequisite: BIO 187 or instructor approval.

BIO 321 Introductory Ecology Laboratory. (3)
once a year
Laboratory and field observations and experiments to test current concepts and theories in ecology. Lab. Fee. Pre- or corequisite: BIO 320.
General Studies: L

BIO 331 Animal Behavior. (3)
fall
Evolutionary, genetic, physiological, and ecological bases of animal behavior. Prerequisite: BIO 187 (or its equivalent).

BIO 336 Sociobiology. (3)
selected semesters
Survey of animal and human social behavior examined from an evolutionary perspective. Suitable for nonmajors. Prerequisite: BIO 331 recommended.

BIO 340 General Genetics. (4)
fall, spring, summer
Science of heredity and variation. 3 hours lecture, 1 hour recitation. Prerequisite: BIO 187.

BIO 341 Genetic Analysis. (5)
selected semesters
General genetics: science of heredity and variation using critical inquiry. Not open to students with credit for BIO 340. 3 hours lecture, 6 hours lab. Prerequisites: BIO 187 and 193 (or their equivalents).

BIO 342 General Genetics Laboratory. (2)
fall
Explores general principles of inheritance with special reference to Mendelian, molecular, and computational genetics via laboratory experiments. Lab. Pre- or corequisite: BIO 340.

BIO 343 Genetic Engineering and Society. (4)
fall
Introduces genetic engineering, with emphasis on applications (gene therapy, DNA fingerprinting, bioremediation, transgenic animals and plants). 3 hours lecture, 3 hours lab. Cross-listed as MBB 343. Credit is allowed for only BIO 343 or MBB 343. Fee. Prerequisites: preferably both MBB 245 and 246 or only BIO 188 (or its equivalent).
General Studies: L

BIO 344 Origins, Evolution, and Creation. (3)
selected semesters
Examines scientific, mythic, and religious ideas relating to origins (particularly human). Place of antievolutionism and "scientific creationism" in American culture. Lecture, discussion. Cross-listed as HPS 311/HUM 371/REL 383. Credit is allowed for only BIO 344 or HPS 311 or HUM 371 or REL 383.

BIO 345 Organic Evolution. (3)
spring
Processes of adaptive change and speciation in sexual populations. Prerequisite: BIO 187.

BIO 346 The Darwinian Revolution. (3)
selected semesters
Intellectual and cultural history of Darwinism and modern evolutionary theory and their impact on 19th- and 20th-century thought. Lecture, discussion. Cross-listed as HPS 332/HUM 372. Credit is allowed for only BIO 346 or HPS 332 or HUM 372.

BIO 351 Developmental Anatomy. (3)
fall
General developmental biology (embryology) and comparative structure of organ systems, illustrated mainly by vertebrate examples. Prerequisite: BIO 187.

BIO 352 Laboratory in Vertebrate Developmental Anatomy. (2)
fall
Morphology of representative embryonic and adult vertebrates. 2 3-hour labs. Fee. Prerequisites: BIO 187; BIO 351 recommended.

BIO 353 Cell Biology. (3)
fall, spring, summer
Survey of major topics in cell biology, including structural, biochemical, and molecular aspects of cell function. Prerequisite: BIO 187.

BIO 360 Animal Physiology. (3)
fall and spring
Physiological mechanisms of the higher vertebrates. Prerequisites: BIO 187; CHM 115; MAT 117.

BIO 361 Animal Physiology Laboratory. (2)
fall and spring
Experimental laboratory studies of physiological mechanisms in animals and model systems. Lab, recitation. Fee. Prerequisites: CHM 115; MAT 117. Pre- or corequisite: BIO 360.

BIO 370 Vertebrate Zoology. (4)
fall and spring
Characteristics, classification, evolution, and natural history of the major groups of vertebrate animals. 3 hours lecture, 3 hours lab. Fee. Prerequisite: BIO 187.

BIO 385 Comparative Invertebrate Zoology. (4)
fall
Characteristics, life cycles, adaptations, and evolution of invertebrate animals. 3 hours lecture, 3 hours lab. Fee. Prerequisite: BIO 187 or instructor approval.

BIO 386 General Entomology. (4)
selected semesters
Form, activities, and classification of insects. 3 hours lecture, 3 hours lab. Fee. Prerequisite: BIO 187.

BIO 394 Special Topics. (2–3)
selected semesters
Topics of current or special interest in one or more aspects of biology. Topics vary. Prerequisite: junior standing.

BIO 406 Computer Applications in Biology. (3)
fall
Computer analysis techniques in biology emphasizing data entry, management and analysis, and graphic portrayal. Employs mainframe and microcomputers. 2 hours lecture, 3 hours lab. Cross-listed as PLB 432. Credit is allowed for only BIO 406 or PLB 432. Fee. Prerequisites: both BIO 187 and MAT 117 (or 210) or only instructor approval.
General Studies: CS

BIO 410 Techniques in Wildlife Conservation Biology. (3)
fall
Field and analytical techniques used in evaluating population structure, viability and environmental impacts. Lecture, lab. Fee. Prerequisites: both BIO 317 and 320 or only instructor approval.
General Studies: L

BIO 411 Advanced Conservation Biology I. (3)
fall
Principles of conservation science, biology of threatened species, management principles that meet conservation goals, emphasizing North American ecosystems. Prerequisites: BIO 317, 320.

BIO 412 Advanced Conservation Biology II. (3)
spring
Global biodiversity patterns, processes, and conservation; global environmental change; sustainable use of natural resources; emphasizing international approaches to conservation biology. Prerequisites: BIO 317, 320.

BIO 414 Research Colloquium in Biology and Society II. (1)
spring
Further develops critical thinking abilities, research methods, and writing skills for research in the interactions between biological sciences and society. Lecture, discussion. Prerequisites: both BIO 311 and 314 or only instructor approval.
General Studies: L (if credit also earned in BIO 314)

BIO 415 Biometry. (4)
fall
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 College of Liberal Arts and Sciences' General Studies program. 3 hours lecture, 3 hours lab. Fee. Prerequisite: MAT 210 (or its equivalent).
General Studies: CS

BIO 416 Professional Values in Science. (3)
once a year
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. Credit is allowed for only BIO 416 or HPS 410.
General Studies: L

BIO 417 Experimental Design. (3)
spring
Fixed, random, mixed models; crossed and nested factorial designs; balanced and unbalanced data; completely randomized, blocked, repeated measure designs; ANCOVA. Prerequisite: BIO 415 (or its equivalent).

BIO 420 Field Zoology. (3)
selected semesters
Experience in zoological field techniques. Weekend or longer field trips. Prerequisite: instructor approval.

BIO 423 Population and Community Ecology. (3)
selected semesters
Organization and dynamics of population and communities, emphasizing animals. Theoretical and empirical approaches. Prerequisite: BIO 320 or instructor approval.

BIO 424 Mathematical Models in Ecology. (4)
selected semesters
Mathematical modeling of populations, communities, and ecosystems, including case studies and student-designed projects. 3 hours lecture, 3 hours lab. Prerequisites: BIO 320; a course in calculus.

BIO 425 Animal Ecology. (3)
selected semesters
Physiological and behavioral adaptations of individual animals to both abiotic and biotic environments. Prerequisite: BIO 320.

BIO 426 Limnology. (4)
selected semesters
Structure and function of aquatic ecosystems, with emphasis on freshwater lakes and streams. 3 hours lecture, 3 hours lab or field trip. Fee. Prerequisite: BIO 320 or instructor approval.
General Studies: L

BIO 427 Fire. (3)
spring in odd years
Interdisciplinary survey of fire on Earth—its history, ecology, and management. Prerequisite: BIO 187.

BIO 428 Biogeography. (3)
fall
Environmental and historical processes determining distributional patterns of animals and plants, emphasizing terrestrial life. Prerequisites: BIO 187 (or its equivalent); junior standing.
General Studies: L

BIO 431 Human Development and Fertility. (3)
selected semesters
Global influences of human population development on the human environment, including understanding human fertility and clinical influences on fertility. Discussion, presentation. Prerequisite: general biology.

BIO 435 Research Techniques in Animal Behavior. (3)
selected semesters
Experimental and field studies of animal behavior; description and quantification of animal behavior and interpretation of behavior within an evolutionary framework. 1 hour lecture, 6 hours lab. Prerequisite: BIO 331.
General Studies: L

BIO 441 Cytogenetics. (3)
selected semesters
Chromosomal basis of inheritance. Cross-listed as PLB 412. Credit is allowed for only BIO 441 or PLB 412. Prerequisite: BIO 340.

BIO 442 Cytogenetics Laboratory. (2)
selected semesters
Microscopic analysis of meiosis, mitosis, and aberrant cell division. 6 hours lab. Cross-listed as PLB 413. Credit is allowed for only BIO 442 or PLB 413. Pre- or corequisite: BIO 441 or PLB 412.

BIO 446 Principles of Human Genetics. (3)
once a year
Molecular and cellular analysis of the human genome. Prerequisite: BIO 340.
General Studies: L

BIO 450 Advanced Developmental Biology. (3)
spring
Current concepts and experimental methods involving differentiation and biosynthetic activities of cells and organisms, with examples from microorganisms, plants, and animals. Prerequisite: BIO 351.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

BIO 453 Animal Histology. (4)
spring
Microscopic study of animal tissues. 3 hours lecture, 3 hours lab. Fee. Prerequisite: BIO 187 or instructor approval.

BIO 454 Aquatic Insects. (3)
selected semesters
Systematics and ecology of aquatic insects. Prerequisite: BIO 386.

BIO 464 Photobiology. (3)
selected semesters
Principles underlying the effects of light on growth, development, and behavior of plants, animals, and microorganisms. Cross-listed as PLB 440. Credit is allowed for only BIO 464 or PLB 440. Prerequisites: CHM 231 (or 331); 12 hours in life sciences.

BIO 465 Neurophysiology. (3)
spring in even years
Detailed treatment of cellular and organismal neurophysiology and nervous system function. Prerequisite: BIO 360.

BIO 466 Neurophysiology Laboratory. (2)
selected semesters
Intracellular and extracellular electrophysiological recording techniques, histological preparations, and dye-filling techniques. 6 hours lab. Pre- or corequisite: BIO 465.

BIO 470 Systematic Zoology. (4)
spring in odd years
Philosophy, theory, practice of interpreting animal diversity, including species concepts speciation, nomenclature, and evolutionary and phylogenetic classification emphasizing phylogenetics. 3 hours lecture, 3 hours lab. Prerequisites: junior standing; 18 hours in life sciences.
General Studies: L

BIO 471 Ornithology. (3)
spring in odd years
Biology of birds. 2 hours lecture, 3 hours lab, weekend field trips. Fee. Prerequisite: BIO 370 or instructor approval.

BIO 472 Mammalogy. (4)
fall in odd years
Classification, structure, habits, ecology, and distribution of mammals, emphasizing North American forms. 3 hours lecture, 3 hours lab or field trip, weekend field trips. Fee. Prerequisite: BIO 370 or instructor approval.

BIO 473 Ichthyology. (3)
spring in odd years
Systematics and biology of recent and extinct fishes. 2 hours lecture, 3 hours lab or field trip, weekend field trips. Fee. Prerequisites: both BIO 370 and 425 or only instructor approval.

BIO 474 Herpetology. (3)
spring in even years
Systematics and biology of recent and extinct reptiles and amphibians. 2 hours lecture, 3 hours lab or field trip. Fee. Prerequisite: BIO 370.

BIO 480 Methods of Teaching Biology. (3)
spring
Methods of instruction, experimentation, organization, and presentation of appropriate content in biology. Prerequisite: 20 hours in the biological sciences.

BIO 482 Advanced Methods of Teaching Biology. (3)
fall in odd years
Design, delivery, and evaluation of student-centered, inquiry-based lessons for high school biology students. Learning cycle. Prerequisite: BIO 480.

BIO 484 Internship. (3)
selected semesters

BIO 493 Honors Thesis. (1–6)
fall, spring, summer
General Studies: L

BIO 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Cell Biotechnology. (4)

BIO 495 Undergraduate Thesis. (3)
fall, spring, summer
Guided research culminating in the preparation of an undergraduate thesis based on supervised research done in this and previous semesters. Prerequisites: at least 3 hours of BIO 310 (or 499); formal conference with instructor; instructor and department chair approval.

BIO 499 Individualized Instruction. (1–3)
fall and spring

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Chemistry and Biochemistry

www.asu.edu/clas/chemistry
480/965-3461
PS D102

Robert Blankenship, Chair

Regents' Professors: Angell, Buseck, C. Moore, O'Keeffe, Pettit

Professors: Allen, Birk, Blankenship, Fromme, Fuchs, Glick, Gust, Holloway, Kouvetakis, Lohr, A. Moore, T. Moore, Petuskey, Rose, Shock, Skibo, Steimle, Williams, Woodbury

Associate Professors: Booksh, Hayes, O'Day, Wolf

Assistant Professors: Caudle, Francisco, Ghirlanda, Gould, Matyushov, Richert, Seo, Wachter

Senior Lecturer: White

Lecturers: Bauer, Marks

CHEMISTRY—B.A.

The B.A. degree in Chemistry consists of 46 semester hours. Required courses are as follows:

Choose between the course combinations below ..... 9 or 8
CHM 113 General Chemistry *SQ* (4)
CHM 115 General Chemistry with Qualitative Analysis *SQ* (5)
— or —
CHM 117 General Chemistry for Majors I *SQ** (4)
CHM 118 General Chemistry for Majors II *SQ** (4)
Choose between the course combinations below 8
CHM 317 Organic Chemistry for Majors I* (3)
CHM 318 Organic Chemistry for Majors II* (3)
CHM 319 Organic Chemistry Laboratory for Majors I* (1)
CHM 320 Organic Chemistry Laboratory for Majors II* (1)
— or —
CHM 331 General Organic Chemistry (3)
CHM 332 General Organic Chemistry (3)
CHM 335 General Organic Chemistry Laboratory (1)

CHM 336 General Organic Chemistry Laboratory (1)
CHM 325 Analytical Chemistry 3
CHM 326 Analytical Chemistry Laboratory 1
CHM 341 Elementary Physical Chemistry 3
CHM 343 Physical Chemistry Laboratory 1
CHM 453 Inorganic Chemistry 3
CHM electives 2
Minimum total 29–30

* CHM 117, 118, 317, 318, 319, and 320 are strongly recommended for qualified students.

Related courses must include the following:

MAT 270 Calculus with Analytic Geometry I *MA*[1] 4
MAT 271 Calculus with Analytic Geometry II *MA*[1] 4
PHY 111 General Physics *SQ*[2, 3] 3
PHY 112 General Physics *SQ*[2, 3] 3
PHY 113 General Physics Laboratory *SQ*[2, 3] 1
PHY 114 General Physics Laboratory *SQ*[2, 3] 1
Total 16

[1] Equivalent courses may be taken in place of MAT 270 and 271.
[2] More advanced PHY courses may be taken in place of PHY 111, 112, 113, and 114.
[3] Both PHY 111 and 113 or PHY 112 and 114 must be taken to secure SQ credit.

The remaining courses to complete the major are determined by students in consultation with their advisors.

CHEMISTRY—B.S.

The program consists of 46 semester hours in chemistry and 20 hours of related courses outside the major. Required courses are as follows:

Choose between the course combinations below ..... 9 or 8
CHM 113 General Chemistry *SQ* (4)
CHM 115 General Chemistry with Qualitative Analysis *SQ* (5)
— *or* —
CHM 113 General Chemistry *SQ* (4)
CHM 116 General Chemistry *SQ* (4)
— *or* —
CHM 117 General Chemistry for Majors I *SQ** (4)
CHM 118 General Chemistry for Majors II *SQ** (4)
Choose between the course combinations below 8
CHM 317 Organic Chemistry for Majors I* (3)
CHM 318 Organic Chemistry for Majors II* (3)
CHM 319 Organic Chemistry Laboratory for Majors I* (1)
CHM 320 Organic Chemistry Laboratory for Majors II* (1)
— *or* —
CHM 331 General Organic Chemistry (3)
CHM 332 General Organic Chemistry (3)
CHM 335 General Organic Chemistry Laboratory (1)
CHM 336 General Organic Chemistry Laboratory (1)
Total ..... 16 or 17

* CHM 117, 118, 317, 318, 319, and 320 are strongly recommended for qualified students.

Additional required chemistry courses are as follows:

CHM 240 Introduction to Physical Chemistry[1] *CS* 3
CHM 325 Analytical Chemistry 3
CHM 326 Analytical Chemistry Laboratory 1
CHM 327 Instrumental Analysis 3
CHM 328 Instrumental Analysis Laboratory 2
CHM 345 Physical Chemistry I[2] 3
CHM 346 Physical Chemistry II[2] 3
CHM 348 Physical Chemistry Laboratory I *L*[2] 1
CHM 349 Physical Chemistry Laboratory II *L*[2] 1
CHM 452 Inorganic Chemistry Laboratory *L*[2] 1
CHM 453 Inorganic Chemistry 3
CHM 460 Biological Chemistry 3
Chemistry elective (choose from the courses below) 3
CHM 302 Environmental Chemistry (3)
CHM 392 Introduction to Research Techniques (1–3)
CHM 424 Separation Science (3)
CHM 431 Qualitative Organic Analysis (3)
CHM 471 Solid-State Chemistry (3)
CHM 480 Methods of Teaching Chemistry (3)
CHM 481 Geochemistry (3)
CHM 485 Meteorites and Cosmochemistry (3)
Total 30

[1] Completion of MAT 274 and 342 satisfies the CHM 240 requirement.
[2] CHM 348, 349, and 452 must all be taken to secure L credit.

Additional required related field courses are as follows:

MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Total 20

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

A course in a computer language, such as CSE 181 Applied Problem Solving with Visual BASIC is strongly recommended.

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 "College Degree Requirements," page 306.

American Chemical Society Certification. A student who satisfactorily completes the B.S. in Chemistry 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.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

BIOCHEMISTRY—B.S.

The program consists of 36 semester hours in chemistry and 31 semester hours of related courses. Required courses are as follows:

Choose between the course combinations below ..... 9 or 8
- CHM 113 General Chemistry *SQ* (4)
- CHM 115 General Chemistry with Qualitative Analysis *SQ* (5)

— or —

- CHM 113 General Chemistry *SQ* (4)
- CHM 116 General Chemistry *SQ* (4)

— or —

- CHM 117 General Chemistry for Majors I *SQ** (4)
- CHM 118 General Chemistry for Majors II *SQ** (4)

Choose between the combinations of courses below 8
- CHM 317 Organic Chemistry for Majors I* (3)
- CHM 318 Organic Chemistry for Majors II* (3)
- CHM 319 Organic Chemistry Laboratory for Majors I* (1)
- CHM 320 Organic Chemistry Laboratory for Majors II* (1)

— or —

- CHM 331 General Organic Chemistry (3)
- CHM 332 General Organic Chemistry (3)
- CHM 335 General Organic Chemistry Laboratory (1)
- CHM 336 General Organic Chemistry Laboratory (1)

Total ..... 16 or 17

* CHM 117, 118, 317, 318, 319, and 320 are strongly recommended for qualified students.

Additional required chemistry courses are as follows:

BCH 461 General Biochemistry 3
BCH 462 General Biochemistry 3
BCH 463 Biophysical Chemistry 3
BCH 464 Biophysical Chemistry Laboratory 2
BCH 467 Analytical Biochemistry Laboratory *L* 3
CHM 341 Elementary Physical Chemistry* 3
Chemistry elective (choose from the courses below) 3
- BCH 392 Introduction to Research Techniques (1–3)
- BCH 494 ST: Topics in Nucleic Acids Biochemistry (2)
- BCH 494 ST: Topics in Protein Biochemistry (2)
- CHM 327 Instrumental Analysis (3)
- CHM 424 Separation Science (3)
- CHM 431 Qualitative Organic Analysis (3)
- CHM 453 Inorganic Chemistry (3)
- CHM 471 Solid-State Chemistry (3)

Total 20

* CHM 345 may be taken in place of CHM 341.

Additional required related field courses are as follows:

BIO 187 General Biology I *SG* 4
BIO 188 General Biology II *SQ* 4
BIO 340 General Genetics 4
BIO 353 Cell Biology 3
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
PHY 111 General Physics *SQ*[1] 3
PHY 112 General Physics *SQ*[2] 3
PHY 113 General Physics Laboratory *SQ*[1] 1
PHY 114 General Physics Laboratory *SQ*[2] 1

Total 31

[1] Both PHY 111 and 113 must be taken to secure SQ credit.
[2] Both PHY 112 and 114 must be taken to secure SQ credit.

Additional biology courses selected from BIO 343, 351, 360, 441, 450, and 465 are strongly recommended. Other biology courses may be substituted.

Additional biochemistry and chemistry courses, including CHM 392 Introduction to Research Techniques, may be taken by students and should be chosen in consultation with an advisor.

MINOR IN CHEMISTRY

A minor in Chemistry is awarded to students who complete the following required courses:

CHM 113 General Chemistry *SQ*[1] 4
CHM 115 General Chemistry with Qualitative Analysis *SQ*[1] 5
or CHM 116 General Chemistry *SQ*[1] (4)
CHM 325 Analytical Chemistry 3
CHM 326 Analytical Chemistry Laboratory 1
Choose between the course combinations below 8
- BCH 361 Principles of Biochemistry (3)
- BCH 367 Elementary Biochemistry Laboratory (1)
- CHM 231 Elementary Organic Chemistry *SQ*[2] (3)
- CHM 235 Elementary Organic Chemistry Laboratory *SQ*[2] (1)

— or —

- CHM 331 General Organic Chemistry (3)
- CHM 332 General Organic Chemistry (3)
- CHM 335 General Organic Chemistry Laboratory (1)
- CHM 336 General Organic Chemistry Laboratory (1)

Choose between the course combinations below ..... 4 or 8
- CHM 341 Elementary Physical Chemistry (3)
- CHM 343 Physical Chemistry Laboratory (1)

— or —

- CHM 345 Physical Chemistry I (3)
- CHM 346 Physical Chemistry II (3)
- CHM 348 Physical Chemistry Laboratory I *L*[3] (1)
- CHM 349 Physical Chemistry Laboratory II *L*[3] (1)

Minimum total 24

[1] Equivalent courses may be taken in place of CHM 113, 115, or 116.
[2] Both CHM 231 and 235 must be taken to secure SQ credit.
[3] CHM 348, 349, and 452 must all be taken to secure L credit.

B.I.S. CONCENTRATION

A concentration in chemistry is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

Chemistry. This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

The academic specialization consists of 43 semester hours in chemistry plus work in related fields. Required courses are as follows:

BCH 361 Principles of Biochemistry	3
CHM 113 General Chemistry *SQ*	4
CHM 115 General Chemistry with Qualitative Analysis *SQ*	5
CHM 325 Analytical Chemistry	3
CHM 326 Analytical Chemistry Laboratory	1
CHM 331 General Organic Chemistry	3
CHM 332 General Organic Chemistry	3
CHM 335 General Organic Chemistry Laboratory	1
CHM 336 General Organic Chemistry Laboratory	1
CHM 341 Elementary Physical Chemistry	3
or CHM 345 Physical Chemistry I (3)	
and CHM 346 Physical Chemistry II (3)	
Total	27

The remaining chemistry courses to complete the specialization are determined by students in consultation with their advisors.

Additional required related field courses are as follows:

MAT 270 Calculus with Analytic Geometry I *MA*	4
MAT 271 Calculus with Analytic Geometry II *MA*	4
PHY 111 General Physics *SQ**	3
PHY 112 General Physics *SQ**	3
PHY 113 General Physics Laboratory *SQ**	1
PHY 114 General Physics Laboratory *SQ**	1
Total	16

* Both PHY 111 and 113 or PHY 112 and 114 must be taken to secure SQ credit.

Minor Teaching Field. The minor teaching field consists of the following required courses:

CHM 113 General Chemistry *SQ*	4
CHM 115 General Chemistry with Qualitative Analysis *SQ*	5
Choose between the course combinations below	10 or 8
BCH 361 Principles of Biochemistry (3)	
CHM 231 Elementary Organic Chemistry *SQ** (3)	
CHM 325 Analytical Chemistry (3)	
CHM 326 Analytical Chemistry Laboratory (1)	
— *or* —	
CHM 331 General Organic Chemistry (3)	
CHM 332 General Organic Chemistry (3)	
CHM 335 General Organic Chemistry Laboratory (1)	
CHM 336 General Organic Chemistry Laboratory (1)	
CHM 341 Elementary Physical Chemistry	3
Total	20 or 22

* Both CHM 231 and 235 must be taken to secure SQ credit.

The remaining courses to complete the specialization are determined by students in consultation with their advisors.

GRADUATE PROGRAMS

The faculty in the Department of Chemistry and Biochemistry offer programs leading to the degrees of Master of Natural Science, M.S., and Ph.D. See the *Graduate Catalog* for requirements.

The department participates in the interdisciplinary program for the M.S. and Ph.D. degrees in Molecular and Cellular Biology. For more information, visit the program office in LSE 411, or call 480/965-0743.

BIOCHEMISTRY (BCH)

BCH 361 Principles of Biochemistry. (3)
fall and summer
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. Credit is allowed for only BCH 361 or 461. Prerequisite: CHM 231 or 318 or 332.

BCH 367 Elementary Biochemistry Laboratory. (1)
fall and summer
Qualitative/quantitative analyses of constituents of biological systems, enzyme activity measurements and metabolic studies. 1 hour conference, 3 hours lab. Pre- or corequisite: BCH 361 or instructor approval.

BCH 392 Introduction to Research Techniques. (1–3)
fall, spring, summer
Instrumental methods and philosophy of research by actual participation in chemical research projects. May be repeated for total of 6 semester hours. Prerequisite: advisor and research supervisor approval.

BCH 461 General Biochemistry. (3)
fall
Structure, chemistry, and metabolism of biomolecules and their role in the biochemical processes of living organisms. Credit is allowed for only BCH 461 or 361. Prerequisite: CHM 318 or 332. Corequisite: CHM 341 or 346.

BCH 462 General Biochemistry. (3)
spring
Continuation of BCH 461. Prerequisite: BCH 461 or instructor approval.

BCH 463 Biophysical Chemistry. (3)
spring
Principles of physical chemistry as applied to biological systems. Prerequisite: CHM 341 or 346.

BCH 464 Biophysical Chemistry Laboratory. (2)
fall
Introduces physical methods in modern biochemistry. Prerequisite: BCH 463.

BCH 467 Analytical Biochemistry Laboratory. (3)
spring
Quantitative analysis, separation and purification of biological molecules. Applies chemical and physical methods to the characterization of biological macromolecules. 1 conference, 1 hour lecture, 5 hours lab. Prerequisite: BCH 461. Corequisite: BCH 462.
General Studies: L

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

BCH 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Topics in Nucleic Acids Biochemistry. (2)
- Topics in Protein Biochemistry. (2)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

CHEMISTRY (CHM)

CHM 101 Introductory Chemistry. (4)
fall, spring, summer
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. Credit is allowed for only CHM 101 or 107 or 113 or 114 or 117. 3 hours lecture, 1 hour discussion, 2 hours lab. Fee.
General Studies: SQ

CHM 107 Chemistry and Society. (4)
fall and spring
General chemical principles and concepts presented in context of social and technological issues, e.g., energy, pollution, global warming, and others. Credit is allowed for only CHM 101 or 107 or 113 or 114 or 117. 3 hours lecture, 1 hour discussion, 2 hours lab. Fee.
General Studies: SQ

CHM 113 General Chemistry. (4)
fall, spring, summer
Principles of chemistry. Adapted to the needs of students in the physical, biological, and earth sciences. Credit is allowed for only CHM 101 or 107 or 113 or 114 or 117. 3 hours lecture, 1 hour discussion, 2 hours lab. Fee. Prerequisites: MAT 106 or 3 semesters of high school algebra; 1 year of high school chemistry recommended.
General Studies: SQ

CHM 114 General Chemistry for Engineers. (4)
fall and spring
Emphasis toward engineering. 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 or 107 or 113 or 114 or 117 and for only CHM 114 or 115 or 116 or 118. 3 hours lecture, 1 hour discussion, 2 hours lab. Fee. Prerequisites: MAT 106 (or 3 semesters of high school algebra); 1 year of high school chemistry.
General Studies: SQ

CHM 115 General Chemistry with Qualitative Analysis. (5)
fall, spring, summer
Continuation of CHM 113. Equilibrium theory, chemistry of metals, nonmetals, and metalloids; introduces organic chemistry. Laboratory includes qualitative analysis. Credit is allowed for only CHM 114 or 115 or 116 or 118. 3 hours lecture, 2 hours discussion, 4 hours lab. Fee. Prerequisite: CHM 113 or 2 years of high school chemistry.
General Studies: SQ

CHM 116 General Chemistry. (4)
fall and spring
Continuation of CHM 113. Equilibrium theory, chemistry of metals, nonmetals, and metalloids; introduces organic chemistry. Credit is allowed for only CHM 114 or 115 or 116 or 118. 3 hours lecture, 1 hour discussion, 2 hours lab. Fee. Prerequisite: CHM 113 or 2 years of high school chemistry.
General Studies: SQ

CHM 117 General Chemistry for Majors I. (4)
fall
Atomic and molecular structure, properties and physical states of matter, thermodynamics, kinetics, acids and bases, chemical analysis, and stoichiometry. Credit is allowed for only CHM 101 or 107 or 113 or 114 or 117. 3 hours lecture, 1 conference, 2 hours lab. Fee. Prerequisites: 3 years of high school mathematics; minimum of 1 year of high school physics. Prerequisite with a grade of "B" or higher: minimum of 1 year of high school chemistry.
General Studies: SQ

CHM 118 General Chemistry for Majors II. (4)
spring
Continuation of CHM 117. Credit is allowed for only CHM 114 or 115 or 116 or 118. 3 hours lecture, 1 conference, 2 hours lab. Fee. Prerequisite: CHM 117. Corequisite: MAT 270.
General Studies: SQ

CHM 231 Elementary Organic Chemistry. (3)
fall and spring
Survey of organic chemistry, with emphasis on the reactivity of basic functional groups. Credit is allowed for only CHM 231 or 317 or 331. Prerequisite with a grade of "B" or higher: CHM 101 or 114 or 115 or 116 or 117 or 1 year of high school chemistry or instructor approval.
General Studies: SQ (if credit also earned in CHM 235)

CHM 235 Elementary Organic Chemistry Laboratory. (1)
fall and spring
Organic chemistry experiments in synthesis, purification, analysis, and identification. Lab. Fee. Pre- or corequisite: CHM 231.
General Studies: SQ (if credit also earned in CHM 231)

CHM 240 Introduction to Physical Chemistry. (3)
spring
Introduces mathematical/computational methods in chemical kinetics, thermodynamics, quantum chemistry. Mathematical-based computer laboratory. 2 hours lecture, 4 hours lab. Fee. Prerequisite with a grade of "C" or higher: MAT 272.
General Studies: CS

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

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

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

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

CHM 320 Organic Chemistry Laboratory for Majors II. (1)
spring
Continuation of CHM 319. Credit is allowed for only CHM 320 or 336. 1 conference, 3 hours lab. Fee. Prerequisite: CHM 319. Corequisite: CHM 318.

CHM 325 Analytical Chemistry. (3)
fall and summer
Principles and methods of chemical analysis. Prerequisite: CHM 115 or 116.

CHM 326 Analytical Chemistry Laboratory. (1)
fall and summer
Experiments in chemical analysis. 4 hours lab. Fee. Corequisite: CHM 325.

CHM 327 Instrumental Analysis. (3)
spring
Principles of instrumental methods in chemical analysis. Electroanalytical and optical techniques. Prerequisites: CHM 325, 326. Pre- or corequisite: CHM 346.

CHM 328 Instrumental Analysis Laboratory. (2)
spring
Experiments in chemical analysis by electroanalytical and optical techniques. 6 hours lab. Fee. Corequisite: CHM 327.

CHM 331 General Organic Chemistry. (3)
fall, spring, summer
Chemistry of organic compounds. Credit is allowed for only CHM 231 or 317 or 331. Prerequisite: CHM 115 or 116 or 118.

CHM 332 General Organic Chemistry. (3)
fall, spring, summer
Continuation of CHM 331. Credit is allowed for only CHM 318 or 332. Prerequisite: CHM 331.

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

CHM 336 General Organic Chemistry Laboratory. (1)
fall, spring, summer
Continuation of CHM 335. Credit is allowed for only CHM 320 or 336. 4 hours lab. Fee. Prerequisite: CHM 335. Corequisite: CHM 332.

CHM 341 Elementary Physical Chemistry. (3)
fall
Thermodynamics, equilibrium, states of matter, solutions, and chemical kinetics. For students in premedical, biological, and educational curricula. Prerequisites: CHM 115 (or 114 or 118 or 325), 231 (or 331); MAT 271; PHY 112.

CHM 343 Physical Chemistry Laboratory. (1)
fall
Physical chemistry experiments. Credit is allowed for only CHM 343 or both CHM 348 and 349. 1 hour conference, 3 hours lab. Fee. Corequisite: CHM 341 or 345.

CHM 345 Physical Chemistry I. (3)
fall
Introduces quantum chemistry with application to electronic structure and dynamics of atoms and molecules. Prerequisite: only CHM 240 or both MAT 272 and 274 (with grades of "C" or higher).

CHM 346 Physical Chemistry II. (3)
spring
Introduces equilibrium and statistical thermodynamics. Laws of thermodynamics, equations of state, multicomponent chemical and phase equilibria, and electrochemistry. Prerequisite: CHM 345. Corequisite: MAT 274.

CHM 348 Physical Chemistry Laboratory I. (1)
fall
Laboratory experiments in spectroscopy and computational chemistry. 4 hours lab. Fee. Pre- or corequisite: CHM 345.
General Studies: L (if credit also earned in CHM 349 and 452)

CHM 349 Physical Chemistry Laboratory II. (1)
spring
Laboratory experiments in thermodynamics, electrochemistry, and computational chemistry. 4 hours lab. Fee. Pre- or corequisite: CHM 346.
General Studies: L (if credit also earned in CHM 348 and 452)

CHM 392 Introduction to Research Techniques. (1–3)
fall, spring, summer
Instrumental methods and philosophy of research by actual participation in chemical research projects. May be repeated for a total of 6 semester hours. Prerequisite: approval of advisor and research supervisor.

CHM 424 Separation Science. (3)
selected semesters
Basic theory and practical aspects of gas, liquid, ion-exchange, and gel-permeation chromatographies, and other important industrial and research techniques. 2 hours lecture, 4 hours lab. Fee. Prerequisite: CHM 318 or 332 or 346 or instructor approval.

CHM 431 Qualitative Organic Analysis. (3)
spring
Systematic identification of organic compounds. 1 hour lecture, 6 hours lab. Fee. Prerequisites: both CHM 118 (or 327) and 320 (or 336) or only instructor approval.

CHM 452 Inorganic Chemistry Laboratory. (1–2)
spring
Preparation and characterization of typical inorganic substances, emphasizing methods and techniques. 1 conference, 5 hours lab. Fee. Prerequisite: instructor approval.
General Studies: L (if credit also earned in CHM 348 and 349)

CHM 453 Inorganic Chemistry. (3)
fall
Principles and applications of inorganic chemistry. Prerequisite: CHM 341 or 346.

CHM 460 Biological Chemistry. (3)
spring
Structure and function of macromolecules and their involvement in the processing of energy and information by living cells. Prerequisites: CHM 318, 346, 453.

CHM 471 Solid-State Chemistry. (3)
fall
Crystal chemistry, thermodynamics and electrochemistry of solids, nonstoichiometric compounds, diffusion and solid-state reactions, crystal growth, and selected topics. Pre- or corequisite: CHM 346 or instructor approval.

CHM 480 Methods of Teaching Chemistry. (3)
spring
Organization and presentation of appropriate content of chemistry; preparation of reagents, experiments, and demonstrations; organization of stock rooms and laboratories; experience in problem solving. Fee. Prerequisite: instructor approval.

CHM 481 Geochemistry. (3)
spring
Origin and distribution of the chemical elements. Geochemical cycles operating in the earth's atmosphere, hydrosphere, and lithosphere. Cross-listed as GLG 481. Credit is allowed for only CHM 481 or GLG 481. Prerequisite: CHM 341 (or 346) or GLG 321.

CHM 485 Meteorites and Cosmochemistry. (3)
selected semesters
Chemistry of meteorites and their relationship to the origin of the earth, solar system, and universe. Cross-listed as GLG 485. Credit is allowed for only CHM 485 or GLG 485.

CHM 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Chemistry of Global Climate Change. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Chicana and Chicano Studies

www.asu.edu/clas/chicana
480/965-5091
COWDN 224

Cordelia Candelaria, Chair

Professors: Candelaria, Montiel

Associate Professors: Aldama, Escobar

Assistant Professors: Garcia, Gutiérrez, Magaña

The Department of Chicana and Chicano Studies (CCS) is an interdisciplinary degree program whose central mission is to increase the direct participation of Mexican Americans and Latinos in the human and capital development of American society. This mission is advanced by the department's core undergraduate curriculum and related programs that examine the culture, artistic achievements, history, and current status of people of Mexican descent and other Latinas and Latinos living in the United States. The curriculum combines a research-based understanding of the humanities, social sciences, and the arts with practical CCS applications (studio formats, internships, community research projects, etc.) as preparation for successful careers and productive public service in diverse communities.

CHICANA AND CHICANO STUDIES—B.A.

The major in Chicana and Chicano Studies requires 45 semester hours of course work. A minimum of 30 semester hours must be in CCS, CSH, and CSS courses. The remaining course work must be in a related field and approved by an advisor. All CCS majors must take 15 semester hours in the following core courses:

CCS	101	Introduction to Chicana and Chicano Studies *C*	3
CCS	111	Introduction to Chicana and Chicano Culture *C*	3
CCS	498	Pro-Seminar	3
HST	331	Mexican American History to 1900 *SB, C, H*	3
HST	332	Mexican American History Since 1900 *SB, C, H*	3

Within the 45 semester hours, CCS majors must also take 18 semester hours in one of two concentrations—humanities/cultural studies or social sciences/policy—and 12 hours in the other concentration for a total of 45 semester hours.

Majors are expected to fulfill the college's language requirement in Spanish. Although the department advisor can make exceptions on a case by case basis, all majors must demonstrate proficiency in Spanish.

All Chicana and Chicano Studies majors must take an established minor or credential of at least 18 semester hours in another field.

CHICANA AND CHICANO STUDIES MINOR

The Chicana and Chicano Studies minor requires 18 semester hours of course work. All Chicana and Chicano Studies minors must take the following courses:

CCS	101	Introduction to Chicana and Chicano Studies *C*	3
		or CCS 111 Introduction to Chicana and Chicano Culture *C* (3)	
HST	417	Topics in Mexican American History *SB, C, H*	3
Total			6

Students must also take at least three credits in both CCS concentrations: humanities/cultural studies and social sciences/policy.

Within the 18 semester hour requirement, students must take a minimum of 12 semester hours in CCS, CSH, and CSS courses. Any courses taken in a related field must be approved by an advisor.

B.I.S. CONCENTRATION

A concentration in Chicana and Chicano studies is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

CHICANA AND CHICANO STUDIES (CCS)

CCS 101 Introduction to Chicana and Chicano Studies. (3)
fall
Historical and contemporary issues in the Chicana and Chicano community; focus on economic, sociological, cultural, and political status of Chicanas and Chicanos in the U.S.
General Studies: C

CCS 111 Introduction to Chicana and Chicano Culture. (3)
fall
Interdisciplinary analysis of customs, values, belief systems, and cultural symbols; special attention is given to cultural continuity and change.
General Studies: C

CCS 210 Introduction to Ethnic Studies in the U.S. (3)
fall and spring
Covers diversity of experiences and relations among racial and ethnic groups in the United States. Lecture, discussion. Cross-listed as AFS 210/APA 210. Credit is allowed for only AFS 210 or APA 210 or CCS 210.
General Studies: C

CCS 300 Chicana and Chicano Culture and Society. (3)
fall
Intensive analysis of how Mexican American writers, artists, film makers, entertainers, and academicians have interpreted aspects of the Chicana and Chicano experience.
General Studies: C

CCS 445 Teaching Chicana and Chicano Studies in Native Language. (3)
selected semesters
Approaches/techniques for infusion of Chicana and Chicano Studies content into elementary and secondary bilingual curriculum. Taught in Spanish. Prerequisite: proficiency in Spanish.

CCS 446 Teaching Chicana and Chicano Studies in the Schools. (3)
selected semesters
Approaches/techniques for infusion of Chicana and Chicano Studies content into elementary and secondary curriculum; designed for teachers who work with Chicana and Chicano students.

CCS 498 Pro-Seminar. (3)
once a year
Required courses for majors on topic selected by instructor; writing-intensive course related to the development of interdisciplinary research skills.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

CHICANA AND CHICANO STUDIES HUMANITIES (CSH)

CSH Note 1. Completion of the First-Year Composition requirement (ENG 101 and 102 [or 105] or ENG 107 and 108 with a grade of "C" or higher) is a prerequisite for all English courses above the 100 level.

CSH Note 2. A term paper or equivalent out-of-class written work is required in all upper-division (300- and 400-level) ENG courses.

CSH 210 Chicana and Chicano Poetry. (3)
fall
Writing seminar on Chicana and Chicano poetics and intensive creative writing workshop. Workshop, seminar.

CSH 220 Chicana and Chicano Cultural Expression. (3)
once a year
Interrelation between economic, social, and political status and forms of artistic expression; i.e., music, dance, drama, literature, and graphic arts.

CSH 310 Chicana and Chicano Folklore. (3)
once a year
Analyzes Chicana and Chicano folk beliefs, traditions, and practices.
General Studies: HU, C

CSH 350 Mexican and Mexican American Artistic Production. (3)
once a year
Overview of Mexican and Mexican American artistic production from colonial times to present; emphasis on religious and folk art.
General Studies: HU, C, G

CSH 351 Contemporary Chicana and Chicano Art. (3)
once a year
Intensive analysis of contemporary Chicana and Chicano art movement as appraised within the context of contemporary American art and the art of Mexico.
General Studies: HU, C

CSH 363 Chicana and Chicano Literature. (3)
fall
Development of Chicana and Chicano literature; study of genres and themes; attention to literary antecedents. Cross-listed as ENG 363. Credit is allowed for only CSH 363 or ENG 363. See CSH Notes 1, 2.
General Studies: L/HU, C

CSH 484 Internship. (3)
selected semesters

CSH 485 Chicana Writers. (3)
once a year
Critical reading of Mexican American women authors; emphasis on contemporary (post-1970) poetry, novels, short stories, and essays.
General Studies: L/HU, C

CSH 498 Pro-Seminar. (3)
once a year
Required course for majors on topic selected by instructor; writing-intensive course related to the development of interdisciplinary research skills.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

CHICANA AND CHICANO STUDIES SOCIAL SCIENCE (CSS)

CSS 315 Chicano Family Structures and Perceptions. (3)
once a year
Traditional and changing family relationships; emphasis on gender and intergenerational relations and impact of modern society on traditional family values.

CSS 330 Chicana and Chicano Politics and Policy. (3)
once a year
Historical/contemporary analysis of Chicana and Chicano political ideologies, attitudes, strategies, and movements; relations with governmental agencies; and public policy issues.
General Studies: C

CSS 331 Policy Issues in Chicana and Chicano Urban Settings. (3)
spring
Historical, demographic, and sociological overview of the status of Chicanas and Chicanos in urban settings as well as the public policy relevance.
General Studies: C

CSS 336 Issues in Immigration and Migration. (3)
once a year
Historical/contemporary overview of Mexican immigration into and within the U.S.; factors affecting population movement, settlement patterns, and migrants' incorporation into society.
General Studies: C, H

CSS 432 Issues in Chicana and Chicano Gender. (3)
once a year
Analyzes social construction of gender identities; emphasizes impact of American and Mexican cultural values on normative gender relations.
General Studies: C

CSS 490 Field Studies in the Chicana and Chicano Community. (3)
once a year
Introduces principles and methods of qualitative research applied to the Chicana and Chicano community.

CSS 498 Pro-Seminar. (3)
once a year
Required course for majors on topic selected by instructor; writing-intensive course related to the development of interdisciplinary research skills.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Computational Biosciences

Interdisciplinary Master's Degree

www.asu.edu/compbiosci

480/965-5519

PSA 216

Rosemary Renaut, Director

GRADUATE PROGRAMS

The master's degree in Computational Biosciences is administered by an interdisciplinary committee. The faculty participating in this M.S. program are drawn from departments including Biology, Chemistry and Biochemistry, Computer Science Engineering, Mathematics and Statistics, and Plant Biology.

For more information, contact the program office or refer to the *Graduate Catalog*.

COMPUTATIONAL BIOSCIENCES (CBS)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Economics

The College of Liberal Arts and Sciences offers a Bachelor of Arts (B.A.) degree and a Bachelor of Science (B.S.) degree in Economics. The B.S. degree is designed primarily for students intending to seek employment upon completion of their undergraduate studies. The B.A. degree is designed primarily for students intending to go on to graduate school or law school. The W. P. Carey School of Business also offers a B.S. degree in Economics. Faculty, course descriptions, and the major requirements in the W. P. Carey School of Business are listed under "Department of Economics," see page 166.

ECONOMICS—B.A.

The B.A. is designed to prepare students for graduate programs in economics, business, or law. Concurrent degree programs such as mathematics and physics coordinate well with the B.A. program in economics.

The requirements for the B.A. in Economics consist of three parts: the university requirements for all students at ASU, see "University Graduation Requirements," page 81; the requirements of the College of Liberal Arts and Sciences, see "College Degree Requirements," page 306; and the requirements of the Department of Economics.

Requirements of the Department of Economics

The program consists of at least 43 semester hours of course work distributed between economics and related fields as shown below. Students must earn grades of "C" or higher in all courses in the major. If a student receives a grade below "C" in any course in the major, this course must be repeated. To qualify for upper-division course work in economics, students must have an ASU GPA of at least 2.50. Transfer students desiring to major in Economics must have a transfer GPA of at least 2.50 and are given a one-semester period to register and establish a GPA at ASU. In addition, students must meet all prerequisites and course requirements as listed in the catalog. These include:

A. Mathematics and Statistics: MAT 270, 271, and 272 or MAT 290 and 291; STP 226 or QBA 221; and ECN 470

B. Principles of Economics: ECN 111 and 112

C. Completion of 21 semester hours in economics courses and quantitative business analysis courses at the 300-level or above. These 21 hours must include:
   1. Economic Theory: ECN 313 and 314
   2. Econometrics and Statistics: ECN 425 or QBA 321 or QBA 410 or STP 421
   3. A Capstone course or Honors Thesis: ECN 475 or 493
   4. Economics electives at the 400-level or above to fill out the remaining hours. A maximum of three hours of ECN 484 Economics Internship, can be used to satisfy this requirement. ECN 475 and 493 cannot be used to satisfy the requirement.

ECONOMICS—B.S.

The B.S. degree is designed to prepare students for employment in the private or public sectors of the economy. This program will provide students with the typical analytical and quantitative skills employers expect of individuals holding economics degrees.

Requirements for the College of Liberal Arts and Sciences B.S. in Economics consist of three parts: the university requirements for all students at ASU, see "University Graduation Requirements," page 81; the requirements of the College of Liberal Arts and Sciences, see "College Degree Requirements," page 306; and the requirements of the Department of Economics.

Requirements of the Department of Economics

The program consists of at least 45 semester hours of course work distributed between economics and related fields as shown below. Students must earn grades of "C" or higher in all courses in the major. If a student receives a grade below "C" in any course in the major, this course must be repeated. To qualify for upper-division course work in economics, students must have an ASU GPA of at least 2.50. Transfer students desiring to major in Economics must

have a transfer GPA of at least 2.50 and are given a one-semester period to register and establish a GPA at ASU. In addition, students must meet all prerequisites and course requirements as listed in the catalog. These include:

A. Mathematics and Statistics: MAT 210 or 270 or 290; STP 226 or QBA 221

B. Principles of Economics: ECN 111 and 112

C. Completion of 24 semester hours in economics courses and quantitative business analysis courses at the 300-level or above. At least four of these courses must be at the 400-level or above. These 24 semester hours must include:
   1. Economic Theory: ECN 313 and 314
   2. Econometrics and Statistics: ECN 425 or QBA 321 or QBA 410 or STP 421
   3. A Capstone course or Honors Thesis: ECN 475 or 493
   4. Economics electives at the 300-level or above to fill out the remaining hours. A maximum of three hours of ECN 484 Economics Internship, can be used to satisfy this requirement. ECN 475 and 493 cannot be used to satisfy the requirement.

D. A total of nine semester hours from the Approved List of Related Field Courses.

Latin American Studies Certificate or Emphasis. Students majoring in Economics may elect to pursue a Latin American Studies Certificate or emphasis, combining courses from the major with selected outside courses of wholly Latin American content. See "Latin American Studies," page 317, for more information.

Certificate in International Business Studies. Students majoring in Economics may elect to pursue a Certificate in International Business Studies, combining courses from the major with selected international business courses. For more information see "Certificate in International Business Studies," page 171.

Certificate in Quality Analysis. Students majoring in Economics may elect to pursue a Certificate in Quality Analysis, combining courses from the major with selected quantitative business analysis courses. For more information, see "Certificate in Quality Analysis," page 161.

MINOR IN ECONOMICS

Minor in General Economics. This minor (and BIS area of concentration) requires 18 semester hours of course work which includes ECN 111 and 112, and 12 semester hours of economics courses at the 300-level or above for which all prerequisites have been met. The W. P. Carey School of Business does not permit its professional program students to enroll in this minor. Students must earn grades of "C" or higher in all courses in the minor. If a student receives a grade below "C" in any course in the minor, this course must be repeated.

Minor in Economics for Students Planning a Career in Law. This minor requires 18 semester hours of course work that includes ECN 111, 112, 314, 450, 453, and one additional economics or accounting course at the 300-level or above for which all prerequisites have been met. Students must earn grades of "C" or higher in all courses in the minor. If a student receives a grade below "C" in any course in the minor, this course must be repeated.

Honors Students

Students admitted to the Barrett Honors College may substitute ECN 294 Macroeconomics for ECN 111 and 313, and ECN 294 ST: Microeconomics for ECN 112 and 314. These courses with grades of "C" or higher satisfy the prerequisites and pre/corequisites for all upper-division economics courses.

B.I.S. CONCENTRATIONS

Concentrations in (1) economics and (2) economics for students planning a career in law are available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

Economics. The minor teaching field consists of 21 semester hours. ECN 111 Macroeconomic Principles and ECN 112 Microeconomic Principles and MAT 210 Brief Calculus are required. The remainder must be approved by the advisor in consultation with the student.

Social Studies. This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the

L literacy and critical inquiry / MA mathematics / CS computer/statistics/ quantitative applications / HU humanities and fine arts / SB social and behavioral sciences / SG natural science—general core courses / SQ natural science—quantitative / C cultural diversity in the United States / G global / H historical / See "General Studies," page 85.

Office of Student Services in the College of Education at 480/965-5555.

GRADUATE PROGRAMS

The faculty in the Department of Economics offer programs leading to the M.S. and Ph.D. degrees. See the *Graduate Catalog* for requirements.

For faculty and course descriptions see "Department of Economics," page 166.

Department of English

www.asu.edu/clas/english
480/965-3168
LL 542

Elizabeth Horan, Chair

Regents' Professors: Dubie, Ríos

Professors: Adams, Bender, Bjork, Boyer, Brack, Candelaria, Carlson, Crowley, Goldberg, Gutierrez, Helms, Hogue, Horan, Kehl, Lester, Lightfoot, Major, A. Nilsen, D. Nilsen, Rhodes, Richard, Roen, Sands, Sensibar, Tobin, van Gelderen

Associate Professors: Bates, Bivona, Castle, Chancy, Corse, DeLamotte, M. Goggin, Lussier, Mahoney, McNally, Miller, Morgan, Nelson, Perry, Pritchard, Ramage, Savard, Schwalm, Tohe, Voaden

Assistant Professors: Blasingame, Fox, Fuse, P. Goggin, Harris, Johnson, Lockard, Milun, Parchesky, Webb Peterson

Senior Lecturers: Cook, Cooper, Duerden, Dugan, Dwyer, Heenan, Norton, Sudol, Wheeler

Lecturers: Binkley, Duttagupta, Pettipiece, Ray, Stancliff

Academic Associate: McNeil

Academic Professional: Glau

ENGLISH—B.A.

The faculty in the Department of English offer courses in comparative literature, creative writing, English as a second language, English education, English linguistics, literature and language, and rhetoric and composition. Undergraduate degrees include the B.A. degree in English, with a concentration in either linguistics or literature, and a Secondary Education Bachelor of Arts in Education degree. The faculty also offer a Writing Certificate. Students interested in creative writing are encouraged to use electives to pursue a creative writing emphasis. Students should work with advisors to design an individual program of study that takes full advantage of the diversity within the department as well as interdisciplinary and multicultural contexts available in the college and university.

The B.A. degree in English with a concentration in linguistics consists of 42 semester hours. Required courses are as follows:

ENG	200	Critical Reading and Writing About Literature *L/HU* ... 3
ENG	213	Introduction to the Study of Language ... 3
ENG	221	Survey of English Literature *HU, H* ... 3
		or ENG 222 Survey of English Literature *HU, H* (3)
		or ENG 241 Literatures of the United States to 1860 *HU* (3)
		or ENG 242 Literatures of the United States, 1860–Present *HU* (3)
ENG	312	English in Its Social Setting *L/HU/SB* ... 3
ENG	313	Phonology and Morphology *L* ... 3
ENG	314	Modern Grammar ... 3
ENG	413	History of the English Language *HU* ... 3
ENG	414	Studies in Linguistics (repeated for a total of nine semester hours) ... 9

Twelve additional hours are electives, chosen in consultation with the student's advisor. These courses must be at the 200 level or above. At least one must be a three-credit course in a modern language other than English at the 400 level or above. A grade of "C" or higher is required in all courses taken for the major. *No course may be used to satisfy more than one requirement.*

The B.A. degree in English with a concentration in literature consists of 45 semester hours. Required courses are as follows:

ENG	200	Critical Reading and Writing About Literature *L/HU* ... 3
ENG	221	Survey of English Literature *HU, H* ... 3
ENG	222	Survey of English Literature *HU, H* ... 3
ENG	241	Literatures of the United States to 1860 *HU* ... 3
ENG	242	Literatures of the United States, 1860–Present *HU* ... 3
ENG	421	Shakespeare *HU* ... 3

Courses taken to fulfill the areas and periods listed below can be used to satisfy more than one of these requirements:

- Upper-division course in critical theory (3)
- Upper-division course in gender, American ethnic literatures, and/or postcolonial studies (3)
- Course in the history and/or structure of language (3)
- Upper-division course in literature before 1660, exclusive of ENG 421 (3)
- Upper-division course in literature between 1660 and 1900 (3)
- Upper-division course in literature after 1900 (3)

Additional hours needed to complete the 45 hours are electives chosen from the department's offerings at the 200 level and above. At least 18 of the 45 hours must be taken at the 300 or 400 level. A grade of "C" or higher is required in all courses taken for the major.

MINORS

The minor in English with a concentration in linguistics consists of 24 semester hours. Required courses are as follows:

ENG 200 Critical Reading and Writing About Literature *L/HU* 3
ENG 213 Introduction to the Study of Language 3
ENG 221 Survey of English Literature *HU, H* 3
or ENG 222 Survey of English Literature *HU, H* (3)
or ENG 241 Literatures of the United States to 1860 *HU* (3)
or ENG 242 Literatures of the United States, 1860–Present *HU* (3)
ENG 312 English in Its Social Setting *L/HU/SB* 3
ENG 314 Modern Grammar 3
ENG 413 History of the English Language *HU* 3

The six additional hours are electives chosen from the department's offerings, with at least one course (three hours) required at the 300 or 400 level. A grade of "C" or higher is required in all courses for the minor.

The minor in English with a concentration in literature consists of 24 semester hours. These courses are required:

ENG 200 Critical Reading and Writing About Literature *L/HU* 3
ENG 221 Survey of English Literature *HU, H* 3
or ENG 222 Survey of English Literature *HU, H* (3)
ENG 241 Literatures of the United States to 1860 *HU* 3
or ENG 242 Literatures of the United States, 1860–Present *HU* (3)
ENG 321 Introduction to Shakespeare *L/HU* 3
or ENG 421 Shakespeare *HU* (3)

Also required are two upper-division courses in literature (six hours) and two electives (six hours) chosen from among the department's offerings, with at least one course (three hours) at the 300 or 400 level. A grade of "C" or higher is required in all courses taken for the minor.

B.I.S. CONCENTRATIONS

Four concentrations in English (creative writing, linguistics concentration, literature concentration, and writing certificate) are available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

WRITING CERTIFICATE

The Writing Certificate consists of 19 semester hours. Initial entry into the program requires a minimum GPA of 3.00 in ENG 101 and 102, 105, or 107 and 108. Students must also have completed at least 30 hours of course work and must have a minimum GPA of 3.00. Required courses are as follows:

ENG 216 Persuasive Writing on Public Issues *L* 3
or ENG 412 Creative Nonfiction (3)
ENG 301 Writing for the Professions *L* 3
ENG 372 Document Production *L* 3
ENG 472 Rhetorical Studies *L* 3
ENG 484 Internship: Writing Certificate 3
ENG 498 PS: Writing Certificate Portfolio 1
Total 16

Also required is an additional writing course in English (three hours) or a writing or design course (three hours) selected from an approved list of courses from across campus. All students are required to submit a portfolio before receiving the certificate.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

English. The major teaching field consists of 45 semester hours in English. Required courses are as follows:

ENG 200 Critical Reading and Writing About Literature *L/HU* 3
ENG 212 English Prose Style *L* 3
or ENG 215 Strategies of Academic Writing *L* (3)
or ENG 216 Persuasive Writing on Public Issues *L* (3)
or ENG 217 Writing Reflective Essays *L* (3)
ENG 221 Survey of English Literature *HU, H* 3
ENG 222 Survey of English Literature *HU, H* 3
ENG 241 Literatures of the United States to 1860 *HU* 3
ENG 242 Literatures of the United States, 1860–Present *HU* 3
ENG 312 English in Its Social Setting *L/HU/SB* 3
or ENG 314 Modern Grammar (3)
ENG 421 Shakespeare *HU* 3
ENG 471 Literature for Adolescents *HU* 3
ENG 480 Methods of Teaching English: Composition *L* 3
ENG 482 Methods of Teaching English: Language *L* 3
Total 33

Also required is one course in women's literature or American ethnic literatures. Nine additional hours are electives chosen from Department of English offerings, six hours of which must be in the upper division. ENG 471, 480, and 482 must be taken before student teaching.

The minor teaching field consists of the following required courses:

ENG 200 Critical Reading and Writing About Literature *L/HU* 3
ENG 215 Strategies of Academic Writing *L* 3
or ENG 216 Persuasive Writing on Public Issues *L* (3)
or ENG 217 Writing Reflective Essays *L* (3)
ENG 321 Introduction to Shakespeare *L/HU* 3
or ENG 421 Shakespeare *HU*
ENG 470 Symbols and Archetypes in Children's Literature *L/HU* 3
ENG 471 Literature for Adolescents *HU* 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ENG 480 Methods of Teaching English: Composition *L* 3
ENG 482 Methods of Teaching English: Language *L* 3
Choose from among the courses below 3
ENG 221 Survey of English Literature *HU, H* (3)
ENG 222 Survey of English Literature *HU, H* (3)
ENG 241 Literatures of the United States to 1860 *HU* (3)
ENG 242 Literatures of the United States, 1860–Present *HU* (3)
ENG 312 English in Its Social Setting *L/HU/SB* (3)
ENG 352 Short Story *HU* (3)
A course in women's literature or American ethnic literatures (3)

Total 24

These courses are also recommended for Elementary Education majors.

GRADUATE PROGRAMS

The faculty in the Department of English offer programs leading to the M.A. degree in English (with concentrations in comparative literature, English linguistics, literature and language, and rhetoric and composition), Master of Fine Arts degree in Creative Writing (options include fiction, nonfiction, poetry, and screenwriting), Master of Teaching English as a Second Language degree, and Ph.D. degree in English with two concentrations, one in literature and one in rhetoric/composition and linguistics. See the *Graduate Catalog* for requirements.

ENGLISH (ENG)

ENG Note 1. Completion of the First-Year Composition requirement (ENG 101 and 102 [or 105] or ENG 107 and 108 with a grade of "C" or higher) is a prerequisite for all English courses above the 100 level.

ENG Note 2. A term paper or equivalent out-of-class written work is required in all upper-division (300- and 400-level) ENG courses.

ENG Note 3. English majors and minors are expected to have completed ENG 200 before taking 400-level literature courses.

ENG 101 First-Year Composition. (3)
fall, spring, summer
Discovering, organizing, and developing ideas in relation to the writer's purpose, subject, and audience. Emphasizes modes of written discourse and effective use of rhetorical principles. Foreign students, see ENG 107. Prerequisite: see "University Testing Requirements," page 69, and "First-Year Composition Requirement," page 81.

ENG 102 First-Year Composition. (3)
fall, spring, summer
Critical reading and writing; emphasis on strategies of academic discourse. Requires research paper. Foreign students, see ENG 108. Prerequisite with a grade of "C" or higher: ENG 101.

ENG 105 Advanced First-Year Composition. (3)
fall and spring
Concentrated composition course for students with superior writing skills; intensive reading; research papers; logical and rhetorical effectiveness. Credit is allowed for only ENG 105 or First-Year Composition. Prerequisite: see "University Testing Requirements," page 69, and "First-Year Composition Requirement," page 81.

ENG 107 English for Foreign Students. (3)
fall and spring
For students from non-English-speaking countries who have studied English in their native countries, but who require practice in the idioms of English. Intensive reading, writing, and discussion. Satisfies the graduation requirement of ENG 101.

ENG 108 English for Foreign Students. (3)
fall and spring
For foreign students; critical reading and writing; strategies of academic discourse. Requires research paper. Satisfies graduation requirement of ENG 102. Prerequisite with a grade of "C" or higher: ENG 107.

ENG 114 English Grammar and Usage. (3)
fall and spring
Fundamentals of English grammar (word and phrase structure) and of English usage (punctuation, grammatical correctness).

ENG 200 Critical Reading and Writing About Literature. (3)
fall and spring
Introduces the terminology, methods, and objectives of the study of literature, with practice in interpretation and evaluation. See ENG Note 1. Prerequisite: English major or minor.
General Studies: L/HU

ENG 201 World Literature. (3)
fall
Classical and medieval periods. Selections from the great literature of the world in translation and lectures on the cultural background. See ENG Note 1.
General Studies: HU, H

ENG 202 World Literature. (3)
spring
Renaissance and modern periods. Selections from the great literature of the world in translation and lectures on the cultural background. See ENG Note 1.
General Studies: HU, H

ENG 204 Introduction to Contemporary Literature. (3)
once a year
Poetry, fiction, drama, and possibly other genres. See ENG Note 1.
General Studies: HU

ENG 210 Introduction to Creative Writing. (3)
fall and spring
Beginning writing of poetry, fiction, drama, or mixed genre. Separate sections for each genre. Each genre may be taken once. See ENG Note 1.

ENG 212 English Prose Style. (3)
selected semesters
Analysis and practice of writing in various classical and modern prose styles. See ENG Note 1. Prerequisite: preferably English major or both approval of advisor and instructor. Prerequisite with a grade of "B" or higher: ENG 102 or 105.
General Studies: L

ENG 213 Introduction to the Study of Language. (3)
fall and spring
Language as code; phonetics, phonology, morphology, and syntax; the lexicon; language acquisition; sociolinguistics. See ENG Note 1.

ENG 215 Strategies of Academic Writing. (3)
fall and spring
Advanced course in techniques of analyzing and writing academic expository prose. Writing is research based. See ENG Note 1.
General Studies: L

ENG 216 Persuasive Writing on Public Issues. (3)
fall and spring
Advanced course in techniques of analyzing and writing persuasive arguments addressing topics of current public interest. Papers are research based. See ENG Note 1.
General Studies: L

ENG 217 Writing Reflective Essays. (3)
fall and spring
Critical examination of the influences discourse has on formation of identity; narrative analyses of self and culture. See ENG Note 1.
General Studies: L

ENG 218 Writing About Literature. (3)
fall and spring
Advanced writing course requiring analytical and expository essays about fiction, poetry, and drama. For non-English majors. See ENG Note 1.
General Studies: L

ENG 221 Survey of English Literature. (3)
fall and spring
Medieval, Renaissance, and 18th-century literature. Emphasizes major writers and their works in their literary and historical contexts. See ENG Note 1.
General Studies: HU, H

ENG 222 Survey of English Literature. (3)
fall and spring
Romantic, Victorian, and 20th-century literature. Emphasizes major writers and their works in their literary and historical contexts. See ENG Note 1.
General Studies: HU, H

ENG 241 Literatures of the United States to 1860. (3)
fall and spring
Survey of literary movements and genres from colonization to the Civil War. See ENG Note 1.
General Studies: HU

ENG 242 Literatures of the United States, 1860–Present. (3)
fall and spring
Survey of literary movements and genres from the Civil War to the present. See ENG Note 1.
General Studies: HU

ENG 245 Popular Culture Issues. (3)
fall and spring
Selected topics in various forms of popular culture related to written texts. May be repeated for credit when topics vary. See ENG Note 1.
General Studies: L

ENG 301 Writing for the Professions. (3)
fall and spring
Advanced practice in writing and editing expository prose. Primarily for preprofessional majors. See ENG Notes 1, 2.
General Studies: L

ENG 303 Classical Backgrounds of English Literature. (3)
selected semesters
Readings of Greek and Latin literature in translation as they relate to literature in English. See ENG Notes 1, 2.
General Studies: HU

ENG 310 Intermediate Creative Writing. (3)
fall and spring
Separate sections for fiction and poetry. May be taken once for poetry, once for fiction. Lecture, writing assignments, discussion, criticism. See ENG Notes 1, 2. Prerequisite: ENG 210 or instructor approval.

ENG 312 English in Its Social Setting. (3)
fall and spring
Introduces the sociolinguistic study of the English language. See ENG Notes 1, 2.
General Studies: L/HU/SB

ENG 313 Phonology and Morphology. (3)
spring
Introduces English morphology, phonology, etymology, and phonetic aspects of rhyme, alliteration, and other sound-based literary devices. See ENG Notes 1, 2.
General Studies: L

ENG 314 Modern Grammar. (3)
fall and spring
Modern descriptive models of English grammar. See ENG Notes 1, 2.

ENG 315 Medieval Literature in Translation. (3)
once a year
Medieval literature (insular and continental) in translation, from Beowulf to Malory (excluding Chaucer), emphasizing cultural and intellectual backgrounds. Lecture, discussion. See ENG Notes 1, 2.

ENG 321 Introduction to Shakespeare. (3)
fall and spring
Shakespeare's major comedies, histories, and tragedies. See ENG Notes 1, 2.
General Studies: L/HU

ENG 325 Restoration and the 18th Century. (3)
once a year
Writers and movements in nondramatic literature of the restoration and early 19th century. Lecture, discussion. See ENG Notes 1, 2.

ENG 326 English Drama 1660–1800. (3)
once a year
English drama 1660–1800. See ENG Notes 1, 2.
General Studies: HU

ENG 328 The Novel to Jane Austen. (3)
selected semesters
From origins of prose fiction through the 18th century. See ENG Notes 1, 2.
General Studies: HU, H

ENG 329 19th-Century British Fiction. (3)
selected semesters
Includes such authors as Austen, Dickens, Eliot, and Conrad. See ENG Notes 1, 2.
General Studies: HU

ENG 330 19th-Century British Poetry. (3)
selected semesters
Romantic and Victorian poets studied in context. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2.

ENG 331 American Drama. (3)
once a year
Major works in the development of American drama from its beginnings to the present. See ENG Notes 1, 2.
General Studies: L/HU

ENG 332 Major American Novels. (3)
once a year
Major American novels studied in their ethnically diverse literary, historical, and cultural contexts. See ENG Notes 1, 2.
General Studies: L

ENG 333 American Ethnic Literature. (3)
once a year
Examines America's multiethnic identity through works of literature that depict American ethnic, gender, and class sensibilities. Cross-listed as AFH 333. Credit is allowed for only AFH 333 or ENG 333. See ENG Notes 1, 2.
General Studies: L/HU, C

ENG 335 American Poetry. (3)
selected semesters
Themes and developments in American poetry. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2.

ENG 342 20th-Century British and Irish Literature. (3)
selected semesters
Major works in the development of literature since 1900, studied in their historical and cultural contexts. Lecture, discussion. See ENG Notes 1, 2.
General Studies: HU

ENG 345 Selected Authors or Issues. (3–4)
selected semesters
Different topics may be offered. Film topics with lab may carry 4 credits. May be repeated for credit when topics vary. See ENG Notes 1, 2.

ENG 352 Short Story. (3)
fall and spring
Development of the short story as a literary form; analysis of its technique from the work of representative authors. See ENG Notes 1, 2.
General Studies: HU

ENG 353 African American Literature: Beginnings Through the Harlem Renaissance. (3)
fall
Historical survey of African American literary traditions and cultural contexts from slavery through the 1930s. Cross-listed as AFH 353. Credit is allowed for only AFH 353 or ENG 353. See ENG Notes 1, 2.
General Studies: L/HU, C

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ENG 354 African American Literature: Harlem Renaissance to the Present. (3)
spring
Historical survey of African American literary traditions and cultural contexts from the 1920s to the present. Cross-listed as AFH 354. Credit is allowed for only AFH 354 or ENG 354. See ENG Notes 1, 2.
General Studies: L/HU, C

ENG 355 European Dramatic Traditions. (3)
selected semesters
Development of European drama since Aeschylus. See ENG Notes 1, 2.
General Studies: L/HU

ENG 356 The Bible as Literature. (3)
fall and spring
Readings in the Jewish and Christian Scriptures in modern translation. See ENG Notes 1, 2.
General Studies: HU

ENG 357 Introduction to Folklore. (3)
selected semesters
Survey of the history, genres, and dynamics of folklore, with emphasis on oral traditions. See ENG Notes 1, 2.
General Studies: HU

ENG 359 American Indian Literatures. (3)
selected semesters
Selected oral traditions and contemporary works by American Indian authors. See ENG Notes 1, 2.
General Studies: L/HU, C

ENG 360 Western American Literature. (3)
once a year
Critical examination of ideas and traditions of the literature of the western United States, including the novel. See ENG Notes 1, 2.
General Studies: L/HU

ENG 361 Silent Film. (4)
fall
Development of motion pictures from 1850 through 1930. 3 hours lecture, screenings. See ENG Notes 1, 2.
General Studies: HU

ENG 362 Sound Film Genres. (4)
spring
Examines the western, the horror film, the comedy, and other genres. 3 hours lecture, screenings. See ENG Notes 1, 2.
General Studies: HU

ENG 363 Chicana and Chicano Literature. (3)
fall
Development of Chicana and Chicano literature; study of genres and themes; attention to literary antecedents. Cross-listed as CSH 363. Credit is allowed for only CSH 363 or ENG 363. See ENG Notes 1, 2.
General Studies: L/HU, C

ENG 364 Women and Literature. (3)
selected semesters
Approaches to issues of gender and representation in literature by and about women. See ENG Notes 1, 2.
General Studies: HU

ENG 372 Document Production. (3)
fall and spring
Introduces document design and production. Practice in critique and in writing the content of publications. Lecture, discussion. See ENG Notes 1, 2. Prerequisite: instructor approval.
General Studies: L

ENG 374 Technical Editing. (3)
fall and spring
Fundamentals of editing technical and professional materials. Role of editors in analyzing, revising, and polishing manuscripts. Successful writer-editor dialogues. See ENG Notes 1, 2.

ENG 385 Career Development for English Majors. (3)
selected semesters
Theoretical and practical aspects of career planning related to skills and interests developed in English studies. Lecture, discussion, workshop. See ENG Notes 1, 2.
General Studies: L

ENG 400 History of Literary Criticism. (3)
selected semesters
Major critics and critical traditions in the Western world. See ENG Notes 1, 2, 3. Prerequisite: 6 hours in literature or instructor approval.
General Studies: L/HU, H

ENG 401 Topics in Critical Theory. (3)
selected semesters
Major critical schools of recent decades—postcolonialist, psychoanalytic, deconstructionist, feminist, new historicist. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: 6 hours in literature or instructor approval.

ENG 409 Advanced Screenwriting. (3)
selected semesters
Applies the principles taught in a complete feature-length screenplay. See ENG Notes 1, 2. Prerequisite: instructor approval.

ENG 411 Advanced Creative Writing. (3)
fall and spring
Poetry, fiction, and drama for experienced writers, emphasizing individual style. Each genre may be taken once. See ENG Notes 1, 2. Prerequisite: ENG 310 or instructor approval.

ENG 412 Creative Nonfiction. (3)
selected semesters
Lectures, discussion, and criticism concerning techniques of writing creative nonfiction for publication. See ENG Notes 1, 2. Prerequisite: ENG 310 or 411 or instructor approval.

ENG 413 History of the English Language. (3)
once a year
Development of English from the earliest times to the modern period. See ENG Notes 1, 2. Prerequisite: junior standing or instructor approval.
General Studies: HU

ENG 414 Studies in Linguistics. (3)
fall and spring
Relationship of linguistics to literature, gender, power, and other social issues. May be repeated for credit. See ENG Notes 1, 2. Prerequisite: junior standing.

ENG 415 Topics in Medieval Literature and Culture. (3)
selected semesters
Interdisciplinary approach to medieval literature, emphasizing cultural and historical context. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: HU

ENG 416 Chaucer in Middle English. (3)
once a year
Yearly alternate between Chaucer's *The Canterbury Tales* and *Troilus and Criseyde.* May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: HU

ENG 418 Renaissance Literature. (3)
once a year
Selected topics, authors, contexts, and themes in Renaissance literature. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: L/HU

ENG 419 English Literature in the Early 17th Century. (3)
once a year
Topics, authors, and themes in English literature, 1603–1660. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: L/HU

ENG 421 Shakespeare. (3)
fall and spring
A selection of Shakespeare's works in different genres. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: HU

ENG 422 Studies in Shakespeare. (3)
once a year
Topics for close examination in selected dramatic and/or nondramatic works. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 421 or instructor approval.
General Studies: HU

ENG 423 Renaissance Drama. (3)
spring
Topics, authors, and themes in the drama of the Tudor and early Stuart periods. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: L/HU

ENG 424 Milton. (3)
once a year
Selected prose and poetry, emphasizing *Paradise Lost, Paradise Regained,* and *Samson Agonistes.* See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or instructor approval.
General Studies: HU

ENG 425 Studies in Romanticism. (3)
fall
Romanticism in continental, British, and American literature and culture. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or 241 or instructor approval.
General Studies: HU

ENG 427 Studies in 18th-Century Literature and Culture. (3)
selected semesters
Literary, social, and cultural issues of the period studied in an interdisciplinary format. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or 222 or instructor approval.
General Studies: HU

ENG 429 Studies in European Literature and Culture. (3)
selected semesters
Literary, cultural, and historical issues. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3.

ENG 430 Studies in Victorian Literature and Culture. (3)
once a year
Literary, social, and cultural issues of the period studied in an interdisciplinary format. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or instructor approval.
General Studies: L/HU

ENG 434 Studies in the Literature and Culture of the Americas. (3)
selected semesters
Literature and culture of North America, South America, and the Caribbean. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 241 or 242 or instructor approval.
General Studies: HU, C

ENG 436 Studies in Anglophone Literature and Culture. (3)
selected semesters
Literary, social, and cultural issues of English-speaking former colonial territories. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or 242 or instructor approval.

ENG 440 Studies in American Literature and Culture. (3)
once a year
Various genres in their literary, political, theoretical, and historical contexts. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 241 or 242 or instructor approval.
General Studies: HU

ENG 442 Studies in 20th-Century British and Irish Literature and Culture. (3)
once a year
Major literary genres (novel, poetry, and drama) in their cultural and historical contexts. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or instructor approval.

ENG 444 Studies in American Romanticism. (3)
once a year
Fiction, poetry, and essays of such nineteenth-century authors as Hawthorne, Emerson, Melville, Thoreau, Fuller, Whitman, and Dickinson. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 241 or instructor approval.
General Studies: HU

ENG 445 Studies in American Realism. (3)
once a year
Writers and influences that shaped the development of literary realism. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 242 or instructor approval.
General Studies: L/HU

ENG 446 Studies in Modernism. (3)
selected semesters
Cultural, historical, and literary problems in American and European modernism. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or 242 or instructor approval.
General Studies: HU

ENG 447 Studies in Postmodernism. (3)
selected semesters
Literary, social, and cultural issues. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or 242 or instructor approval.

ENG 448 Studies in Irish Literature and Culture. (3)
selected semesters
Themes and problems pertaining to Irish literature, film, and social and cultural history. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3. Prerequisite: ENG 222 or instructor approval.
General Studies: HU

ENG 452 Studies in the Novel. (3)
selected semesters
May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or 222 or 241 or 242 or instructor approval.
General Studies: HU

ENG 453 Studies in the American Novel. (3)
fall and spring
Poetics and politics of the novel, 18th through 21st centuries. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 241 or 242 or instructor approval.
General Studies: HU

ENG 455 Forms of Verse: Theory and Practice. (3)
selected semesters
Types, history, analysis of traditional poetic forms and contemporary adaptations. Writing of poetry in forms such as sonnet, villanelle, sestina. See ENG Notes 1, 2. Prerequisite: ENG 310 or instructor approval.

ENG 457 Studies in American Poetry. (3)
selected semesters
May be repeated for credit when topics vary. See ENG Notes 1, 2, 3. Prerequisite: ENG 241 or 242 or instructor approval.
General Studies: HU

ENG 459 Studies in African American/Caribbean Literatures. (3)
selected semesters
Studies in African American or Caribbean literatures according to genre, period, theory, or selected authors. May be repeated for credit when topics vary. Cross-listed as AFH 459. Credit is allowed for only AFH 459 or ENG 459. See ENG Notes 1, 2, 3.

ENG 461 Studies in Women and Literature. (3)
selected semesters
Advanced topics in literature by or about women. May be repeated for credit when topics vary. See ENG Notes 1, 2, 3.
General Studies: HU

ENG 464 Studies in Drama. (3)
selected semesters
Selected topics in the history and theory of the genre. See ENG Notes 1, 2, 3. Prerequisite: ENG 221 or 222 or 241 or 242 or instructor approval.
General Studies: HU

ENG 465 Studies in Film. (3–4)
selected semesters
Advanced topics in cinema. May be repeated for credit when topics vary. Lecture, viewing, discussion. See ENG Notes 1, 2.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

ENG 469 Science and Literature. (3)
selected semesters
Historical and theoretical links between science and literature, from Francis Bacon to the present, examined in cultural context. May be repeated for credit when topics vary. Lecture, discussion. See ENG Notes 1, 2, 3.

ENG 470 Symbols and Archetypes in Children's Literature. (3)
fall
Various critical approaches and recurring themes studied in relation to classical and contemporary children's literature. Lecture, discussion, reading. See ENG Notes 1, 2, 3.
General Studies: L/HU

ENG 471 Literature for Adolescents. (3)
fall and spring
Prose and poetry that meet the interests and capabilities of junior high and high school students. Stresses recent literature. Requires passing grade of at least "C" before students are permitted to student teach in English. See ENG Notes 1, 2, 3.
General Studies: HU

ENG 472 Rhetorical Studies. (3)
fall and spring
Developments in theory and practice of major rhetorical inquiries. Seminar, workshop. See ENG Notes 1, 2. Prerequisite: junior standing.
General Studies: L

ENG 480 Methods of Teaching English: Composition. (3)
fall or spring and summer
Methods of instruction, organization, and presentation of appropriate content in the teaching of composition and other writing skills. See ENG Notes 1, 2.
General Studies: L

ENG 482 Methods of Teaching English: Language. (3)
fall or spring and summer
Methods of instruction, organization, and presentation of appropriate content in language and usage for junior and senior high schools. Lecture, discussion, lab. See ENG Notes 1, 2.
General Studies: L

ENG 484 Internship. (1–12)
fall and spring
Selected from the following areas. May be repeated for credit. See ENG Notes 1, 2. Topics may include the following:
- General. (1–12)
- Service Learning. (3)
  Fee.
- Writing Certificate. (3)

ENG 493 Honors Thesis. (1–6)
selected semesters
General Studies: L

ENG 498 Pro-Seminar. (1–7)
fall and spring
Selected from the following areas. May be repeated for credit when topics vary. See ENG Notes 1, 2. Topics may include the following:
- Introduction to Graduate Studies. (1)
- Issues in Creative Writing. (3)
- Writing Certificate Portfolio. (1)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

LINGUISTICS (LIN)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

WRITING ACROSS THE CURRICULUM (WAC)

WAC 101 Introduction to Academic Writing. (3)
fall and spring
Combines classroom and supplemental instruction to teach academic genres of writing, including definition, summary, and analysis.

WAC 107 Introduction to Academic Writing for International Students. (3)
fall and spring
For students from non-English-speaking countries. Combines classroom and supplemental instruction with intensive reading, writing, and discussion.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Department of Family and Human Development

www.asu.edu/clas/fhd
480/965-6978
COWDN 106

Richard Fabes, Chair

Professors: Christopher, Fabes, Griffin, Ladd, Martin, Roosa

Associate Professors: Dumka, Madden-Derdich, Neff

Assistant Professors: Hanish, Heard, Liu, Spinrad, Updegraff

Senior Lecturers: Bodman, Weigand

FAMILY AND HUMAN DEVELOPMENT—B.S.

For the B.S. degree in Family and Human Development at ASU Main, students must pursue the concentration in family studies/child development. The mathematics proficiency must be met by completing MAT 117 or higher.

Family Studies/Child Development

The concentration in family studies/child development consists of the following core courses:

CDE	232	Human Development *SB*	3
CDE	430	Infant/Toddler Development in the Family *SB*	3
CDE	498	Pro-Seminar	6
		or FAS 498 Pro-Seminar (6)	
FAS	331	Marriage and Family Relationships *SB*	3
FAS	361	Introduction to Family/Child Research Methods *L*	3
FAS	370	Family, Ethnic, and Cultural Diversity *SB, C*	3
FAS	431	Parent-Adolescent Relationships *SB*	3
FAS	435	Advanced Marriage and Family Relationships *L/SB*	3
FAS	440	Fundamentals of Marriage and Family Therapy	3
Total			30

In addition, 12 semester hours of electives must be taken from the following:

CDE	337	Early Childhood Intervention	3
CDE	338	Child Development Practicum	2–4

CDE	437	Observational and Naturalistic Methods of Studying Children *L/SB*	3
CDE	444	Children and Poverty	3
CDE	498	Pro-Seminar	3
		or FAS 498 Pro-Seminar (3)	
		or FAS 499 Individualized Instruction (3)	
FAS	301	Introduction to Parenting	3
FAS	330	Personal Growth in Human Relationships *SB*	3
FAS	332	Human Sexuality *SB*	3
FAS	390	Supervised Research Experience	1–3
FAS	432	Family Development	3
FAS	484	Internship	1–3

FAMILY AND HUMAN DEVELOPMENT MINOR

The minor in Family and Human Development consists of 18 semester hours in which students specialize in family studies/child development.

At least 12 of the 18 semester hours must be in upper-division courses.

Students take the following courses:

CDE	232	Human Development *SB*	3
FAS	331	Marriage and Family Relationships *SB*	3
FAS	440	Fundamentals of Marriage and Family Therapy	3
Total			9

Three courses (or nine semester hours) must be selected from the following and at least one course must be a CDE course:

CDE	337	Early Childhood Intervention	3
CDE	430	Infant/Toddler Development in the Family *SB*	3
CDE	444	Children and Poverty	3
CDE	498	Pro-Seminar	3
		or FAS 498 Pro-Seminar (3)	
FAS	370	Family, Ethnic, and Cultural Diversity *SB, C*	3
FAS	431	Parent-Adolescent Relationships *SB*	3

B.I.S. CONCENTRATION

A concentration in family studies/child development is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

Family and Human Development. Applications are not being accepted at this time.

GRADUATE PROGRAMS

The faculty in the Department of Family and Human Development offer programs leading to the M.S. and Ph.D. degrees. See the *Graduate Catalog* for requirements.

CHILD DEVELOPMENT (CDE)

CDE 232 Human Development. (3)
fall, spring, summer
Lifespan development from conception through adulthood, with emphasis on family influences. Recognizes individuality within the universal pattern of development. Prerequisites: PGS 101; SOC 101.
General Studies: SB

CDE 337 Early Childhood Intervention. (3)
fall
Explores how child development theory affects practice with children and families, emphasizing development of young children and early intervention. Prerequisite: CDE 232 (or its equivalent).

CDE 338 Child Development Practicum. (2–4)
fall and spring
Supervised practicum in the Child Development Lab preparing students for work in child care centers and agencies serving young children and families. Lab. Pre- or corequisite: CDE 337.

CDE 430 Infant/Toddler Development in the Family. (3)
fall and spring
Examines the development of infants/toddlers, the socialization processes of families, and the interactions of these processes. Prerequisite: CDE 232 (or its equivalent).
General Studies: SB

CDE 437 Observational and Naturalistic Methods of Studying Children. (3)
selected semesters
In-depth examination of implementing observational and naturalistic studies of children in a variety of settings. 2 hours lecture, 3 hours lab. Prerequisites: CDE 430; 6 hours in psychology.
General Studies: L/SB

CDE 444 Children and Poverty. (3)
fall
Impact that poverty has on children and their families. 2 hours lecture, 3 hours lab. Prerequisites: CDE 232 (or its equivalent); 6 hours in upper-division social sciences.

CDE 498 Pro-Seminar. (1–7)
fall and spring

CDE 499 Individualized Instruction. (3)
fall and spring

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

FAMILY STUDIES (FAS)

FAS 301 Introduction to Parenting. (3)
fall and spring
Integrated approach to understanding parenting and parent-child interactions. Television course. Prerequisites: PGS 101; SOC 101 (or its equivalent).

FAS 330 Personal Growth in Human Relationships. (3)
fall and spring
Personal development and behavior as related to competency in interpersonal relationships within the family. Processes of family interaction. Prerequisites: PGS 101; SOC 101 (or its equivalent).
General Studies: SB

FAS 331 Marriage and Family Relationships. (3)
fall and spring
Issues, challenges, and opportunities relating to present-day marriage and family living. Factors influencing interrelations within the family. Prerequisite: a course in psychology or sociology.
General Studies: SB

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

FAS 332 Human Sexuality. (3)
fall and spring
Relationship of sexuality to family life and to major societal issues. Emphasizes developing healthy, positive, and responsive ways of integrating sexual and other aspects of human living. Prerequisite: PGS 101.
General Studies: SB

FAS 361 Introduction to Family/Child Research Methods. (3)
fall and spring
Examines basic methods applied to family/child research, critiques current research literature, and applies methods in current topics. Prerequisites: CDE 232; FAS 331.
General Studies: L

FAS 370 Family, Ethnic, and Cultural Diversity. (3)
fall and spring
Integrative approach to understanding historical and current issues related to the structure and internal dynamics of diverse American families. Lecture, discussion. Cross-listed as AFS 370. Credit is allowed for only AFS 370 or FAS 370. Prerequisite: PGS 101 or SOC 101.
General Studies: SB, C

FAS 390 Supervised Research Experience. (1–3)
fall, spring, summer
Practical, firsthand experience within current faculty research projects in family studies or child development. "Y" grade only; may be repeated for total of 6 hours. Prerequisites: FAS 361; 3.00 GPA in major; approval of supervising faculty member before registration.

FAS 431 Parent-Adolescent Relationships. (3)
fall
Dynamics of the relationships between parents and adolescents. Developmental characteristics of adolescence and the corresponding adult stage. Prerequisites: CDE 232; FAS 331.
General Studies: SB

FAS 432 Family Development. (3)
selected semesters
Normative changes in families over time from formation until dissolution. Emphasizes the marital subsystem in middle and later years. Prerequisites: both CDE 232 and FAS 331 or only instructor approval.

FAS 435 Advanced Marriage and Family Relationships. (3)
fall and spring
Recent research, issues, and trends relating to marriage and family interaction. Influence of family composition, physical environment, family patterns, and values on family dynamics. Prerequisites: FAS 331, 361.
General Studies: L/SB

FAS 440 Fundamentals of Marriage and Family Therapy. (3)
fall and spring
Introduces the fundamental orientations of marriage and family therapy.

FAS 484 Internship. (1–3)
fall and spring

FAS 498 Pro-Seminar. (1–7)
fall and spring

FAS 499 Individualized Instruction. (3)
fall, spring, summer

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

FAMILY AND HUMAN DEVELOPMENT (FRD)

FRD 451 Field Experience. (1–12)
selected semesters
Supervised field placement in the area of student's concentration with a community business or agency. Students must make arrangements with instructor 1 semester in advance of enrollment. Prerequisites: completion of 60 hours; instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

HOME ECONOMICS EDUCATION (HEE)

HEE 461 Presentations in Home Economics. (3)
selected semesters
Presentation and demonstration techniques in teaching home economics. Development of audiovisual materials for home economics content areas. Prerequisites: junior standing; instructor approval.

HEE 480 Methods of Teaching Home Economics. (3–4)
selected semesters
Instruction, organization, presentation, and evaluation of subject matter in home economics. HEE students register for 4 semester hours. Dietetic students register for 3 semester hours.

HEE 481 Teaching Occupational Home Economics. (3)
selected semesters
Career orientation related to home economics, cooperative work-related instruction, programs, and youth club advisement associated with secondary home economics programs. Possible field trips. Prerequisite: Family and Human Development major or minor.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Department of Geography

geography.asu.edu
480/965-7533
SCOB 330

Breandán Ó hUallacháin, Chair

Professors: Arreola, Balling, Brazel, Burns, Cerveny, Dorn, Gober, Ó hUallacháin, Pasqualetti, Zehnder

Associate Professors: Fall, Kuby, McHugh

Assistant Professors: Edsall, Ellis, Keys, Li, Wentz

Lecturer: Shaeffer

Geography is a discipline that integrates the physical and human dimensions of the world in the study of places, people, and environments. The mission of the Department of Geography is the creation, dissemination, and application of geographic knowledge and scholarship in a liberal arts and sciences tradition.

Undergraduate students may choose to pursue a B.A. degree in Geography, B.S. degree in Geography, B.A.E. degree in Secondary Education, or minor in Geography. A grade of "C" or higher is necessary in all required Department of Geography courses. Both B.A. and B.S. degrees in Geography consist of a minimum of 45 semester hours. A minor consists of a minimum of 18 semester hours.

GEOGRAPHY—B.A.

A student choosing a B.A. degree in Geography may be interested in a liberal arts and sciences focus on the breadth of the field. A B.A. degree may also focus on a geographic

region. In either case, the student crafts an individualized program of study in consultation with an advisor.

The B.A. degree consists of courses in core geographic knowledge (10–11 semester hours), core geographic skills (12 semester hours), a regional course (three semester hours), and electives (12 semester hours), for a minimum of 37 semester hours in geography. At least 18 semester hours in geography must be in upper-division courses. The remaining hours are made up of electives from geography courses or related fields of study, chosen in consultation with an advisor.

Core Geographic Knowledge

GCU	102 Introduction to Human Geography *SB*	3
GCU	121 World Geography *SB, G**	4
GPH	111 Introduction to Physical Geography *SQ*	4
	or GPH 411 Physical Geography (3)	
Total		10–11

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

Core Geographic Skills

GCU	495 Quantitative Methods in Geography *CS*	3
GCU	496 Geographic Research Methods *L*	3
GPH	371 Introduction to Cartography and Georepresentation *CS*	3
GPH	491 Geographic Field Methods	3
Total		12

Geographic Region

Choose one of the courses below, in consultation with an advisor. 3

- GCU 322 Geography of U.S. and Canada *SB, C* (3)
- GCU 323 Geography of Latin America *SB, G* (3)
- GCU 325 Geography of Europe *SB, G* (3)
- GCU 326 Geography of Asia *SB, G* (3)
- GCU 327 Geography of Africa *SB, G* (3)
- GCU 328 Geography of Middle East and North Africa *SB, G* (3)
- GCU 332 Geography of Australia and Oceania *SB, G* (3)
- GCU 344 Geography of Hispanic Americans *SB, C* (3)
- GCU 421 Geography of Arizona and Southwestern United States *SB, C* (3)
- GCU 423 Geography of South America *SB, G* (3)
- GCU 424 Geography of Mexico and Middle America *SB, G* (3)
- GCU 425 Geography of the Mexican American Borderland *L/SB, G* (3)
- GCU 426 Geography of Russia and Surroundings *SB, G* (3)
- GCU 433 Geography of Southeast Asia (3)
- GPH 433 Alpine and Arctic Environments *G* (3)

A student can design, in consultation with an advisor, a general B.A. degree in Geography. In addition, there are three cooperative programs whereby a student receives a B.A. degree in Geography and an emphasis in Asian Studies, Southeast Asian Studies, or Latin American Studies.

Asian and Southeast Asian Emphasis. Students majoring in Geography may elect to pursue an Asian or Southeast Asian emphasis combining courses from the major with selected courses of wholly Asian or Southeast Asian content. The Asian program requires 30 semester hours of Asian content courses, selected from the list drawn up by the Center for Asian Studies. Also required is knowledge of an Asian language; this is deemed to be fulfilled by 20 semester hours or equivalent in Chinese, Indonesian, Japanese, Thai, or Vietnamese. The Southeast Asian Studies Certificate is awarded to Geography students who emphasize a regional studies specialization in Geography and one year of Indonesian, Thai, or Vietnamese. For more information, see "Asian Studies," page 314, and "Southeast Asian Studies," page 318.

Latin American Studies Emphasis. Students majoring in Geography may elect to pursue a Latin American studies concentration combining courses from the major with selected outside courses of wholly Latin American content. At least 30 upper-division semester hours of the program must be in Latin American content courses, including 15 hours in geography (or in courses approved by the Department of Geography advisor) and 15 in other disciplines. A reading knowledge of Spanish or Portuguese is required and a reading knowledge of the other language is suggested. The program must be approved by the Latin American Studies Center. See "Latin American Studies," page 317, for more information.

GEOGRAPHY—B.S.

The B.S. degree consists of courses in core geographic knowledge (10–11 semester hours), core geographic skills (12 semester hours) and core geographic techniques (from three to four semester hours), and electives (12 semester hours)—for a minimum of 37 semester hours in geography. At least 18 semester hours in geography must be in upper-division courses. The remaining hours are made up of electives from geography courses or related fields of study, chosen in consultation with an advisor.

Core Geographic Knowledge

GCU	102 Introduction to Human Geography *SB*	3
GCU	121 World Geography *SB, G**	4
GPH	111 Introduction to Physical Geography *SQ*	4
	or GPH 411 Physical Geography (3)	
Total		10–11

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

Core Geographic Skills

GCU	495 Quantitative Methods in Geography *CS*	3
GCU	496 Geographic Research Methods *L*	3
GPH	371 Introduction to Cartography and Georepresentation *CS*	3
GPH	491 Geographic Field Methods	3
Total		12

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Core Geographic Techniques

Choose one of the courses below, in consultation with an advisor 3–4
- GPH 372 Air Photo Interpretation (3)
- GPH 373 Geographic Information Science I *CS* (4)
- GPH 471 Geographics: Interactive and Animated Cartography and Geovisualization *CS* (3)

The remaining four courses (12 semester hours) of geography electives and nine hours of geography or related fields of study vary among the options available for a B.S. degree in Geography. There are two specific departmental concentrations: meteorology-climatology and urban studies. In addition, a student can design, in consultation with an advisor, an individualized B.S. degree emphasizing other areas within the major.

Meteorology-Climatology Concentration. See an undergraduate advisor in the Department of Geography for the latest National Weather Service certification requirements. The required courses for the meteorology-climatology concentration include a minimum of 39 semester hours in geography plus course work in mathematics and physics:

Core Courses

GCU 102 Introduction to Human Geography *SB* 3
GCU 121 World Geography *SB, G** 4
GCU 495 Quantitative Methods in Geography *CS* 3
GCU 496 Geographic Research Methods *L* 3
GPH 111 Introduction to Physical Geography *SQ* 4
or GPH 411 Physical Geography (3)
GPH 370 Geographic Information Technologies *CS* 3
GPH 371 Introduction to Cartography and Georepresentation *CS* 3
GPH 491 Geographic Field Methods 3
Total 25–26

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

Required Meteorology Courses

GPH 213 Introduction to Climatology 3
GPH 215 Introduction to Climatology Laboratory 1
GPH 409 Synoptic Meteorology I 4
GPH 410 Synoptic Meteorology II 4
GPH 412 Physical Climatology 3
or GPH 413 Meteorological Instruments and Measurement (3)
or GPH 414 Climate Change *G* (3)
Total 15

Mathematics and Physics-Related Courses

MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
PHY 121 University Physics I: Mechanics *SQ*[1] 3
PHY 122 University Physics Laboratory I *SQ*[1] 1
PHY 131 University Physics II: Electricity and Magnetism *SQ*[2] 3
PHY 132 University Physics Laboratory II *SQ*[2] 1
Total 20

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

Urban Studies Concentration. The required courses for the urban studies concentration are as follows:

Core Courses

GCU 102 Introduction to Human Geography *SB* 3
GCU 121 World Geography *SB, G** 4
GCU 495 Quantitative Methods in Geography *CS* 3
GCU 496 Geographic Research Methods *L* 3
GPH 111 Introduction to Physical Geography *SQ* 4
or GPH 411 Physical Geography (3)
GPH 371 Introduction to Cartography and Georepresentation *CS* 3
GPH 373 Geographic Information Science I *CS* 4
or another three-hour techniques course if GPH 373 is taken to meet a core requirement
GPH 491 Geographic Field Methods 3
Total 26–27

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

Required Urban Studies

GCU 361 Urban Geography *SB* 3
GCU 484 Human Geography Internship 3
or one upper-division elective course outside the department in a related field of study chosen in consultation with an advisor (3)
Choose one of the courses below 3
- GCU 351 Population Geography *SB, G* (3)
- GCU 357 Social Geography *SB* (3)
- GCU 364 Energy in the Global Arena *SB, G* (3)
- GCU 441 Economic Geography *SB* (3)
- GCU 442 Geographical Analysis of Transportation *SB* (3)
- One upper-division or graduate-level GCU course chosen in consultation with an advisor (3)

Choose two of the courses below 6
- GCU 359 Cities of the World I *SB, G, H* (3)
- GCU 360 Cities of the World II *SB, G* (3)
- GCU 444 Geographic Studies in Urban Transportation *SB* (3)
- GCU 494 ST: Geography of Phoenix (3)

Urban studies total 15

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

MINOR IN GEOGRAPHY

A minor in Geography is awarded to students who complete a minimum of 18 hours in geography. A letter grade of "C" or higher is required for all courses taken for the minor.

The following lower-division courses are required:

GCU 102 Introduction to Human Geography *SB* 3
GPH 111 Introduction to Physical Geography *SQ* 4
or GPH 411 Physical Geography (3)
Total 6–7

The remaining courses are selected in conjunction with an advisor. At least one course should be a geographic skill. Possible courses include: Geographic Information Technologies (GPH 370), Introduction to Cartography and Georepresentation (GPH 371), Air Photo Interpretation (GPH 372), Geographic Field Methods (GPH 491), or a course in Geographic Information Science (GPH 373). At least four courses should be upper-division courses in geography.

B.I.S. CONCENTRATIONS

Five concentrations in Geography (geography, environmental geography, geographical information science, geography for business, and international geography) are available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

GCU	102 Introduction to Human Geography *SB*	3
GCU	121 World Geography *SB, G**	4
GPH	111 Introduction to Physical Geography *SQ*	4
	or GPH 411 Physical Geography (3)	
Total		10–11

* Completion of three semester hours of transfer course work can also be used to fulfill this requirement.

In conjunction with an advisor, students choose the remaining geography courses.

CULTURAL GEOGRAPHY (GCU)

GCU 102 Introduction to Human Geography. (3)
fall and spring
Systematic study of human use of the earth. Spatial organization of economic, social, political, and perceptual environments. Fee.
General Studies: SB

GCU 121 World Geography. (4)
fall and spring
Description and analysis of areal variations in social, economic, and political phenomena in major world regions.
General Studies: SB, G

GCU 141 Introduction to Economic Geography. (3)
fall
Production, distribution, and consumption of various types of commodities of the world and relationships to the activities of humans.
General Studies: SB, G

GCU 200 Orientation to Geography. (1)
fall
Basic introduction to the Department of Geography faculty, undergraduate graduation requirements, and possible jobs and skills in geography. Cross-listed as GPH 200. Credit is allowed for only GCU 200 or GPH 200.

GCU 240 Introduction to Southeast Asia. (3)
fall
Interdisciplinary introduction to the cultures, religions, political systems, geography, and history of Southeast Asia. Cross-listed as ASB 240/HST 240/POS 240/REL 240. Credit is allowed for only ASB 240 or GCU 240 or HST 240 or POS 240 or REL 240.
General Studies: G

GCU 253 Introduction to Cultural and Historical Geography. (3)
selected semesters
Cultural patterns, including such phenomena as language, religion, and various aspects of material culture. Origins and diffusion and division of the world into cultural areas.
General Studies: SB, G

GCU 294 Special Topics. (4)
once a year
Topics include global awareness.

GCU 322 Geography of U.S. and Canada. (3)
fall
Spatial distribution of relevant physical, economic, and cultural phenomena in the United States and Canada.
General Studies: SB, C

GCU 323 Geography of Latin America. (3)
fall
Spatial distribution of relevant physical, economic, and cultural phenomena in South, Middle, and Caribbean America.
General Studies: SB, G

GCU 325 Geography of Europe. (3)
once a year
Broad and systematic overview of Europe, emphasizing physical, economic, and cultural phenomena.
General Studies: SB, G

GCU 326 Geography of Asia. (3)
fall
Spatial distribution of relevant physical, economic, and cultural phenomena in Asia, excluding the former Soviet Union.
General Studies: SB, G

GCU 327 Geography of Africa. (3)
selected semesters
Spatial distribution of relevant physical, economic, and cultural phenomena in Africa.
General Studies: SB, G

GCU 328 Geography of Middle East and North Africa. (3)
selected semesters
Spatial distribution of relevant physical, economic, and cultural phenomena in the Middle East and North Africa. Prerequisite: GCU 121 or instructor approval.
General Studies: SB, G

GCU 332 Geography of Australia and Oceania. (3)
selected semesters
Spatial distribution of relevant physical, economic, and cultural phenomena in Australia, New Zealand, and Pacific Islands.
General Studies: SB, G

GCU 344 Geography of Hispanic Americans. (3)
spring
Examines the homelands, migrations, settlements, landscapes, roles, and selected cultural traditions of Hispanic Americans.
General Studies: SB, C

GCU 350 The Geography of World Crises. (3)
fall and spring
Contemporary world crises viewed from a perspective of geographic concepts and techniques.
General Studies: SB, G

GCU 351 Population Geography. (3)
fall
Demographic patterns; spatial, temporal, and structural investigation of the relationship of demographic variables to cultural, economic, and environmental factors.
General Studies: SB, G

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

GCU 352 Political Geography. (3)
selected semesters
Relationship between the sociophysical environment and the state.
General Studies: SB, G

GCU 357 Social Geography. (3)
once a year
Environmental perception of individuals and groups. Stresses the spatial aspect of social and physical environments.
General Studies: SB

GCU 359 Cities of the World I. (3)
fall
Historical evolution of urban patterns and structures in the Middle East, India, Southeast Asia, China, Japan, and Europe.
General Studies: SB, G, H

GCU 360 Cities of the World II. (3)
spring
Historical evolution of urban patterns and structures in Latin America, North America, Sub-Saharan Africa, and Australasia.
General Studies: SB, G

GCU 361 Urban Geography. (3)
fall and spring
External spatial relations of cities, internal city structure, and spatial aspects of urban problems in various parts of the world, particularly in the United States. Fee.
General Studies: SB

GCU 364 Energy in the Global Arena. (3)
spring
Production, transportation, and consumption of energy, emphasizing the electric power industry and its environmental problems.
General Studies: SB, G

GCU 394 Special Topics. (1–4)
fall and spring

GCU 414 Teaching Geography Standards. (3)
fall and summer
Introduces Arizona Geography Standards for K–12 educators, emphasizing exciting curricula and illustrated with best practices by master teachers. Internet.

GCU 421 Geography of Arizona and Southwestern United States. (3)
fall and spring
Geography of the Southwest with an emphasis on Arizona. Divided into physical geography, history, people, and economy.
General Studies: SB, C

GCU 423 Geography of South America. (3)
selected semesters
Prerequisite: GCU 323 or instructor approval.
General Studies: SB, G

GCU 424 Geography of Mexico and Middle America. (3)
once a year
Central America and Mexico. Prerequisite: GCU 323 or instructor approval.
General Studies: SB, G

GCU 425 Geography of the Mexican American Borderland. (3)
spring
Geography of a binational and bicultural region. Examines settlement, boundary issues, ethnic subregions, population change, industrial development, and urban growth. Field trips. Fee.
General Studies: L/SB, G

GCU 426 Geography of Russia and Surroundings. (3)
selected semesters
Examines the geography of Russia and other post-Soviet states. Prerequisite: GCU 121 or instructor approval.
General Studies: SB, G

GCU 432 Geography of China. (3)
selected semesters
Examines the physical, economic, cultural, social, demographic, agricultural, political, historical, and environmental aspects of the geography of China. Lecture, discussion. Prerequisite: GCU 326 or instructor approval.
General Studies: SB, G

GCU 433 Geography of Southeast Asia. (3)
selected semesters
Examines the biophysical and social features of Southeast Asian nations and peoples. Prerequisite: GCU 326 or instructor approval.

GCU 441 Economic Geography. (3)
once a year
Spatial distribution of primary, secondary, and tertiary economic and production activities. Prerequisite: GCU 141 or instructor approval.
General Studies: SB

GCU 442 Geographical Analysis of Transportation. (3)
fall
Networks, modes, economics, and flows at the urban, national, and international scales. Prerequisite: GCU 141 or 441.
General Studies: SB

GCU 444 Geographic Studies in Urban Transportation. (3)
spring
Current urban transportation issues in metropolitan Phoenix. Lecture, team project. Fee. Prerequisite: GCU 361.
General Studies: SB

GCU 453 Recreational Geography. (3)
selected semesters
Examines problems surrounding the organization and use of space for recreation. Introduces geographic field survey methods of data collection and analysis. Possible Saturday field trips.

GCU 455 Historical Geography of U.S. and Canada. (3)
selected semesters
Geographical perspective on the evolution of the United States and Canada from pre-Columbian times to early 20th century.
General Studies: SB, H

GCU 474 Public Land Policy. (3)
selected semesters
Geographic aspects of federal public lands, policy, management, and issues. Emphasizes western wilderness and resource development problems.
General Studies: SB

GCU 484 Human Geography Internship. (3)
fall and spring

GCU 494 Special Topics. (1–4)
once a year
Topics may include the following:
- Geography of Phoenix. (3)

GCU 495 Quantitative Methods in Geography. (3)
fall and spring
Statistical techniques applied to the analysis of spatial distributions and relationships. Introduces models and theory in geography. Fee. Prerequisite: MAT 119.
General Studies: CS

GCU 496 Geographic Research Methods. (3)
fall and spring
Scientific techniques used in geographic research. Fee. Prerequisites: GCU 495; GPH 371, 491.
General Studies: L

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

PHYSICAL GEOGRAPHY (GPH)

GPH 111 Introduction to Physical Geography. (4)
fall and spring
Spatial and functional relationships among climates, landforms, soils, water, and plants. Credit is allowed for only GPH 111 or 411. 3 hours lecture, 3 hours lab, field trips. Fee.
General Studies: SQ

GPH 200 Orientation to Geography. (1)
fall
Basic introduction to the Department of Geography faculty, undergraduate graduation requirements, and possible jobs and skills in geogra-

phy. Cross-listed as GCU 200. Credit is allowed for only GCU 200 or GPH 200.

GPH 210 Society and Environment. (3)
fall
Examines the interaction between social processes, key environmental issues, and nature's role as a resource at global and regional scales.
General Studies: G

GPH 211 Landform Processes. (3)
spring
Geographic characteristics of landforms and earth-surface processes, emphasizing erosion, transportation, deposition, and implications for human management of the environment. Fee. Prerequisites: ENG 101 (or 105); GPH 111.
General Studies: L

GPH 212 Introduction to Meteorology. (3)
fall
Fundamentals of weather and climate, including basic atmospheric processes and elements. Students whose curricula require a laboratory course must also register for GPH 214. Prerequisite: GPH 111 or instructor approval.
General Studies: SG (if credit also earned in GPH 214)

GPH 213 Introduction to Climatology. (3)
spring
Fundamentals of meteorological/climatological analysis, including terminology and symbology. Recommended for meteorology/climatology program students. Prerequisite: instructor approval.

GPH 214 Introduction to Meteorology Laboratory. (1)
fall
Introduces basic meteorological/climatological data and measurements. Suggested concurrent enrollment in GPH 212. 3 hours lab.
General Studies: SG (if credit also earned in GPH 212)

GPH 215 Introduction to Climatology Laboratory. (1)
spring
Fundamentals of meteorological/climatological map analysis and interpretation. Recommended for meteorology/climatology program students. May be taken concurrently with GPH 213. Prerequisite: instructor approval.

GPH 271 Maps and Map Reading. (3)
selected semesters
Map types, uses, limitations, and evolution. Communication via paper and digital medium. Navigation, interpretation, projections, sources, symbols, classification, case, handling.

GPH 314 Global Change. (3)
fall
Response of Earth's natural systems (atmosphere, hydrosphere, lithosphere, biosphere) to past environmental change, and effects of potential future changes.
General Studies: HU, G

GPH 370 Geographic Information Technologies. (3)
fall and spring
Introduces modern geographic information technologies, including cartography, GIS, remote sensing, global positioning systems, and statistical analyses. Lecture, lab.
General Studies: CS

GPH 371 Introduction to Cartography and Georepresentation. (3)
selected semesters
Study and creation of maps. Fundamental mapping principles (projection, scale, generalization, symbolization) and computer-based cartographic production. Lecture, lab. Prerequisite: GPH 111.
General Studies: CS

GPH 372 Air Photo Interpretation. (3)
once a year
Subset, remote sensing, includes: photography, films, aerial geometry, image components, stereoscopy, photogrammetry, ground truthing; interpret physical, cultural, economic, intelligence information. Prerequisite: GPH 211 or a course in Cultural Geography (GCU) or instructor approval.

GPH 373 Geographic Information Science I. (4)
once a year
History and basic aspects of GIS, including map and data file structure, conversions, and synthesis with a computerized environment. Fee. Prerequisite: GPH 370.
General Studies: CS

GPH 381 Geography of Natural Resources. (3)
once a year
Nature and distribution of natural resources and the problems and principles associated with their use.
General Studies: G

GPH 394 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Geographic Information Science. (3)

GPH 401 Topics in Physical Geography. (1–3)
selected semesters
Open to students qualified to pursue independent studies. Possible field trips. Prerequisite: instructor approval.

GPH 405 Energy and Environment. (3)
spring
Sources, regulatory and technical controls, distribution, and consequences of the supply and human use of energy. Fee. Prerequisite: a course in physical or life sciences or instructor approval.

GPH 409 Synoptic Meteorology I. (4)
fall
Diagnostic techniques and synoptic forecasting. Includes techniques of weather analysis, map interpretation, and satellite and radar analysis. Prerequisites: MAT 270; PHY 131, 132.

GPH 410 Synoptic Meteorology II. (4)
spring
Diagnostic techniques and synoptic forecasting. Includes techniques of weather analysis, map interpretation, and satellite and radar analysis. Prerequisite: GPH 409.

GPH 411 Physical Geography. (3)
once a year
Introduces physiography and the physical elements of the environment. Credit is allowed for only GPH 411 or 111. Field trips.

GPH 412 Physical Climatology. (3)
once a year
Physical processes in the earth-atmosphere system on regional and global scales; concepts and analysis of energy, momentum, and mass balances. Prerequisites: both GPH 212 and 213 or only instructor approval.

GPH 413 Meteorological Instruments and Measurement. (3)
once a year
Design and operation of ground-base and aerological weather measurement systems. Collection, reduction, storage, retrieval, and analysis of data. Field trips. Prerequisites: both GPH 212 and 213 or only instructor approval.

GPH 414 Climate Change. (3)
spring
Survey of three climate research areas: paleoclimatology, theories (e.g., greenhouse warming), numerical modeling. Prerequisite: GPH 212 or instructor approval.
General Studies: G

GPH 418 Landforms of the Western United States. (3)
once a year
Studies landforms and geomorphic processes in the western United States, including lecture, topographical maps, aerial photographs, satellite imagery, and field trips. Lecture, critical inquiry, laboratory, field work. Fee. Prerequisites: GPH 211 (or its equivalent); a General Studies L course.
General Studies: L

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

GPH 422 Plant Geography. (3)
once a year
Plant communities of the world and their interpretation, emphasizing North American plant associations. Cross-listed as PLB 422. Credit is allowed for only GPH 422 or PLB 422. Prerequisites: preferably both PLB 200 and 201 or only BIO 187 or only GPH 111.

GPH 433 Alpine and Arctic Environments. (3)
selected semesters
Regional study of advantages and limitations of the natural environment upon present and future problems involving resource distribution, human activities, and regional and interregional adjustments. Field trips. Prerequisite: GPH 111 or instructor approval.
General Studies: G

GPH 471 Geographics: Interactive and Animated Cartography and Geovisualization. (3)
selected semesters
Advanced cartography, stressing influence and application of the computer on geographic representation. Emphasizes creation of maps for the Internet. Lecture, lab. Fee. Prerequisites: GPH 371 or instructor approval.
General Studies: CS

GPH 473 Geographic Information Science II. (3)
fall
GIS as a basis for microcomputer spatial analysis and synthesis. Includes digitizing, database organization, spatial retrieval, and graphics. Lecture, lab. Fee. Prerequisites: GPH 373 (or instructor approval); CSE 100.
General Studies: CS

GPH 474 Dynamic Meteorology I. (3)
fall
Large-scale atmospheric motion, kinematics, Newton's laws, wind equation, baroclinics, vorticity, and the midlatitude depression. Prerequisites: GPH 213, 215; MAT 271; PHY 131, 132.

GPH 475 Dynamic Meteorology II. (3)
spring
Topics in climate dynamics. General circulation, numerical modeling, teleconnection phenomena, and surface-atmosphere interaction. Prerequisite: GPH 474 or instructor approval.

GPH 481 Environmental Geography. (3)
once a year
Problems of environmental quality, including uses of spatial analysis, research design, and field work in urban and rural systems. Field trips. Prerequisite: instructor approval.

GPH 483 Geographic Information Analysis. (3)
fall
Basics of spatial data analysis. Topics include point pattern analysis, spatial autocorrelation, spatial regression, and kriging. Lecture, lab. Fee. Prerequisites: both one 200-level or above course in geography or biology or plant biology or geology or planning and one basic statistics course (GCU 495).

GPH 484 Internship. (1–12)
selected semesters
Topics may include the following:
- Physical Geography Internship. (3)
  fall and spring
  Assist in teaching sixth-grade students a simplified version of GPH 111 using hands-on activities.
- Service Learning
  fall, spring, summer
  Fee.

GPH 491 Geographic Field Methods. (3)
spring and summer
Field techniques, including use of aerial photos, large-scale maps, and fractional code system of mapping; urban and rural field analysis to be done off campus. Fee. Prerequisites: GCU 102, 121; GPH 111.

GPH 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Geographic Information Analysis

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Geological Sciences

geology.asu.edu
480/965-5081
PS F686

Simon Peacock, Chair

Regents' Professors: Buseck, Greeley, Moore

Edgar and Helen Korrick Presidential Professor: Christensen

Professors: Burt, Farmer, Fink, Holloway, Knauth, Peacock, Reynolds, Shock, Stump, Tyburczy, Williams

Associate Professors: Arrowsmith, Leshin, O'Day, Sharp

Assistant Professors: Clarke, Fouch, Garnero

GEOLOGICAL SCIENCES—B.S.

The B.S. degree in Geological Sciences requires 39 semester hours including the following core courses or their equivalents:

GLG 101	Introduction to Geology I (Physical) *SQ*,[1] *G*	3
GLG 102	Introduction to Geology II (Historical) *SG*,[2] *H*	3
GLG 103	Introduction to Geology I—Laboratory *SQ*[1]	1
GLG 104	Introduction to Geology II—Laboratory *SG*[2]	1
GLG 310	Structural Geology	3
GLG 321	Mineralogy	3
GLG 400	Geology Colloquium	1
GLG 424	Petrology	3
GLG 435	Sedimentology	3
GLG 451	Field Geology I *L*	3
GLG 452	Field Geology II *L*	3
Total		27

[1] Both GLG 101 and 103 must be taken to secure SQ credit.
[2] Both GLG 102 and 104 must be taken to secure SG credit.

In addition, two of the following four branch courses must be taken:

GLG 418	Geophysics	3
GLG 430	Paleontology	3
GLG 470	Hydrogeology	3
GLG 481	Geochemistry	3

To complete the total required hours, other upper-division courses in geological sciences (excluding GLG 300 and 304) or courses in related fields listed as approved by the department may be taken. See "College Degree Requirements," page 306.

Supporting courses required in related fields include:

CHM	113 General Chemistry *SQ*	4
CHM	116 General Chemistry *SQ*	4
MAT	270 Calculus with Analytic Geometry I *MA*	4
MAT	271 Calculus with Analytic Geometry II *MA*	4
MAT	272 Calculus with Analytic Geometry III *MA*	4
	or MAT 274 Elementary Differential Equations *MA* (3)	
PHY	121 University Physics I: Mechanics *SQ*[1]	3
PHY	122 University Physics Laboratory I *SQ*[1]	1
PHY	131 University Physics II: Electricity and Magnetism *SQ*[2]	3
PHY	132 University Physics Laboratory II *SQ*[2]	1
Total		28

[1] Both PHY 121 and 122 must be taken to secure SQ credit.
[2] Both PHY 131 and 132 must be taken to secure SQ credit.

MAT 290 Calculus I and MAT 291 Calculus II may be substituted for MAT 270, 271, and 272.

MINOR IN GEOLOGICAL SCIENCES

A minor in Geological Sciences is awarded to students who complete a minimum of 21 hours of geological science courses. Required courses are as follows:

GLG	101 Introduction to Geology I (Physical) *SQ*,[1] *G*	3
GLG	102 Introduction to Geology II (Historical) *SG*,[2] *H*	3
GLG	103 Introduction to Geology I—Laboratory *SQ*[1]	1
GLG	104 Introduction to Geology II—Laboratory *SG*[2]	1
GLG	310 Structural Geology	3
GLG	321 Mineralogy	3
GLG	400 Geology Colloquium	1
Total		15

[1] Both GLG 101 and 103 must be taken to secure SQ credit.
[2] Both GLG 102 and 104 must be taken to secure SG credit.

The remaining six semester hours may be chosen among other upper-division geological sciences courses, except GLG 300 and 400, after consultation with a departmental advisor.

B.I.S. CONCENTRATION

A concentration in geological sciences is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAMS

The faculty in the Department of Geological Sciences offer programs leading to the degrees of Master of Natural Science, M.S., and Ph.D. See the *Graduate Catalog* for requirements.

GEOLOGICAL SCIENCES (GLG)

GLG 101 Introduction to Geology I (Physical). (3)
fall, spring, summer
Basic principles of geology, geochemistry, and geophysics. Rocks, minerals, weathering, earthquakes, mountain building, volcanoes, water, and glaciers. Possible weekend field trips.
General Studies: SQ (if credit also earned in GLG 103), G

GLG 102 Introduction to Geology II (Historical). (3)
spring
Basic principles of applied geology and the use of these principles in the interpretation of geologic history. Possible weekend field trips. Fee. Prerequisite: GLG 101.
General Studies: SG (if credit also earned in GLG 104), H

GLG 103 Introduction to Geology I—Laboratory. (1)
fall, spring, summer
3 hours lab, some field trips. Fee. Corequisite: GLG 101.
General Studies: SQ (if credit also earned in GLG 101)

GLG 104 Introduction to Geology II—Laboratory. (1)
spring
Laboratory techniques involving map interpretation, cross sections, and fossils. 3 hours lab, possible field trips. Prerequisite: GLG 103 (or its equivalent). Corequisite: GLG 102.
General Studies: SG (if credit also earned in GLG 102)

GLG 105 Introduction to Planetary Science. (4)
spring
Solar system objects and their geologic evolution, surfaces, interiors, and atmospheres; weekly laboratory for data analysis and experiments. Lecture, lab, weekend field trip.
General Studies: SG

GLG 110 Geologic Disasters and the Environment. (3)
fall
Geological studies as they apply to interactions between humans and earth. Includes geological processes and hazards, resources, and global change.
General Studies: SG (if credit also earned in GLG 111), G

GLG 111 Geologic Disasters Laboratory. (1)
fall
Basic geological processes and concepts. Emphasizes geology-related environmental problems. Case histories, field studies, lab. Corequisite: GLG 110.
General Studies: SG (if credit also earned in GLG 110)

GLG 294 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Geology of the Planets

Fee.

GLG 300 Geology of Arizona. (3)
once a year
Basic and historical geology, fossils, mining, energy resources, environmental problems, landscape development, and meteorites, cast in examples from Arizona. Majors who have taken GLG 101 for credit may not enroll.

GLG 304 Geology of the Grand Canyon. (2)
selected semesters
Reviews the discovery, history, origin, and geology of the Grand Canyon of the Colorado River in Arizona. Requires 6-day field trip down the river (first 6 days after commencement in May) at student's expense. Requires field research and term paper on trip.

GLG 310 Structural Geology. (3)
fall
Geologic structures and the mechanical processes involved in their formation. 2 hours lecture, 3 hours lab. Possible field trips. Fee. Prerequisites: GLG 101; MAT 270 (or 290).

GLG 321 Mineralogy. (3)
spring
Crystal chemistry, crystallography, mineral identification, origin and occurrence of minerals, systematic mineralogy. 2 hours lecture, 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

hours lab, possible field trips. Prerequisites: CHM 113; MAT 270 (or 290). Pre- or corequisite: CHM 116.

GLG 362 Geomorphology. (3)
selected semesters
Land forms and processes which create and modify them. Laboratory and field study of physiographic features. 2 hours lecture, 3 hours lab, possible weekend field trips. Prerequisite: GLG 101. Pre- or corequisite: GLG 310.

GLG 400 Geology Colloquium. (1)
fall and spring
Presentation of recent research by faculty and guests. Requires written assignments. 1 semester hour required for Geological Sciences majors; may be repeated for a total of 2 semester hours. Prerequisite: 2 courses in the department or instructor approval.

GLG 405 Geology of the Moon. (3)
selected semesters
Current theories of the origin and evolution of the moon through photogeological analyses and consideration of geochemical and geophysical constraints. Possible field trips to examine Arizona geology. Fee. Prerequisite: GLG 105 or instructor approval.

GLG 406 Geology of Mars. (3)
selected semesters
Geological evolution of Mars through analyses of spacecraft data, theoretical modeling, and study of terrestrial analogs; emphasizes current work. Possible field trips to examine Arizona geology. Fee. Prerequisite: GLG 105 or instructor approval.

GLG 410 Computers in Geology. (3)
fall
Geological computer skills, including data processing, visualization, presentation, numerical analysis, software and hardware applications. 2 hours lecture, 3 hours lab. Prerequisites: both GLG 101 and an upper-division course in geology or only instructor approval.
General Studies: CS

GLG 412 Geotectonics. (3)
selected semesters
Earthquakes, earth's interior, formation of oceanic and continental crust, and plate tectonics. Emphasizes current work. Prerequisite: GLG 310.

GLG 416 Field Geophysics. (3)
spring
Methods of applied geophysical exploration; seismic refraction, gravity, electrical resistivity, geomagnetics. Includes survey planning, data acquisition, processing, analysis, and interpretation. Lecture, field exercises. Prerequisite: a course in geology or instructor approval.

GLG 418 Geophysics. (3)
fall
Solid earth geophysics; geomagnetism, gravity, seismology, heat flow. Emphasizes crust and upper mantle. Prerequisites: a combination of GLG 310 and MAT 272 and PHY 131 or only instructor approval.

GLG 419 Geodynamics. (3)
selected semesters
Emphasizes application of continuum principles to geological problems, including lithospheric stresses, heat transfer, fluid mechanics, and rock rheology. Prerequisite: PHY 131.

GLG 420 Volcanology. (3)
once a year
Distribution of past and present volcanism, types of volcanic activity, mechanism of eruption, form and structure of volcanoes, and geochemistry of volcanic activity. Possible weekend field trips. Fee. Prerequisite: GLG 424.

GLG 424 Petrology. (3)
fall
Origin of igneous and metamorphic rocks. Optical mineralogy, hand specimen identification, and thin-section analysis. 2 hours lecture, 3 hours lab, possible weekend field trips. Fee. Prerequisite: GLG 321.

GLG 430 Paleontology. (3)
fall
Introduces concepts and analytical techniques in biogeology, paleobiology, paleoecology, and paleoenvironmental reconstruction from the fossil record. 2 hours lecture, 3 hours lab. Fee. Prerequisites: both GLG 102 and MAT 270 (or 290) or only instructor approval.

GLG 435 Sedimentology. (3)
spring
Origin, transport, deposition, and diagenesis of sediments and sedimentary rocks. Physical analysis, hand specimen examination, and interpretation of rocks and sediments. 2 hours lecture, 3 hours lab, possible weekend field trips. Fee. Prerequisites: GLG 102, 321.

GLG 441 Ore Deposits. (3)
selected semesters
Origin, occurrence, structure, and mineralogy of ore deposits. Possible weekend field trips. Fee. Prerequisite: GLG 424 or instructor approval.

GLG 451 Field Geology I. (3)
spring
Geological mapping techniques using topographic maps and aerial photos. Intensive field-based instruction. Lab. Prerequisites: GLG 310, 321.
General Studies: L

GLG 452 Field Geology II. (3)
summer
Continuation of GLG 451. Lab. Prerequisite: GLG 451.
General Studies: L

GLG 455 Advanced Field Geology. (3–4)
once a year
Geologic mapping in igneous, sedimentary, and metamorphic terrains of the Basin and Range province of Arizona. May be repeated for credit. Weekend field trips. Fee. Prerequisite: instructor approval.

GLG 456 Cordilleran Regional Geology. (3)
selected semesters
Systematic coverage through space and time of the geological development of western North America, emphasizing the western United States. Fee. Prerequisite: senior major or graduate student in Geological Sciences or instructor approval.

GLG 461 Geomicrobiology. (3)
spring
Past and present interactions among microbial life, geological materials, and biogeochemical cycles involving carbon, sulfur, phosphate, nitrogen, and minerals. Cross-listed as MIC 461. Credit is allowed for only GLG 461 or MIC 461. Prerequisites: introductory courses in chemistry and microbiology (or geological sciences); instructor approval.

GLG 470 Hydrogeology. (3)
spring
Geology of groundwater occurrence, aquifer and well hydraulics, water chemistry and quality, contaminant transport, remediation. Emphasizes quantitative methods. Prerequisites: GLG 101 (or 103); MAT 270; PHY 121.

GLG 481 Geochemistry. (3)
spring
Origin and distribution of the chemical elements. Geochemical cycles operating in the earth's atmosphere, hydrosphere, and lithosphere. Cross-listed as CHM 481. Credit is allowed for only CHM 481 or GLG 481. Prerequisite: CHM 341 (or 346) or GLG 321.

GLG 484 Internship. (1–4)
selected semesters
Topics may include the following:
- Geology Internship. (3)
  fall and spring
  Assist in teaching fifth-grade students a simplified version of GLG 103 using hands-on activities.
- Service Learning
  fall, spring, summer
  Fee.

GLG 485 Meteorites and Cosmochemistry. (3)
selected semesters
Chemistry of meteorites and their relationship to the origin of the earth, solar system, and universe. Cross-listed as CHM 485. Credit is allowed for only CHM 485 or GLG 485.

GLG 490 Topics in Geology. (1–3)
fall, spring, summer
Special topics in a range of fields in geology. May be repeated for credit. Fee. Prerequisite: instructor approval.

GLG 495 Undergraduate Thesis. (3)
fall, spring, summer
Guided research culminating in the completion and presentation of an undergraduate thesis based on supervised research. Independent study. Prerequisite: GLG 499 (3 hours); formal conference with instructor; instructor and department chair approval.

GLG 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

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Department of History

www.asu.edu/clas/history
480/965-5778
SS 204

Noel J. Stowe, Chair

CORE FACULTY

Regents' Professor: Iverson
Professors: Adelson, Batalden, Burg, Davis, Fuchs, Gratton, Green, Lavrin, MacKinnon, Rosales, Simpson, Stowe, Tillman, Trennert, Warnicke
Associate Professors: Barnes, Carroll, El Hamel, Gray, Gullett, Longley, Powers, Rush, Samuelson, Smith, Soergel, Stoner, Thompson, Thornton, VanderMeer, Warren-Findley, Wright
Assistant Professors: Kaplan, Koopmans, Manchester, Pitti, Whitaker, Wilson
Senior Instructional Professional: Luey

AFFILIATED FACULTY

Art
Associate Professor: Brown

Chicana and Chicano Studies
Associate Professor: Escobar

Humanities
Assistant Professor: Taylor

Women's Studies
Professor: Rothschild

HISTORY—B.A.

The B.A. degree in History consists of 30 semester hours in history and 15 hours in closely related fields, as approved by an undergraduate advisor in consultation with the student. At least 18 hours in history courses and nine hours in related fields must be in upper-division course work, with at least 12 of the upper-division HST hours taken in residence at ASU Main. HST 300 Historical Inquiry and HST 498 History Pro-Seminar are required for all degree candidates. (Honors students may substitute HST 493 Honors Thesis for HST 498.)

Students are required to complete course work in two different areas of concentration. One concentration must be defined geographically: Asia, Europe, Latin America, or the United States. The second concentration may be thematic or geographic. Students completing a thematic concentration must complete two courses outside the field of their geographic concentration. At least two history courses in either concentration must include topics outside the United States and Europe. Students must complete at least one course in the HST 302–307 "Studies in History" sequence.

The major includes the following:

1. one concentration of 18 hours (12 hours HST and six hours related field);
2. one concentration of 15 hours (12 hours HST and three hours related field);
3. HST 300, three hours (may be within a concentration);
4. HST 498, three hours (may be within a concentration);
5. elective related field courses, six hours;
6. two HST courses with content outside Europe and the United States (may be within a concentration);
7. two HST courses in thematic concentration outside the geographic concentration; and
8. at least one course in the HST 302–307 "Studies in History" sequence as part of one concentration.

A minimum GPA of 2.25 in the 30 hours of history course work is required.

Asian Studies Certificate. Students majoring in History may elect to pursue an Asian Studies Certificate combining courses from the major with selected outside courses of wholly Asian content. See "Asian Studies," page 314, for more information.

Jewish Studies Certificate. Students majoring in History may elect to pursue the Jewish Studies Certificate combining courses from the major with selected outside courses of wholly Jewish content. See "Jewish Studies," page 317, for more information.

Latin American Studies Certificate. Students majoring in History may elect to pursue a Latin American Studies Certificate combining courses from the major with selected outside courses of wholly Latin American content. See "Latin American Studies," page 317, for more information.

Medieval and Renaissance Studies Certificate. Students majoring in History may elect to pursue the Medieval and Renaissance Studies Certificate by successfully completing the requirements. See "Medieval and Renaissance Studies," page 317, for more information.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Russian and East European Studies Certificate. Students majoring in History may elect to pursue the Russian and East European Studies Certificate combining courses from the major with selected outside courses of wholly Russian and East European content. See "Russian and East European Studies," page 318, for more information.

Southeast Asian Studies Certificate. Students majoring in History may elect to pursue the Southeast Asian Studies Certificate combining courses from the major with selected outside courses of wholly Southeast Asian content. See "Southeast Asian Studies," page 318, for more information.

Women's Studies Certificate. Students majoring in History may elect to pursue a Women's Studies Certificate by successfully completing the requirements. See "Women's Studies," page 319, for more information.

MINOR IN HISTORY

The History minor consists of 18 semester hours of course work, at least 12 hours of which are in upper-division course work. Students earning a minor in history must complete one 12 hour HST concentration (geographic or thematic), HST 300, and 498. The Department of History requires a grade of at least "C" in all courses in the minor. A minimum of six upper-division hours in the minor must be taken in residence at ASU Main.

B.I.S. CONCENTRATION

A concentration in history is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification (ITC) program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

History. The major teaching field consists of 42 semester hours, of which at least 30 must be in history courses. At least 18 must be in upper-division courses. At least 15 must be in U.S. history. The remaining history and related-area courses must be selected in consultation with an advisor from the Department of History. All degree candidates must complete the following four-course methods block:

HST 300 Historical Inquiry *L/SB, H* 3
HST 480 Methods of Teaching History: Classroom Resources ... 3
HST 481 Methods of Teaching History: Community Resources 3
HST 498 PS: History Pro-Seminar *L* 3

Students should complete HST 300 before enrolling in HST 480, 481, and 498. A minimum GPA of 2.50 in history courses is required for admission to the ITC program and for graduation. HST 480 and 481 may not be counted as part of the 42-hour requirement for the academic specialization.

GRADUATE PROGRAMS

The faculty in the Department of History offer programs leading to the M.A. and Ph.D. degrees. A Scholarly Publishing Certificate is also available. See the *Graduate Catalog* for requirements.

HISTORY (HST)

HST 101 Global History Since 1500. (3)
fall and spring
Survey of Africa, the Americas, and Eurasia; changes in communication, communities, demography, economics, environment, politics, religion, technology, warfare, and women. Lecture, CD-ROM, electronic forum, discussion.
General Studies: G, H

HST 102 Western Civilization. (3)
fall and spring
Origins and development of Western societies and institutions from the ancient world through the Middle Ages.
General Studies: SB, H

HST 103 Western Civilization. (3)
fall and spring
Origins and development of Western societies and institutions from Black Death through the Renaissance and Reformation to the Enlightenment.
General Studies: SB, H

HST 104 Western Civilization. (3)
fall and spring
Origins and development of Western societies and institutions from the French Revolution to the present.
General Studies: SB, G, H

HST 105 Slavic Civilization. (3)
fall, spring, summer
Development of Slavic cultures and societies from medieval Byzantium to the present; introduction to modern Eurasia. Lecture, discussion, electronic forum.
General Studies: SB, H

HST 106 Asian Civilizations. (3)
once a year
Civilizations of China, Japan, and India from antiquity to the 17th century.
General Studies: SB, G, H

HST 107 Asian Civilizations. (3)
once a year
Civilizations of China, Japan, India, and Southeast Asia from the 17th century to the present.
General Studies: SB, G, H

HST 108 Introduction to Japan. (3)
fall
Historical survey of the people, culture, politics, and economy of Japan, supplemented by audiovisual presentations. Intended for nonmajors.
General Studies: SB, G, H

HST 109 The United States to 1865. (3)
fall and spring
Growth of the Republic from the colonial period through the Civil War.
General Studies: SB, H

HST 110 The United States Since 1865. (3)
fall and spring
Growth of the Republic from the Civil War to the present.
General Studies: SB, H

HST 200 Historical Themes. (3)
once a year
General introduction to selected themes in history. May be repeated for credit when topics vary.
General Studies: SB, H

HST 201 Historical Themes in Asia. (3)
once a year
General introduction to selected themes in Asian history. May be repeated for credit when topics vary.
General Studies: SB, H

HST 202 Historical Themes in Europe. (3)
once a year
General introduction to selected themes in European history. May be repeated for credit when topics vary.
General Studies: SB, H

HST 203 Historical Themes in Latin America. (3)
once a year
General introduction to selected themes in Latin American history. May be repeated for credit when topics vary.
General Studies: SB, H

HST 204 Historical Themes in the United States. (3)
once a year
General introduction to selected themes in United States history. May be repeated for credit when topics vary.
General Studies: SB, H

HST 205 Historical Themes in Africa. (3)
fall and spring
General introduction to selected themes in African history. May be repeated for credit when topics vary.

HST 210 American Social History. (3)
once a year
American society from the colonial period to the present. Ethnicity, race, age, and sex as factors in historical experience. Prerequisite: ENG 101 or 105.
General Studies: L/SB, H

HST 211 American Jewish History. (3)
selected semesters
Chronological analysis of Jews and Judaism in American history and letters.
General Studies: SB, H

HST 212 American Military History. (3)
selected semesters
Study of the role of the military in American life during war and peace from colonial times to the present day. 3 hours lecture, conference.
General Studies: SB, H

HST 240 Introduction to Southeast Asia. (3)
fall
Interdisciplinary introduction to the cultures, religions, political systems, geography, and history of Southeast Asia. Cross-listed as ASB 240/GCU 240/POS 240/REL 240. Credit is allowed for only ASB 240 or GCU 240 or HST 240 or POS 240 or REL 240.
General Studies: G

HST 294 ST: Selected Topics in History. (3)
selected semesters
Full description of topics for any semester is available in the Department of History office. May be repeated for credit.

HST 300 Historical Inquiry. (3)
fall and spring
Historical methods and critical inquiry related to particular events and processes. May be repeated for credit when topics vary. Required course for majors. Prerequisite for HST 498. Discussion, seminar, lecture. Prerequisites: ENG 102; History major.
General Studies: L/SB, H

HST 302 Studies in History. (3)
once a year
Specialized topics in history. Explores countries, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.
General Studies: SB, H

HST 303 Studies in Asian History. (3)
once a year
Specialized topics in Asian history. Explores countries, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.
General Studies: SB, H

HST 304 Studies in European History. (3)
once a year
Specialized topics in European history. Explores countries, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.
General Studies: SB, H

HST 305 Studies in Latin American History. (3)
once a year
Specialized topics in Latin American history. Explores countries, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.
General Studies: SB, H

HST 306 Studies in United States History. (3)
once a year
Specialized topics in United States history. Explores regions, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.
General Studies: SB, H

HST 307 Studies in African History. (3)
fall and spring
Specialized topics in African history. Explores countries, cultures, and issues in history, and their interpretation in historical scholarship. May be repeated for credit when topics vary.

HST 309 Exploration and Empire. (3)
once a year
Survey of European discovery, exploration, and imperialism in the early modern and modern periods.
General Studies: L, H

HST 310 Film as History. (3)
once a year
Survey of moving image media as recorder, object, and writer of history.
General Studies: HU

HST 313 American Cultural History to 1865. (3)
fall and spring
Culture, including ideas, ideals, the arts, and social and economic standards, from the nation's colonial and early national periods.
General Studies: SB, H

HST 314 American Cultural History Since 1865. (3)
fall and spring
Culture, including ideas, ideals, the arts, and social and economic standards, from the age of industrialism to modern U.S.
General Studies: SB, H

HST 315 Political History of the United States. (3)
once a year
American political history since independence, focusing post-1865. Evaluates major trends in issues, presidential leadership, elections, and state politics. Lecture, discussion.
General Studies: SB, H

HST 316 20th-Century U.S. Foreign Relations. (3)
once a year
U.S. relations with foreign powers from the late 19th century to the present.
General Studies: SB, G, H

HST 318 United States Labor History. (3)
selected semesters
American workers, from the colonial period to the present, including farmers, slaves, housewives, the skilled and unskilled, unionized and nonunionized.
General Studies: SB, H

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

HST 319 U.S. Urban History to 1850. (3)
once a year
History of the city in American life from the colonial period to the mid-19th century.
General Studies: SB, H

HST 320 U.S. Urban History Since 1850. (3)
once a year
History of the city in American life from the mid-19th century to the present.
General Studies: SB, H

HST 321 Constitutional History of the United States to 1865. (3)
fall
Origin and development of the American constitutional system from colonial period through the Civil War.
General Studies: SB, H

HST 322 Constitutional History of the United States Since 1865. (3)
spring
Development of the U.S. constitutional system from Reconstruction to the present.
General Studies: SB, H

HST 325 Immigration and Ethnicity in the United States. (3)
fall and spring
Origins, historical development, and future of a multiethnic society, 1492 to 2050. Prerequisite: HST 109 or 110.
General Studies: SB, C, H

HST 327 Women in U.S. History, 1600–1880. (3)
fall and spring
Examines American women of diverse racial, religious, and ethnic groups and classes; focuses on changing definitions of women's roles.
General Studies: SB, C, H

HST 328 Women in U.S. History, 1880–1980. (3)
fall and spring
Examines American women of diverse racial, religious, and ethnic groups and classes; focuses on changing definitions of women's roles.
General Studies: SB, C, H

HST 329 Women in 20th-Century U.S. West. (3)
once a year
Examines how women of various cultures have contended for and shaped the U.S. West, including the West of imagination. Lecture, discussion.
General Studies: C, H

HST 330 Mexican Women in the United States: Conquests and Migrations. (3)
once a year
Overview of Chicana history from Mesoamerican origins to the present, focusing on Mexican women in the western U.S. Lecture, discussion.
General Studies: L/SB, C, H

HST 331 Mexican American History to 1900. (3)
once a year
Mexican American history from pre-Hispanic origins to frontier journeys north through 19th-century life in the U.S. Southwest.
General Studies: SB, C, H

HST 332 Mexican American History Since 1900. (3)
once a year
Traces the formation of Mexican American communities across the rural and urban U.S. and examines 20th-century immigration from Mexico.
General Studies: SB, C, H

HST 333 African American History to 1865. (3)
once a year
The African American in American history, thought, and culture from slavery to 1865. Cross-listed as AFS 363. Credit is allowed for only AFS 363 or HST 333.
General Studies: SB, C, H

HST 334 African American History Since 1865. (3)
once a year
The African American in American history, thought, and culture from 1865 to the present. Cross-listed as AFS 364. Credit is allowed for only AFS 364 or HST 334.
General Studies: SB, C, H

HST 337 American Indian History to 1900. (3)
fall and spring
Cultural, economic, political, and social continuity and change of American Indian communities to 1900.
General Studies: SB, C, H

HST 338 American Indian History Since 1900. (3)
fall and spring
Cultural, economic, political, and social continuity and change of American Indian communities from 1900 to the present.
General Studies: SB, C, H

HST 341 The U.S. West in the 19th Century. (3)
once a year
Social, political, and economic development of the trans-Mississippi West, beginning with the Louisiana Purchase and ending in 1900.
General Studies: SB, H

HST 342 The U.S. West in the 20th Century. (3)
fall and spring
Role of the western states in U.S. history since 1890 emphasizing politics, the environment, industry and labor, and ethnic minorities.
General Studies: SB, H

HST 343 The American Southwest. (3)
once a year
Development of the region from 1848 to the present.
General Studies: L/SB, H

HST 344 Arizona. (3)
fall and spring
Emergence of the state from early times to the present.
General Studies: SB, H

HST 347 Ancient Greece. (3)
fall
History and civilization of the Greek world from 650 B.C.E. to the death of Alexander the Great.
General Studies: SB, H

HST 348 Rome. (3)
spring
History and civilization of Rome from the beginning of the Republic to the end of the Empire.
General Studies: SB, H

HST 349 The Early Middle Ages. (3)
fall
Political, socioeconomic, and cultural developments of Western Europe from the 5th through 10th centuries.
General Studies: SB, H

HST 350 The Later Middle Ages. (3)
spring
Political, socioeconomic, and cultural developments of Western Europe from the 11th through 15th centuries.
General Studies: SB, H

HST 351 Renaissance Europe. (3)
fall
Culture of the Renaissance in Italy and Northern Europe from the 14th to the early 16th centuries.
General Studies: L/SB, H

HST 352 Europe's Reformations. (3)
spring
Causes and implications of the major Protestant, Catholic, and Radical religious reformations in 16th- and 17th-century Europe.
General Studies: L/SB, H

HST 353 The Old Regime in Europe. (3)
fall
Society and culture of Europe during the 17th and 18th centuries.
General Studies: SB, H

HST 354 Revolutionary Europe. (3)
spring
Political, social, economic, and intellectual currents in Europe from the French through the Russian Revolutions.
General Studies: SB, H

HST 355 Total War and the Crisis of Modernity. (3)
fall
Forces of change and instability in early 20th-century Europe.
General Studies: SB, G, H

HST 356 Europe Since 1945. (3)
selected semesters
Europe in its world setting since World War II, emphasizing major political and social issues from 1945 to the present.
General Studies: SB, G, H

HST 358 Jewish History from the Bible to 1492. (3)
fall
Continuity and change in political, legal, economic, and sociocultural history of the Jews from biblical through medieval times. Lecture, discussion.
General Studies: SB, H

HST 359 Jewish History from 1492 to 1948. (3)
spring
Jewish history from early modern through modern times, highlighting emancipation, enlightenment, and Jewish responses to modernity. Lecture, discussion.
General Studies: SB, G, H

HST 361 Witchcraft and Heresy in Europe. (3)
selected semesters
Background, origins, and development of the Inquisition; persecution of women and marginal groups. Cross-listed as REL 374. Credit is allowed for only HST 361 or REL 374. Prerequisite: upper-division standing or instructor approval.
General Studies: L, H

HST 362 Sex and Society in Classical and Medieval Europe. (3)
fall
Family life, sex roles, and marriage, and their relationship to political, economic, and religious change in classical and medieval Europe. Lecture, discussion. Prerequisite: upper-division standing or instructor approval.
General Studies: SB, H

HST 363 Sex and Society in Early Modern Europe. (3)
spring
Family life, sex roles, and marriage and their relationship to political, economic, and religious change in early modern Europe. Lecture, discussion. Prerequisite: upper-division standing or instructor approval.
General Studies: SB, H

HST 364 Sex and Society in Modern Europe. (3)
selected semesters
Family life, sex roles, and marriage, and their relationship to political, economic, and social changes in modern Europe. Lecture, discussion. Prerequisite: upper-division standing or instructor approval.
General Studies: L/SB, H

HST 365 Women in Europe. (3)
once a year
European women's diverse religious, ethnic, national, and economic roles in society, culture, and politics, 1750 to the present.
General Studies: L/HU/SB, H

HST 366 England to 1689. (3)
once a year
Political, economic, and social development of the English people to the late 17th century.
General Studies: SB, H

HST 367 Modern Britain. (3)
once a year
Political, economic, and social development in Britain from 17th century to the present.
General Studies: SB, H

HST 368 Culture and Imagination in European History. (3)
once a year
Topics in European cultural and intellectual history. May be repeated for credit.
General Studies: HU, H

HST 370 Eastern Europe in Transition. (3)
once a year
Democratization, privatization, and identity transformations since the fall of communism in contemporary Eastern Europe and the former Soviet Union. Lecture, discussion.
General Studies: SB, G, H

HST 372 The Modern Middle East. (3)
selected semesters
Impact of the West and modernization upon Middle Eastern governments, religion, and society in the19th and 20th centuries.
General Studies: SB, G, H

HST 375 Colonial Latin America. (3)
fall and spring
Ancient civilization, exploration and conquerors, and colonial institutions.
General Studies: SB, H

HST 376 Modern Latin America. (3)
fall and spring
Nationalistic development of the independent republics since 1821.
General Studies: SB, H

HST 377 Women in Colonial Latin America. (3)
fall
History of women in colonial Latin America, cross-examining class, race, and gender relations in depth. Lecture, discussion.
General Studies: H

HST 378 Latin American Women: The National Period. (3)
spring
Surveys the history of women, gender relations, and state policies in a broad continental setting, from independence to the present. Lecture, media, discussion.
General Studies: SB, G, H

HST 380 Cultural History of Latin America. (3)
selected semesters
Main currents of thought, the outstanding thinkers, and their impact on 19th- and 20th-century Latin America. Cultural and institutional basis of Latin American life.
General Studies: SB, H

HST 383 China. (3)
fall
Political, economic, social, and cultural history of the Chinese people from early times to the 17th century.
General Studies: SB, H

HST 384 China. (3)
spring
Political, economic, social, and cultural history of the Chinese people from the 17th century to the present.
General Studies: SB, G, H

HST 385 Chinese Science and Medicine. (3)
selected semesters
Explores developments of Chinese traditions dealing with the natural world, science, and medicine. Lecture, discussion. Cross-listed as HPS 325. Credit is allowed for only HPS 325 or HST 385.
General Studies: HU, G, H

HST 386 Interpreting China's Classics. (3)
selected semesters
Study of selected Confucian and/or Taoist classics and ways they have been read in both Asian and Western scholarship. Cross-listed as HUM 312. Credit is allowed for only HST 386 or HUM 312.
General Studies: L/HU, H

HST 387 Japan. (3)
once a year
Political, economic, social, and cultural history of the Japanese people from early times to the 17th century.
General Studies: L/SB, H

HST 388 Japan. (3)
once a year
Political, economic, social, and cultural history of the Japanese people from the 17th century to the present.
General Studies: SB, G, H

HST 389 Japanese Society and Values: Premodern. (3)
selected semesters
Effects of economic and social transitions on personal and social values as reflected in the dramatizations of contemporary events.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

HST 391 Modern Southeast Asia. (3)
spring
Vietnam, Laos, Cambodia, Thailand, Burma, Malaysia, Singapore, Brunei, Indonesia, and Philippines since 1750: imperialism, revolution, and independence. Lecture, discussion.
General Studies: SB, G, H

HST 394 ST: Selected Topics in History. (3)
fall and spring
Full description of topics for any semester is available in the Department of History office. May be repeated for credit.

HST 405 Colonial American History to 1763. (3)
once a year
Political, economic, social, and cultural history of the colonial era. Concentrates on English colonies, with some consideration of Spanish, French, and other colonial regions in North America.
General Studies: SB, H

HST 406 The American Revolution, 1763–1789. (3)
once a year
Causes, course, and consequences of the American Revolution culminating in the ratification of the Constitution.
General Studies: SB, H

HST 407 The Early U.S. Republic, 1789–1850. (3)
once a year
Political, social, economic, and cultural development of the United States from the Revolution to 1850.
General Studies: L/SB, H

HST 408 Civil War and Reconstruction. (3)
once a year
Explores the causes, conduct, and consequences of the American Civil War, concentrating on the years 1848 to 1877.
General Studies: L/SB, H

HST 409 The Emergence of the Modern United States, 1877 to 1918. (3)
once a year
Triumph of modern political, social, and economic structures and values, 1877–1918; role of region, religion, race, and ethnicity.
General Studies: SB, H

HST 410 The Modern United States, 1918 to 1945. (3)
once a year
1920's boom and the crash, the Depression and the New Deal response. The Second World War at home and abroad.
General Studies: SB, H

HST 411 The Postwar United States, 1945 to 1973. (3)
once a year
Cold War, prosperity, reform, and immense social and political change in the U.S.
General Studies: SB, H

HST 412 The Contemporary United States, 1973 to the Present. (3)
once a year
End of the Cold War, political crises, and cultural transformations in the U.S.
General Studies: SB, H

HST 414 The Modern U.S. Economy. (3)
selected semesters
Origins of 19th-century slavery and industrialization; 20th-century crisis and regulation: political economy of an advanced capitalist democracy. Prerequisite: ECN 111 (or 112) or HST 109 (or 110).
General Studies: SB, H

HST 415 Unequal Sisters: Women and Political and Cultural Change. (3)
once a year
Examines race, ethnic, and class differences among women, focusing on the political and cultural experiences of women in the U.S.
General Studies: L/SB, C, H

HST 416 Indian History of the Southwest. (3)
once a year
Reviews historical events from prehistoric peoples, the Spanish and Mexican periods, and the U.S. period from 1846 to present.
General Studies: SB, C, H

HST 417 Topics in Mexican American History. (3)
once a year
Focuses on specific topics in Mexican American history, including immigration, civil rights, the Chicano Movement, union activism, and regional and generational differences.
General Studies: SB, C, H

HST 423 The Tudor Monarchy. (3)
once a year
Political, cultural, and social foundations of 16th-century England.
General Studies: SB, H

HST 424 The Stuart Transformation of England. (3)
once a year
Political, social, economic, and cultural developments in 17th-century England.
General Studies: SB, H

HST 426 The British Empire. (3)
once a year
British imperialism and colonialism in Africa, the Americas, Asia, and the South Pacific. Prerequisite: upper-division standing or instructor approval.
General Studies: SB, H

HST 427 The French Revolution and the Napoleonic Era. (3)
once a year
Conditions in Pre-Revolutionary and Revolutionary France; organization of France under Napoleon and impact of French changes upon Europe.
General Studies: SB, H

HST 428 Modern France. (3)
selected semesters
Social, political, economic, and cultural transformations of French society, 1815–present. Impact of industrialization, war, and revolution on people's lives. Prerequisite: upper-division standing or instructor approval.
General Studies: SB, G, H

HST 429 Modern Germany. (3)
once a year
Germany since 1871.
General Studies: SB, G, H

HST 430 Hitler: Man and Legend. (3)
once a year
Biographical approach to the German Third Reich emphasizing nature of Nazi regime, sociocultural issues, World War II, and historiography.
General Studies: SB, H

HST 431 Eastern Europe and the Balkans Before 1914. (3)
selected semesters
Empire and nation in Eastern Europe and the Balkans before World War I, emphasizing Hapsburg and Ottoman lands.
General Studies: SB, H

HST 432 Eastern Europe and the Balkans in the 20th Century. (3)
selected semesters
Politics and culture in Eastern Europe and the Balkans from World War I to the present.
General Studies: SB, G, H

HST 435 The Russian Empire. (3)
fall
Development of Russian imperial institutions and civil society from the 17th to the early 20th centuries. Lecture, discussion.
General Studies: SB, H

HST 436 The Soviet Experiment. (3)
spring
Communist revolutionaries' rule of Russia, focusing on utopian culture, Stalinist terror, heroism in war, and the breakup of the former USSR.
General Studies: SB, G, H

HST 437 Spain Through the Golden Age. (3)
selected semesters
Cultural, economic, political, and social development of Spain from antiquity to the late 17th century.
General Studies: HU/SB, H

HST 438 Modern Spain. (3)
selected semesters
Cultural, economic, political, and social development of modern Spain.
General Studies: HU/SB, G, H

HST 441 Spanish South America. (3)
selected semesters
Political, economic, and social development of the Spanish-speaking nations of South America since independence. 19th-century developments.
General Studies: SB, H

HST 442 Spanish South America. (3)
once a year
Political, economic, and social development of the Spanish-speaking nations of South America. 20th-century developments.
General Studies: SB, H

HST 443 The United States and Latin America. (3)
once a year
Latin American struggle for diplomatic recognition, attempts at political union, participation in international organizations since 1810, and relations between the United States and Latin America.
General Studies: SB, G, H

HST 445 20th-Century Cuba. (3)
once a year
History of Cuba from colonial era to formation of the early republic; political, economic, social development in late 20th century. Lecture, discussion.
General Studies: SB, G, H

HST 446 Colonial Mexico. (3)
once a year
Political, economic, social, and cultural developments from pre-Columbian times to 1810.
General Studies: SB, H

HST 447 Modern Mexico. (3)
once a year
Political, economic, social, and cultural developments from 1810 to the present.
General Studies: SB, H

HST 451 Chinese Cultural History. (3)
selected semesters
China's classics in translation studied both for their intrinsic ideas and for the origins of Chinese thought.
General Studies: SB, H

HST 452 Chinese Cultural History. (3)
selected semesters
Evolution of Confucian thought, its synthesis with Taoism and Buddhism, and modern reactions against, and uses of, Confucian traditions.
General Studies: SB, G, H

HST 453 The People's Republic of China. (3)
selected semesters
Analyzes major political, social, economic, and intellectual trends in China since the founding of the People's Republic in 1949.
General Studies: SB, G, H

HST 455 The United States and Japan. (3)
fall
Cultural, political, and economic relations in the 19th and 20th centuries. Emphasizes post-World War II period.
General Studies: SB, G, H

HST 456 The Vietnam War. (3)
once a year
Intersection of American and Asian histories in Vietnam, viewed from as many sides as possible.
General Studies: SB, G, H

HST 460 History of Fire. (3)
fall
Global survey of the natural and cultural history of fire. Lecture, discussion.
General Studies: L, H

HST 480 Methods of Teaching History: Classroom Resources. (3)
fall
Methods in instruction, organization, and presentation of the subject matter of history and closely allied fields. Prerequisites: HST 300; ITC admission.

HST 481 Methods of Teaching History: Community Resources. (3)
spring
Identify community-based resources for teaching history, work with resources, and learn how to integrate them into the secondary classroom. Lecture, lab. Prerequisites: HST 300; ITC admission.

HST 484 Internship. (1–4)
selected semesters

HST 492 Honors Directed Study. (1–6)
selected semesters

HST 493 Honors Thesis. (3)
selected semesters
General Studies: L

HST 494 Special Topics. (1–4)
selected semesters

HST 498 History Pro-Seminar. (3)
fall and spring
Required course for majors on topic selected by instructor; writing-intensive course related to the development of research skills and writing tools used by historians. Prerequisites: HST 300; History major.
General Studies: L

HST 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

SCHOLARLY PUBLISHING (PUB)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Interdisciplinary Humanities Program

www.asu.edu/clas/humanities
480/965-6747
LL 641

Peter Lehman, Director

Humanities
Professors: Kugelmass, Lehman
Associate Professor: Privateer
Assistant Professors: Baker, Duncan, Lund, Romeyn, Taylor
Academic Professional: Zaffrann

Languages and Literatures
Regents' Professor: Foster

The humanities are those learned bodies of knowledge that are used to express ideas, to understand the meaning of words, and to explore the values and beliefs that underlie our culture and the cultures of others. As defined by the U.S. Congress, the humanities include archaeology, comparative religion, ethics, history, jurisprudence, literature, linguistics, philosophy, the history and criticism of the arts, and those aspects of the social sciences that employ a philosophical or historical rather than quantitative approach to knowledge.

HUMANITIES—B.A.

The major in Humanities is interdisciplinary and may be intercollegiate. In consultation with an advisor, the student takes a minimum of 44 semester hours of interdisciplinary humanities courses from two components: (1) an interdisciplinary core of 23 hours and (2) an area of concentration of 21 hours.

Interdisciplinary Core

Issues, Methods, and Theory
HUM 200 Encountering the Humanities *HU* 3
HUM 498 Pro-Seminar in the Humanities 3

Cultures in Context
HUM 301 Humanities in the Western World *L/HU, H* 4
HUM 302 Humanities in the Western World *L/HU, H* 4
One approved upper-division HUM course on the cultures and traditions of Latin America, Asia, or Africa 3

Ethnicity, Race, and Gender
One approved course 3

Art, Science, and Technology
One approved course 3

Total 23

Area of Study
Required courses from list obtained from advisor 21

Courses must be selected from an approved list or be approved in advance by the undergraduate advisor. Areas of study include architecture, culture and society; Asian studies; classical studies; film and media studies; and humanistic studies. An undergraduate major may also earn a certificate in Classical Studies.

Students must receive grades of "C" or higher in all courses for the major.

MINOR IN HUMANITIES

The following courses are required for the minor:

HUM 110 Contemporary Issues in Humanities *HU* 3
or HUM 200 Encountering the Humanities *HU* (3)
HUM 301 Humanities in the Western World *L/HU, H* 4
HUM 302 Humanities in the Western World *L/HU, H* 4
Three approved upper-division HUM courses 9

Total 20

B.I.S. CONCENTRATION

A concentration in humanities is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAM

The faculty in the program also offer the M.A. degree in Humanities through the Graduate Committee on Humanities. See the *Graduate Catalog* for requirements.

HUMANITIES (HUM)

HUM 110 Contemporary Issues in Humanities. (3)
fall and spring
Responses of literature, art history, history, philosophy, religion, and other disciplines to common problems affecting modern American life.
General Studies: HU

HUM 194 Special Topics in the Humanities. (1–4)
selected semesters
Open to all students. Topics may include the following:
- American Fine Arts. (3)
- Comparative Fine and Performing Arts. (3)
- Cultures of Ethnic Minorities. (3)
- Non-Western Cultures. (3)
- Western Historical or Contemporary Cultures. (3)

HUM 200 Encountering the Humanities. (3)
fall and spring
Introduces the languages, methods, and objectives of the study of the interdisciplinary humanities. Intersections of ideas, values, and cultural institutions. Lecture, studio, workshop. Prerequisite: Humanities major.
General Studies: HU

HUM 260 Introduction to Islam. (3)
spring
Examines Islamic beliefs, ceremonies, festivals, and institutions. Assumes no prior knowledge about Islam. Lecture, discussion. Cross-listed as REL 260. Credit is allowed for only HUM 260 or REL 260.
General Studies: HU, G

HUM 294 Special Topics in the Humanities. (1–4)
selected semesters
Open to all students. Topics may include the following:
- American Fine Arts. (3)
- Comparative Fine and Performing Arts. (3)
- Cultures of Ethnic Minorities. (3)
- Film and Media Studies. (3)

- Introduction to Film
  Fee.
- Introduction to Southeast Asia
- Non-Western Cultures. (3)

HUM 301 Humanities in the Western World. (4)
fall
Interrelation of arts and ideas in Western civilization, Hellenic through medieval. 3 hours lecture, 1 discussion meeting per week.
General Studies: L/HU, H

HUM 302 Humanities in the Western World. (4)
spring
Interrelation of arts and ideas in Western civilization, Renaissance to the present. 3 hours lecture, 1 discussion meeting per week.
General Studies: L/HU, H

HUM 310 Japanese Cities and Cultures to 1800. (3)
once a year
Relations among ideas and literary, visual, and performing arts of the ancient aristocracy, medieval samurai, and early modern townspeople. Cross-listed as REL 355. Credit is allowed for only HUM 310 or REL 355.
General Studies: L/HU, H

HUM 312 Interpreting China's Classics. (3)
selected semesters
Study of selected Confucian and/or Taoist classics and ways they have been read in both Asian and Western scholarship. Cross-listed as HST 386. Credit is allowed for only HST 386 or HUM 312.
General Studies: L/HU, H

HUM 331 Sexuality, Race, and Power. (3)
fall
Sexuality as an expression of identity politics, social transgression, and racial inequality, as portrayed in international literature, art, and film. Lecture, discussion.

HUM 340 Contemporary American Film and Popular Culture. (3)
fall
Study of American film, television, and popular music of past three decades as cultural documents. Fee.
General Studies: HU

HUM 371 Origins, Evolution, and Creation. (3)
selected semesters
Examines scientific, mythic, and religious ideas relating to origins (particularly human). Place of antievolutionism and "scientific creationism" in American culture. Lecture, discussion. Cross-listed as BIO 344/HPS 311/REL 383. Credit is allowed for only BIO 344 or HPS 311 or HUM 371 or REL 383.

HUM 372 The Darwinian Revolution. (3)
selected semesters
Intellectual and cultural history of Darwinism and modern evolutionary theory and their impact on 19th- and 20th-century thought. Lecture, discussion. Cross-listed as BIO 346/HPS 332. Credit is allowed for only BIO 346 or HPS 332 or HUM 372.

HUM 394 Special Topics in the Humanities. (1–4)
selected semesters
Open to all students. Topics may include the following:
- Art and Politics. (3)
- Culture and Society of Contemporary China. (3)
- Film History
  Fee.
- Immigration and Ethnicity in American Culture. (3)
- The Holocaust and Social Theory. (3)

HUM 401 The Culture and Legacy of the European Enlightenment. (3)
spring
Historical survey of 18th-century European enlightenment and its status within contemporary intellectual culture. Lecture, discussion.
General Studies: HU, H

HUM 420 Interpreting Latin America. (3)
spring
Introduces protocols and methodologies for cultural interpretation of Latin America, with emphasis on four principal cities as cultural space.
General Studies: HU, G, H

HUM 440 Los Angeles and Cultural Theory. (3)
spring
Analyzes representations of Los Angeles in literary, film, and musical texts and broader implications for contemporary American society.
General Studies: L/HU, C

HUM 441 American Jewry Through Film and TV. (3)
fall
Examines the connection between Jews and the entertainment industry with reference to the constructions of race, class, and ethnicity. Lecture, discussion.

HUM 450 Technology and Culture. (3)
spring
Explores sociocultural, ideological, and postmodern implications of technology and the role technology plays in social constructions as well as the spaces it creates. Seminar, discussion.
General Studies: L/HU

HUM 451 Virtual Reality: The Culture of Cyberspace. (3)
once a year
Socioeconomic, cultural, aesthetic, postmodern, theoretical, and human implications of virtual reality technologies. Themes: cultural ideological productions of cyberspace. Collaborative and research based.

HUM 460 Postmodern Culture and Interpretation. (3)
selected semesters
Currents and interpretations of postmodern culture; international, comparative perspective on the culture and traditions of contemporary "Europes" and "Americas." Seminar, discussion.
General Studies: L

HUM 461 Postcolonial Studies. (3)
selected semesters
Interdisciplinary approach to the culture of European imperialism, independence movements, and contemporary postcolonial societies, focusing on literature, film, and theory. Lecture, discussion.

HUM 462 Psychoanalysis and Culture. (3)
fall
Introduces intellectual history of psychoanalytic movement of the 20th century and its contribution to humanities disciplines.
General Studies: L/HU/SB

HUM 465 Narrative in the Human Sciences. (3)
fall
Theories of narrative and narrativity in the humanities, concentrating on the problems of specific disciplines and interdisciplinary solutions.
General Studies: L/HU

HUM 494 Special Topics in the Humanities. (1–4)
selected semesters
Open to all students. Topics may include the following:
- Comedy and Culture. (3)
- Gender and Sexuality in the Ancient World. (3)
- Global Media Studies. (3)
- Italian/American Culture. (3)

HUM 498 Pro-Seminar in the Humanities. (1–7)
fall and spring
Methodologies and comparative theories for the study of relationships between various aspects of culture, the history of ideas, and the arts. For students with a major in Humanities with upper-division standing. May be repeated for a total of 6 semester hours when topics vary. Topics may include the following:
- Theory and Culture. (3)
  General Studies: L/HU

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Department of Kinesiology

www.asu.edu/clas/kines
480/965-3875
PEBW 201

Daniel Landers, Interim Chair

Regents' Professor: Landers

Professors: Darst, Krahenbuhl, Matt, Pangrazi, Stelmach

Associate Professors: Hinrichs, Morgan, Treasure, Willis

Assistant Professors: Etnier, Huey, Ringenbach, Santello

Senior Lecturer: Landers

Lecturers: Orlowicz, Pride

KINESIOLOGY—B.S.

The B.S. degree in Kinesiology consists of 42 semester hours, including 21 semester hours of required KIN core courses (KIN 110 may be repeated for credit). The remaining 21 semester hours of KIN and other courses are prescribed by the specific concentration the student selects.

Each KIN core course has specific prerequisite courses that must be taken before taking the respective core course. These prerequisite courses include the following:

BIO	201	Human Anatomy and Physiology I *SG*	4
BIO	202	Human Anatomy and Physiology II	4
CHM	101	Introductory Chemistry *SQ*	4
MAT	117	College Algebra *MA*	3
PGS	101	Introduction to Psychology *SB*	3
PHY	111	General Physics *SQ**	3
Total			21

* Both PHY 111 and 113 must be taken to secure SQ credit.

The required KIN core courses are as follows:

KIN	110	Movement Analysis Laboratory	6
KIN	200	Introduction to Kinesiology	2
KIN	335	Biomechanics	3
KIN	340	Physiology of Exercise	3
KIN	345	Motor and Developmental Learning	3
KIN	352	Psychosocial Aspects of Physical Activity *SB, C*	3
KIN	498	PS: Kinesiology and the Future	1
Total			21

All prerequisite and KIN courses must be completed with a minimum grade of "C." The requirements for the specific concentrations are described below.

Majors must elect either the exercise science, movement science, or teacher preparation concentration.

Concentrations

Each concentration requires 21 semester hours.

Exercise Science. This concentration is designed for the student interested in more applied aspects of exercise and sport performance, e.g., strength and conditioning, sports medicine, sport skill acquisition, exercise physiology, biomechanical techniques in exercise and sport, and sport psychology.

Choose from among the courses below			9
KIN	334	Functional Anatomy and Kinesiology (3)	
KIN	448	Applied Sport Psychology *L* (3)	
KIN	484	Internship (6)	
KIN	494	ST: Interpretation of Exercise Performance (3)	
Choose from among the courses below			12
KIN	283	Prevention and Care of Athletic Injuries (3)	
KIN	348	Psychological Skills for Optimal Performance (3)	
KIN	370	Advanced First Aid (3)	
KIN	412	Biomechanics of the Skeletal System (3)	
KIN	413	Qualitative Analysis in Sport Biomechanics (3)	
KIN	441	Physiology of Women in Sport *L* (3)	
KIN	442	Fuel Metabolism (3)	
KIN	444	Metabolic Adaptations to Exercise Training (3)	
KIN	445	Exercise Physiology for Children and Adolescents (3)	
KIN	460	Theory of Strength Training *L* (3)	
KIN	485	Advanced Techniques of Athletic Training (3)	
KIN	494	ST: Environmental Exercise Physiology (3)	
KIN	494	ST: Psychology of Health and Physical Activity (3)	
KIN	494	ST: Sport and Social Issues (3)	

Other KIN courses may be substituted with advisor approval.

Movement Science. This concentration is designed for students interested in prehealth professions, biomechanical, physiological, motor control, and/or psychological mechanisms underlying human movement performance. Students interested in pursuing postbaccalaureate training in one of several possible professions in the health care industry (e.g., physical therapy, recreational therapy, occupational therapy, physician's assistant, medicine, dental, podiatry, chiropractic, etc.) will also find this concentration applicable. Additional course work in the sciences must be completed (consult with the department for a list).

Choose from among the courses below			9
KIN	484	Internship (6)	
KIN	492	Honors Directed Study: Research (6)	
KIN	493	Honors Thesis (6)	
KIN	494	ST: Research Methods (3)	
KIN	499	Individualized Instruction (1–6)	
Choose from among the courses below			12
KIN	334	Functional Anatomy and Kinesiology (3)	
KIN	370	Advanced First Aid (3)	
KIN	412	Biomechanics of the Skeletal System (3)	
KIN	414	Electromyographic Kinesiology *L* (3)	
KIN	421	Human Motor Control (3)	
KIN	422	Motor Control in Special Populations (3)	
KIN	423	Motor Control and Aging (3)	
KIN	440	Exercise Biochemistry (3)	
KIN	442	Fuel Metabolism (3)	
KIN	443	Exercise Endocrinology *L* (3)	
KIN	445	Exercise Physiology for Children and Adolescents (3)	
KIN	452	Exercise Psychology *SB* (3)	
KIN	494	ST: Muscle Physiology (3)	
KIN	494	ST: Psychology of Health and Physical Activity (3)	
KIN	494	ST: Voluntary and Reflex Control of Movement (3)	

Teacher Preparation. This concentration is designed for the student interested in a physical education teaching career at the elementary or secondary school level; also appropriate for students interested in coaching, youth sports, and recreation.

Required Courses

KIN 361 Physical Education in the Secondary School 3
KIN 376 Physical Education for the Elementary School 3
KIN 382 Adaptive and Inclusive Physical Education 3
Choose from among the courses below 12
- KIN 100 Introduction to Health Wellness *SB* (3)
- KIN 283 Prevention and Care of Athletic Injuries (3)
- KIN 290 Sports Officiating (3)
- KIN 292 Sports Officiating (3)
- KIN 334 Functional Anatomy and Kinesiology (3)
- KIN 348 Psychological Skills for Optimal Performance *SB* (3)
- KIN 370 Advanced First Aid (3)
- KIN 400 Teaching Physical Activity Concepts *L* (3)
- KIN 413 Qualitative Analysis in Sport Biomechanics (3)
- KIN 441 Physiology of Women in Sport *L* (3)
- KIN 445 Exercise Physiology for Children and Adolescents (3)
- KIN 448 Applied Sport Psychology *L* (3)
- KIN 460 Theory of Strength Training *L* (3)
- KIN 484 Internship (6)
- KIN 494 ST: Administration of Athletics (3)
- KIN 494 ST: Sport and Social Issues (3)

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

Physical Education. Candidates for the B.A.E. degree are required to complete the following courses in physical education in addition to the required KIN core courses:

KIN 361 Physical Education in the Secondary School 3
KIN 376 Physical Education for the Elementary School 3
KIN 382 Adaptive and Inclusive Physical Education 3
KIN 480 Methods of Teaching Physical Education 3
KIN elective* 3
Total 15

* See an advisor for approved electives.

Students must also complete a three-semester Physical Education Teacher Certification Program professional sequence in the College of Education (23 semester hours). Entry into this degree program requires filing an application, 56 semester hours of completed university study, and a minimum GPA of 2.50. See "College of Education," page 180, for additional requirements.

MINOR IN KINESIOLOGY

The minor in Kinesiology consists of the core sequence in exercise science and physical education as follows, plus all prerequisite courses:

KIN 110 Movement Analysis Laboratory 4
KIN 200 Introduction to Kinesiology 2
Choose from among the courses below 9
- KIN 335 Biomechanics (3)
- KIN 340 Physiology of Exercise (3)
- KIN 345 Motor and Developmental Learning (3)
- KIN 352 Psychosocial Aspects of Physical Activity *SB, C* (3)

KIN upper-division electives* 6
Total 21

* Excluding KIN 305, 310, 484, 492, and 493

The minor is not open to Kinesiology majors or Secondary Education majors in the College of Education pursuing an academic specialization in physical education.

B.I.S. CONCENTRATION

A concentration in kinesiology is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

GRADUATE PROGRAMS

The faculty in the Department of Kinesiology offer programs leading to the Master of Physical Education degree and the M.S. degree in Kinesiology. The department also participates with the Graduate College in the program leading to the Ph.D. degree in Exercise Science and with the College of Education and the Graduate College in the program leading to the Ph.D. degree in Curriculum and Instruction with a concentration in physical education. See the *Graduate Catalog* for requirements.

HEALTH SCIENCE (HES)

HES 100 Introduction to Health and Wellness. (3)
fall and spring
Current concepts in health, exercise, and wellness. Emphasis placed on personal health, theories, attitudes, beliefs, and behaviors. Cross-listed as EXW 100/KIN 100. Credit is allowed for only EXW 100 or HES 100 or KIN 100.
General Studies: SB

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

KINESIOLOGY (KIN)

KIN Note 1. A $5.00 towel and locker fee is required each semester by students using towel and locker facilities for physical education classes and intramural activities.

KIN Note 2. Physical education activity classes (KIN 105, 205, 305, 310) may not be taken for audit. Excessive absences and/or tardiness are considered disruptive behavior.

KIN 100 Introduction to Health and Wellness. (3)
fall and spring
Current concepts in health, exercise, and wellness. Emphasis placed on personal health, theories, attitudes, beliefs, and behaviors. Cross-listed as EXW 100/HES 100. Credit is allowed only for EXW 100 or HES 100 or KIN 100.
General Studies: SB

KIN 105 Physical Education Activity. (1)
fall, spring, summer
Beginning instruction in a wide variety of sports such as aerobics, aquatics, racquet sports, physical conditioning, and golf. 3 hours per week. "Y" grade only. May be repeated for credit. See KIN Notes 1, 2.
- Archery
  Fee.
- Fencing
  Fee.
- Golf
  Fee.
- Rock Climbing
  Fee.

KIN 110 Movement Analysis Laboratory. (1–2)
fall, spring, summer
Practical application of biomechanical, physiological, psychological, and learning principles in the analysis of skill acquisition and performance. May be repeated for credit. See KIN Note 1.
- Archery
  Fee.
- Fencing
  Fee.
- Golf
  Fee.

Prerequisites: KIN 105 proficiency; Kinesiology major.

KIN 191 First-Year Seminar. (1–3)
fall and spring

KIN 200 Introduction to Kinesiology. (2)
fall, spring, summer
Introduces the disciplines and professions associated with kinesiology, including an overview of historical and philosophical foundations.

KIN 205 Physical Education Activity. (1)
fall, spring, summer
Intermediate levels. Continuation of KIN 105. 3 hours per week. May be repeated for credit. See KIN Notes 1, 2.
- Archery
  Fee.
- Golf
  Fee.
- Rock Climbing
  Fee.

KIN 283 Prevention and Care of Athletic Injuries. (3)
fall and spring
Taping, injury recognition, emergency care, and observation procedures in athletic training. Prerequisites: BIO 201, 202.

KIN 290 Sports Officiating. (3)
fall
Rules and mechanics of officiating used in football, basketball, and volleyball.

KIN 292 Sports Officiating. (3)
spring
Rules and mechanics of officiating used in softball (slow and fast pitch), baseball, and track and field.

KIN 305 Physical Education Activity. (1)
fall, spring, summer
Advanced levels. Continuation of KIN 205. 3 hours per week. May be repeated for credit. See KIN Notes 1, 2.
- Golf
  Fee.

Prerequisite: instructor approval.

KIN 310 Collegiate Sports. (1)
fall and spring
Participation in men's or women's intercollegiate competition. May be repeated for 4 hours, 1 per year. "Y/E" grade.

KIN 334 Functional Anatomy and Kinesiology. (3)
spring
Muscles, bones, joints, and nerves and how they produce movement. Emphasizes muscle origins, insertions, actions, and innervations. Lecture, lab. Prerequisite: BIO 201.

KIN 335 Biomechanics. (3)
fall, spring, summer
Basic anatomical and mechanical principles applied to human movement. Emphasis placed on kinematic and kinetic concepts. Lecture, recitation, lab. Fee. Prerequisites: BIO 201; MAT 117; PHY 111.

KIN 340 Physiology of Exercise. (3)
fall, spring, summer
Physiological mechanisms of acute responses and chronic adaptations to exercise. Lecture, recitation, lab. Fee. Prerequisites: BIO 201, 202; CHM 101.

KIN 345 Motor and Developmental Learning. (3)
fall, spring, summer
Principles of motor skill acquisition across the life span, focusing on the learner and the learning environment. Lecture, recitation, lab. Fee. Prerequisites: BIO 201; PGS 101.

KIN 348 Psychological Skills for Optimal Performance. (3)
fall and spring
Applies psychological techniques and their use to improve effectiveness and performance in sport and related areas.
General Studies: SB

KIN 352 Psychosocial Aspects of Physical Activity. (3)
fall, spring, summer
Interrelationships between physical activity and psychosocial variables, including socialization, cultural values, aggression, and motivation. Includes the psychological benefits of physical activity and exercise adherence. Lecture, recitation. Prerequisite: PGS 101.
General Studies: SB, C

KIN 361 Physical Education in the Secondary School. (3)
fall and spring
Current trends and theories, such as elective programs, coed classes, legal issues, contract teaching, curriculum, and administration.

KIN 370 Advanced First Aid. (3)
selected semesters
Assessment, management, treatment of wounds, injuries, shock, poisoning, burns, sudden illness, emergency rescue, and cardiopulmonary resuscitation. Lecture, lab. Fee.

KIN 376 Physical Education for the Elementary School. (3)
fall and spring
Scope and values of physical education in the elementary school. Methods, materials, and practice in teaching activities for primary, intermediate, and upper grades.

KIN 382 Adaptive and Inclusive Physical Education. (3)
fall and spring
Teaching individuals with handicapping conditions physical skills and activities.

KIN 400 Teaching Physical Activity Concepts. (3)
fall and spring
Analyzes and critiques teaching concepts, principles, and skills outlined in Arizona Physical Activity Standards. Evaluates national guidelines for promoting physical activity. Prerequisites: ENG 101 (or 107), 102 (or 108); KIN 200 (or its equivalent).
General Studies: L

KIN 412 Biomechanics of the Skeletal System. (3)
fall
Biomechanics of tissues, structures, and major joints of the musculoskeletal system. Discussion of injury mechanisms. Lecture, discussion, some labs. Prerequisite: KIN 335 or instructor approval.

KIN 413 Qualitative Analysis in Sport Biomechanics. (3)
spring
Develops systematic approach for detecting and correcting errors in human performance using anatomical and mechanical principles. Lecture, lab. Prerequisite: KIN 335.

KIN 414 Electromyographic Kinesiology. (3)
spring
Muscular contributions to human movement, muscle mechanics, electrophysiological basis, and practical application of electromyography. Lecture, discussion. Fee. Prerequisites: KIN 335, 340; instructor approval.
General Studies: L

KIN 421 Human Motor Control. (3)
spring
Focuses on understanding how the human central nervous system controls, regulates, and learns movements. Prerequisite: KIN 345 or instructor approval.

KIN 422 Motor Control in Special Populations. (3)
spring
Discusses principles of motor control theories and related practical applications for certain special developmental populations. Lecture, discussion. Cross-listed as PSY 422. Credit is allowed for only KIN 422 or PSY 422. Prerequisite: KIN 345.

KIN 423 Motor Control and Aging. (3)
spring
Functional and behavioral changes to the motor control system as humans age, how specifically it impacts motor control and learning. Prerequisite: KIN 345 or instructor approval.

KIN 440 Exercise Biochemistry. (3)
fall
Study of bioenergetics and metabolism of cellular (skeletal muscle, heart, and liver) organelles and proteins during exercise. Prerequisite: KIN 340.

KIN 441 Physiology of Women in Sport. (3)
fall
Physiological aspects of women engaging in physical activity. Emphasizes factors affecting performance and health throughout life. Prerequisite: KIN 340.
General Studies: L

KIN 442 Fuel Metabolism. (3)
fall
Discusses current research concerning the metabolism of carbohydrate, fat, and protein during exercise. Credit is allowed for only KIN 442 or 536. Prerequisite: KIN 340 or instructor approval.

KIN 443 Exercise Endocrinology. (3)
spring
Discusses current research and theory concerning hormonal changes during exercise. Lecture, discussion. Prerequisite: KIN 340 or instructor approval.
General Studies: L

KIN 444 Metabolic Adaptations to Exercise Training. (3)
summer
Examines physiologic adaptations to exercise training as they relate to metabolism and tissue functions. Prerequisite: KIN 340.

KIN 445 Exercise Physiology for Children and Adolescents. (3)
spring
Understanding the influence of physical growth and maturation on the development of the functional capacities of the exercising child. Credit is allowed for only KIN 445 or 535. Lecture, discussion. Prerequisite: KIN 340 or 530 or instructor approval.

KIN 448 Applied Sport Psychology. (3)
fall, spring, summer
Psychological theories and techniques applied to a sport to enhance the performance and personal growth of athletes and coaches. Lecture, discussion. Prerequisite: KIN 352 (or its equivalent).
General Studies: L

KIN 452 Exercise Psychology. (3)
spring
Contemporary research and theory as related to human behavior and health in an exercise setting. Prerequisite: KIN 352.
General Studies: SB

KIN 460 Theory of Strength Training. (3)
fall
Research and theories on developing muscular strength; programs for developing muscular strength. Lecture, discussion. Prerequisites: KIN 335, 340.
General Studies: L

KIN 478 Student Teaching in Secondary Schools. (3–12)
fall and spring
Practice of teaching. Relationship of practice and theory in teaching. Fee. Prerequisite: two complete semesters of block (or its equivalent).

KIN 480 Methods of Teaching Physical Education. (3)
fall and spring
Methods of instruction, organization, and presentation of appropriate content in elementary and secondary physical education. Prerequisites: KIN 361, 376. Corequisite: student teaching or instructor approval.

KIN 484 Internship. (6)
selected semesters

KIN 485 Advanced Techniques of Athletic Training. (3)
spring
Advanced course in athletic training designed for students seeking NATA certification. Emphasizes therapeutic modalities and rehabilitation procedures. Prerequisites: KIN 283, 370; CPR certification.

KIN 492 Honors Directed Study: Research. (1–6)
selected semesters

KIN 493 Honors Thesis. (1–6)
selected semesters

KIN 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Administration of Athletics. (3)
- Environmental Exercise Physiology. (3)
- Interpretation of Exercise Performance. (3)
- Muscle Physiology. (3)
- Psychology of Health and Physical Activity. (3)
- Research Methods. (3)
- Sport and Social Issues. (3)
- Volume and Reflex Control of Movement. (3)

KIN 498 Pro-Seminar. (1–7)
selected semesters
Topics may include the following:
- Kinesiology and the Future. (1)

KIN 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

Department of Languages and Literatures

www.asu.edu/languages/index.htm
480/965-6281
LL 440

Deborah N. Losse, Chair

Regents' Professors: Foster, Keller

Professors: Alexander, Baldini, Ballon-Aguirre, Chambers, Croft, Ekmanis, Guntermann, Horwath, Losse, Valdivieso, Volek, Wetsel, Williams, Wixted, T. Wong

Associate Professors: Acereda, Candela, Canovas, Choi, Colina, Garcia-Fernández, W. Hendrickson, Hernández-G., B. Lafford, Ossipov, Rees, Reiman, Sanchez, Suwarno, Tompkins, Urioste-Azcorra, Vitullo

Assistant Professors: Cashman, George, Gilfillan, Ginsburg, Gruzinska, Haberman, Orlich, Siegel-Valdes, Tipton

Senior Lecturer: Foard

Lecturers: Cao, S. Hendrickson, Lage, Martinez, Petersen, Poudrier, Shimomura, Stiftel, Walton-Ramirez, E. Wong, Zhang

Instructors: Deal, Le, Oh, Pang

Associate Research Professional: P. Lafford

Academic Associate: Glessner

Research Associate Professor: Sipka

BACHELOR OF ARTS DEGREE

The faculty in the Department of Languages and Literatures offer majors in Asian Languages (Chinese/Japanese), French, German, Italian, Russian, and Spanish. Each major consists of 45 semester hours, of which 30 must be in one language and 15 in a second language or in closely related fields to be approved by the advisor in consultation with the student. Of the 30 hours required for the major, a minimum of 24 hours must be taken at the 300 or 400 level and must include at least nine hours at the 400 level. Specific required courses for each major area are shown in this section and in a brochure available in the department. See "College Degree Requirements," page 306.

MAJORS

Asian Languages (Chinese/Japanese)—B.A.

Students majoring in Asian Languages (Chinese/Japanese) may select a course of study that focuses on either language. The major requires 45 semester hours.

Chinese. At least nine semester hours must be at the 400 level. In addition to the courses shown below, the student must meet with an advisor and choose at least 15 semester hours of courses, including six semester hours of JPN prefix courses such as Japanese language and calligraphy, Japanese literature in Translation (FLA 421) or KOR prefix courses such as Korean language and/or Korean culture, and nine semester hours from appropriate courses in art, humanities, social and behavioral sciences, and business.

Required

CHI	313	Third-Year Chinese I *G*	3
CHI	314	Third-Year Chinese II *G*	3
CHI	321	Chinese Literature *L/HU*	3
CHI	322	Chinese Literature *L/HU, G*	3
		or FLA 420 Foreign Literature in Translation *HU, G* (3)	
CHI	413	Introduction to Classical Chinese *HU*	3
CHI	414	Introduction to Classical Chinese *HU*	3
Total			18

Electives

Choose six semester hours from the courses below 6

CHI	309	Chinese Conversation (2)
CHI	310	Chinese Conversation (2)
CHI	311	Chinese Conversation (2)
CHI	312	Chinese Conversation (2)
CHI	494	Special Topics (1–4)
CHI	499	Individualized Instruction (1–3)

Total 6

Recommended

Two 200-level CHI courses 6

Japanese. At least nine semester hours must be taken from FLA 421, and JPN 321 and 414. No more than eight semester hours may be selected from JPN 309, 310, 311, and 312.

Required

FLA	421	Japanese Literature in Translation *L/HU, G*	3
JPN	313	Third-Year Japanese I *G*	3
JPN	314	Third-Year Japanese II *G*	3
JPN	321	Japanese Literature *L/HU, G*	3
JPN	414	Introduction to Classical Japanese	3
Total			15

Electives

Choose nine semester hours from the courses below 9

JPN	309	Intermediate Japanese Conversation (2)
JPN	310	Intermediate Japanese Conversation (2)
JPN	311	Japanese Conversation and Composition *G* (3)
JPN	312	Japanese Conversation and Composition *G* (3)
JPN	321	Japanese Literature *L/HU, G* (3)
JPN	394	Special Topics (1–4)
JPN	435	Advanced Readings (3)
JPN	485	Problems of Translation (3)
JPN	494	Special Topics (1–4)
JPN	499	Individualized Instruction (1–3)

Total 9

Recommended

Two 200-level JPN courses 6

In addition to these courses, the student must meet with an advisor and choose at least 15 semester hours of courses, including six semester hours of CHI prefix courses such as

Chinese language and calligraphy, Chinese literature in translation (CHI 321 and 322 and FLA 420) or KOR prefix courses such as Korean language and/or Korean culture. At least three semester hours must be in an approved course that provides an overview of Japanese history. The remaining hours may consist of appropriate courses in art, humanities, literature, public programs, social and behavioral sciences, business, etc.

French—B.A.

Required

FRE	205	Readings in French Literature *G* ... 3
FRE	311	French Conversation *G* ... 3
FRE	312	French Composition *G* ... 3
FRE	321	French Literature *L/HU, H* ... 3
FRE	322	French Literature *L/HU* ... 3
Total		... 15

Select 15 semester hours from the following list, including at least nine semester hours from the 400 level:

FRE	315	French Phonetics ... 3
FRE	319	Business French *G* ... 3
FRE	411	Advanced Spoken French *G* ... 3
FRE	412	Advanced Written French *G* ... 3
FRE	415	French Civilization I *HU* ... 3
FRE	416	French Civilization II *HU, G* ... 3
FRE	421	Structure of French ... 3
FRE	422	Applied French Linguistics ... 3
FRE	423	French Syntax ... 3
FRE	441	French Literature of the 17th Century *HU* ... 3
FRE	442	French Literature of the 17th Century *HU, H* ... 3
FRE	445	French Literature of the 18th Century *L/HU* ... 3
FRE	451	French Poetry of the 19th Century ... 3
FRE	452	French Novel of the 19th Century *HU* ... 3
FRE	453	Theater of the 19th Century *L/HU* ... 3
FRE	461	Modern Narrative *HU* ... 3
FRE	462	Modern Poetry *HU* ... 3
FRE	471	The Literature of Francophone Africa and the Caribbean *L/HU* ... 3
FRE	472	Franco-Canadian Civilization ... 3
FRE	480	Translation Theory and Practice ... 3
FRE	482	Business Translation ... 3
FRE	485	Literary Translation ... 3
FRE	494	Special Topics ... 1–4
FRE	499	Individualized Instruction ... 1–3

In addition to the courses, the student must meet with an advisor and choose at least 15 semester hours of courses from appropriate social and behavioral science, humanities, business courses, and other language courses.

German—B.A.

Required

GER	311	German Conversation *G* ... 3
		or GER 312 German Conversation *G* (3)
GER	313	German Composition *G* ... 3
GER	411	Advanced Grammar and Conversation *G* ... 3
GER	412	Advanced Grammar and Composition *G* ... 3
GER	421	German Literature *HU* ... 3
GER	422	German Literature *L/HU* ... 3

Choose six semester hours from the courses below ... 6

- GER 303 Scientific German (3)
- GER 304 Scientific German (3)
- GER 314 Introduction to German Literature (3)
- GER 319 Business Correspondence and Communication *G* (3)
- GER 394 Special Topics (1–4)
- GER 415 German Civilization *HU, H* (3)
- GER 416 German Civilization *HU, H* (3)
- GER 445 German Literature: Enlightenment to Classicism (3)
- GER 451 German Literature: Biedermeier to Naturalism (3)
- GER 494 Special Topics (1–4)

Two 200-level GER courses ... 6

Total ... 30

In addition to these courses, the student must meet with an advisor and choose at least 15 semester hours of courses from appropriate social and behavioral science, humanities, business courses, and other language courses.

Italian—B.A.

Required

ITA	311	Italian Composition and Conversation *G* ... 3
ITA	312	Italian Composition and Conversation *G* ... 3
ITA	325	Introduction to Italian Literature *HU* ... 3
Two 200-level ITA courses		... 6
Total		... 15

Note: ITA 315 Italian for Business may be substituted for either ITA 311 or 312.

Fifteen semester hours are required from the following list, including at least nine semester hours from the 400 level:

ITA	314	Advanced Italian *G* ... 3
ITA	315	Italian for Business ... 3
ITA	394	Special Topics ... 1–4
ITA	415	Italian Civilization *L/HU, G* ... 3
ITA	420	Italian Cinema ... 3
ITA	425	Italian American Culture *L* ... 3
ITA	430	Italian Literature of the Middle Ages *HU* ... 3
ITA	441	Dante: *Divina Commedia L/HU* ... 3
ITA	443	Italian Literature of the Renaissance *HU, H* ... 3
ITA	446	Italian Literature of the 18th and 19th Centuries *HU* ... 3
ITA	449	20th-Century Italian Literature *HU, G* ... 3
ITA	494	Special Topics ... 1–4
ITA	499	Individualized Instruction ... 1–3

In addition to the courses shown above, the student must meet with an advisor and choose at least 15 semester hours of courses from appropriate social and behavioral science, humanities, business courses, and other language courses.

Russian—B.A.

Required

RUS	211	Basic Russian Conversation *G* ... 3
RUS	212	Basic Russian Conversation *G* ... 3
RUS	311	Russian Composition and Conversation *G* ... 3
RUS	312	Russian Composition and Conversation *G* ... 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/ quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

RUS 411 Advanced Composition and Conversation I *G* 3
or RUS 412 Advanced Composition and Conversation II *G* (3)
RUS 498 PS: Senior Seminar* 3
or SLV 498 PS: Senior Seminar (3)
SLV 304 Computational Linguistics of Slavic Languages 3
Total 21

* RUS 493 may be taken instead.

Note: Heritage speakers and other advanced speakers of Russian are, with permission from the Slavic language section head, admitted into a separate track for completion of the major. That track entails completion of 12 of the above semester hours (six semester hours of RUS 495, RUS 498 [or SLV 498], and SLV 304), to be accompanied by 18 additional semester hours from the list below (excluding RUS 303, 411, 412, and 417). At least 12 of the additional 18 semester hours must be at the 400 level.

Nine semester hours are required from the following list, including at least six semester hours from the 400 level:

RUS 303 Scientific Russian 3
RUS 321 Foundations of Russian Literature *HU, H* 3
RUS 322 Great Russian Writers of the 19th Century *L/HU* 3
RUS 323 Modern Russian Literature and the Soviet Legacy *L/HU, G* 3
RUS 411 Advanced Composition and Conversation I *G* 3
RUS 412 Advanced Composition and Conversation II *G* 3
RUS 417 Applied Russian Phonetics 2
RUS 420 Russian Poetry *L/HU* 3
RUS 421 Pushkin *L/HU* 3
RUS 423 Dostoyevsky *L/HU* 3
RUS 424 Tolstoy *L/HU* 3
RUS 425 Chekhov *L/HU* 3
RUS 430 Russian Short Story *L/HU* 3
RUS 441 Survey of Russian Culture *L/HU, G, H* 3
RUS 495 Russian for Heritage Speakers 3
SLV 426 Contemporary East European and Eurasian Literatures *L/HU, G* 3
SLV 440 History of Slavic Languages 3

In addition to the 30 semester hours of course work required for the major, students majoring in Russian must take 15 additional semester hours from a list of approved courses in related fields, at least six semester hours of which must be taken at the upper-division level. Related fields courses should be chosen in consultation with an advisor. Russian majors are encouraged to take related Slavic/East European language courses in the annual summer Critical Languages Institute (CLI). CLI courses may be applied toward the related field requirements.

Spanish—B.A.

Required
SPA 313 Spanish Conversation and Composition *G* 3
or SPA 315 Spanish Conversation and Composition for Bilinguals (3)
SPA 314 Spanish Conversation and Composition *G* 3
or SPA 316 Spanish Conversation and Composition for Bilinguals (3)
SPA 325 Introduction to Hispanic Literature *HU* 3
SPA 412 Advanced Conversation and Composition *G* 3
SPA 425 Spanish Literature *HU* 3
Choose two courses below 6
SPA 426 Spanish Literature *HU* (3)
SPA 427 Spanish American Literature *L* (3)
SPA 428 Spanish American Literature *L, G* (3)
Choose one course below 3
SPA 471 Civilization of the Spanish Southwest *HU* (3)
SPA 472 Spanish American Civilization *HU, G, H* (3)
SPA 473 Spanish Civilization *HU/SB, G* (3)
Total 24

Electives
Two upper-division (300–400-level) SPA courses 6

Related Fields
POR 101 Elementary Portuguese 5
POR 201 Intermediate Portuguese *G* 5

In addition to these courses, the student must meet with an advisor and choose at least six semester hours of courses from appropriate social and behavioral science, humanities, business, and other romance language courses.

SPA 311 and 312 are not counted toward the major or minor in Spanish.

MINORS

Each minor in Asian Languages (Chinese/Japanese), French, German, Italian, and Russian consists of 18 semester hours, of which 12 semester hours must be in the upper division. The Spanish minor requires 18 upper-division semester hours. In addition, specific required courses for each area follow and are in a brochure in the department.

Chinese

Required
CHI 313 Third-Year Chinese I *G* 3
CHI 314 Third-Year Chinese II *G* 3

Consult with the departmental advisor for other courses.

French

Required
FRE 311 French Conversation *G* 3
FRE 312 French Composition *G* 3
FRE 321 French Literature *L/HU, H* 3
or FRE 322 French Literature *L/HU* (3)

Consult with the departmental advisor for other courses. Twelve hours must be at the 300 level or above.

German

Required
GER 311 German Conversation *G* 3
or GER 312 German Conversation *G* (3)
GER 313 German Composition *G* 3
One 400-level GER course 3
Upper-division GER course 3

Consult with the departmental advisor for other courses.

Italian

Required
ITA 311 Italian Composition and Conversation *G* 3
or ITA 312 Italian Composition and Conversation *G* (3)
or ITA 394 Special Topics (1–4)

ITA 325 Introduction to Italian Literature *HU* 3
One 400-level ITA course 3

Consult with the departmental advisor for other courses.

Japanese

Required
JPN 313 Third-Year Japanese I *G* 3
JPN 314 Third-Year Japanese II *G* 3

Consult with the departmental advisor for other courses.

Russian

Required
RUS 303 Scientific Russian 3
RUS 311 Russian Composition and Conversation *G* 3
RUS 312 Russian Composition and Conversation *G* 3

RUS 211 and 212 are the only lower-division courses that may count toward the Russian minor.

Consult with the departmental advisor for other courses.

Spanish

The minor in Spanish requires a minimum of 18 upper-division semester hours.

Required
SPA 313 Spanish Conversation and Composition *G* 3
or SPA 315 Spanish Conversation and Composition for Bilinguals (3)
SPA 314 Spanish Conversation and Composition *G* 3
or SPA 316 Spanish Conversation and Composition for Bilinguals (3)
SPA 325 Introduction to Hispanic Literature *HU* 3
SPA 412 Advanced Conversation and Composition *G* 3
SPA 471 Civilization of the Spanish Southwest *HU* 3
or SPA 472 Spanish American Civilization *HU, G, H* (3)
or SPA 473 Spanish Civilization *HU/SB, G* (3)
One elective course (SPA 319 or above) 3

SPA 311 and 312 are not counted toward the major or minor in Spanish.

CERTIFICATES AND EMPHASES

The following are certificate programs or emphases offered in the Department of Languages and Literatures. For more information, see "Certificate Programs and Areas of Emphasis," page 314.

Asian Studies Certificate. Foreign language students majoring in Asian Languages (Chinese/Japanese) may elect to pursue an Asian Studies Certificate combining courses from the major with selected outside courses of predominantly Asian content.

Classical Studies. Any undergraduate major can earn a certificate in classical studies

Latin American Studies Certificate. Foreign language students majoring in Spanish may elect to pursue a Latin American Studies Certificate combining courses from the major with selected outside courses of wholly Latin American content.

Russian and East European Studies Certificate. Any undergraduate major can earn a Russian and East European Studies Certificate by successfully completing one of the options mentioned in the section on "Russian and East European Studies," page 318.

Scandinavian Studies Certificate. Any undergraduate major can earn a Scandinavian Studies Certificate.

Southeast Asian Studies Certificate. To earn a Southeast Asian Studies Certificate, a student must complete a minimum of 40 semester hours of course work related to Southeast Asia, including two years (20 semester hours) of a Southeast Asian language.

Translation Certificate (Spanish/English). The Translation Certificate program is designed to provide the advanced training required for professional translation in both public and private sectors, preparation for the rigorous examinations required by national and international agencies, and training as an ancillary skill for professional fields, such as international business, public health and medicine, and law, in accordance with guidelines recommended by the American Translators' Association. The certificate is a nondegree program consisting of 15 semester hours of course work and two hours of in-service practicum primarily into the receptor language of English from the source language of Spanish. It may be taken simultaneously with course work leading to an undergraduate degree, as a related area sequence, or as the sole program of study for members of the community who meet the admission requirements of the certificate program and are enrolled in the university. A complete brochure is available at the Department of Languages and Literatures in LL 440.

While the certificate program is not yet available in French, FRE translation courses may be available. See the *Schedule of Classes* for course offerings.

Admission Requirements. Since entrance to professional translation is through work, cultural experience, and examination, the two entrance requirements to this certificate program are (1) written proficiency examination in the source and the receptor languages at the level of completion of the fourth year or most advanced composition course in Spanish, which at ASU is SPA 412, and (2) either an academic year at a university in a Spanish-speaking country, an extensive work experience using Spanish, or demonstrated bilingual facility, both written and oral, in English and Spanish.

Certificate Requirements. The certificate program consists of the following requirements:

Prerequisites
FLA 400 Linguistics *SB* 3
or SPA 494 ST: Introduction to Hispanic Linguistics (3)
or equivalent
SPA 413 Advanced Spanish Grammar *G* 3
SPA 494 ST: Lexicography 3

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Required
FLA 401 Translation Theory and Practice 3

In-Service Practicum
FLA 484 Internship 2

Also required are nine hours of applied translation electives in specialized areas chosen from the following courses:

FLA 481 Technical and Scientific Translation 3
FLA 482 Business and Financial Translation 3
FLA 483 Medical and Legal Translation 3
FLA 485 Problems of Literary Translation 3

B.I.S. CONCENTRATIONS

Students seeking to focus on a language as one of their concentration areas for the Bachelor of Interdisciplinary Studies degree may choose from Chinese, French, German, Italian, Japanese, Russian, Spanish, Spanish for native speakers, and translation (Spanish/English). They may also choose from any of the approved certificate programs. The requirements for the Bachelor of Arts in Interdisciplinary Studies (B.I.S.) concentrations are the same as for the minor in that language. See "Minors," page 378, for specific course requirements. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

French, German, Japanese, and Spanish. Each of the major teaching fields in French, German, Japanese, and Spanish consists of 45 semester hours, of which 30 must be in one language and 15 in a second language or in closely related fields to be approved by the advisor in consultation with the student. Of the 30 hours required for the academic specialization, a minimum of 24 hours must be taken at the 300 or 400 level and must include at least nine hours at the 400 level. Specific required courses for each major area are listed in curriculum check sheets of the individual language areas available in the department.

Applications are not being accepted at this time for Chinese and Russian.

GRADUATE PROGRAMS

The faculty in the Department of Languages and Literatures offer programs leading to the M.A. degree in French, German, and Spanish and the Ph.D. degree in Spanish. See the *Graduate Catalog* for requirements.

FOREIGN LANGUAGES FOR INTERNATIONAL PROFESSIONS

The sequence of two semesters, listed under numbers 107 and 207 in two languages (French and Spanish), integrates an accelerated study, a functional approach to course design, and preparation for international professions (e.g., business, diplomacy, international political economy). It is parallel to the traditional sequence of 101 through 202 and also satisfies the college's foreign language requirement. The sequence differs from traditional basic language programs in that all aspects of the language—vocabulary, grammar, and skill development—are practiced within the context of authentic communication for social and professional purposes in the target culture. Classes meet eight hours weekly, for eight semester hours in each of two semesters.

Students who have had success in learning one foreign language are encouraged to join this program in a second language. Students should contact the Department of Languages and Literatures before registration.

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. This normally includes a sequence of courses numbered 101 and 102 and 201 and 202 *or* 107 and 207. However, important exceptions exist in Greek, Latin, Portuguese, and Romanian.

Greek. To satisfy the foreign language requirement, students must take GRK 301 and 302.

Latin. Students must take LAT 201 before entering LAT 202 or must have completed at least three years of high school Latin before entering LAT 202 to satisfy the College of Liberal Arts and Sciences foreign language requirement.

Portuguese. To satisfy the foreign language requirement, students must take POR 314 or a higher numbered POR course.

Romanian. To satisfy the foreign language requirement, students must complete ROM 314.

FOREIGN LANGUAGE PLACEMENT

Students who transfer from other postsecondary institutions with foreign language credits below the 202 level are placed in a course at the level directly above the work completed.

Students who have completed their secondary education at a school in which the language of instruction was not English are considered to have satisfied the foreign language requirement. Certification of this status is made at the time of admission to ASU.

Questions should be addressed to the International Admissions program within Undergraduate Admissions. For more information, call 480/965-2688, or visit the Web site at www.asu.edu/admissions.

The foreign language requirement can be met in languages not taught at ASU either by transferring credit from another institution or by passing a proficiency examination. When possible, the Department of Languages and Litera-

tures recommends to the college an appropriate source for such examinations and proctors them. Grading is done by the institution that provides the examination, and the student pays any costs incurred. The examination can be used only to demonstrate proficiency; it does not produce semester hours of credit.

Students desiring placement above the 101-level course in French, German, or Spanish should take the placement exam for that language in the Computer Language Laboratory in LL 65.

Ordinarily, no placement or proficiency examination is administered to students who wish to continue studying languages for which high school credits have been earned. Students should be guided by the following principles of equivalency: (1) one unit (one academic year) of high school-level study is considered, for placement purposes only, to equal one semester of study of the same language at the university level. Thus, students with one year of high school study would enroll in the second semester course (102); students with two years of high school study, in the third semester course (201), and so on. (2) Students who feel that their high school language preparation was inadequate may choose to place themselves in a lower level, but not lower than 111 with two or three years of high school study and 201 with four years of high school study.

Students with prior knowledge of a language may meet the college foreign language requirement in any one of the following ways:

1. by satisfactory results in a nonrepeatable college-approved proficiency examination;
2. by achieving a grade of at least "C" in the last course of the required sequence; or
3. by achieving a grade of at least "C" in a course taught in the language for which the last course of the required sequence is a prerequisite.

Students are expected to follow the progressive sequence of 100, 200, and 300. Once a grade of "C" or higher is earned in a 300-level class in a language, students may not earn lower-division credit in that language.

First-year foreign language courses taught by the Department of Languages and Literatures are not open to students who have spent one or more years in a country where that language is the predominant language. Individual language areas may have different policies. Students with questions about this policy should check with the appropriate language coordinator in the department.

If transfer students are uncertain about course equivalencies, they should contact the Department of Languages and Literatures.

LANGUAGE LABORATORY REQUIREMENT

All students enrolled in 101, 102, 201, and 202 language courses are expected to spend a minimum of one hour per week in the language laboratory or in other assigned audio-lingual tape exercises in addition to the regular class periods.

FOREIGN LANGUAGES (FLA)

FLA 150 Introduction to East Asian Culture. (3)
spring
Introduces the cultures of China, Japan, and Korea.
General Studies: HU, G

FLA 323 Survey of Literature of the Soviet Era in Translation. (3)
fall and spring
Surveys main literary movements, prominent authors, most significant works of prose, poetry, and drama of the Soviet period, 1917–1991.
General Studies: L/HU, G

FLA 400 Linguistics. (3)
spring
Introduces the analysis of language and its use in social contexts. Topics: morphology, phonology, pragmatics, semantics, syntax, and variation. Prerequisites: junior standing; instructor approval.
General Studies: SB

FLA 401 Translation Theory and Practice. (3)
selected semesters
Translation theories and professional practices and ethics; bibliography, computer technology, and sample texts for natural and social sciences and humanities. Prerequisite: 4th-year composition or instructor approval in respective language area.

FLA 415 Bilingualism and Languages in Contact. (3)
fall
Analyzes linguistic aspects of bilingualism, e.g., pidgins and creoles, code-switching, and other contact phenomena; simultaneous/sequential bilingual language acquisition. Prerequisite: FLA 400 (or its equivalent) or instructor approval.

FLA 420 Foreign Literature in Translation. (3)
fall and spring
Not for language majors (except in Asian languages and Russian); open to language majors as a related-area course. Graduate students by permission. Topics may include the following:
- Brazilian
- Chinese
- French
- German
- Greek
- Italian
- Latin
- Portuguese
- Russian
- Soviet
- Spanish
- Spanish American

General Studies: HU, G

FLA 421 Japanese Literature in Translation. (3)
fall and spring
Readings selected by theme or genre or period from various works of Japanese literature in English translation. May be repeated when topics vary. Graduate students by permission. Prerequisite: a General Studies L course.
General Studies: L/HU, G

FLA 480 Methods of Teaching Foreign Languages. (3)
fall
Teaching foreign languages and literatures at secondary and college levels. Does not meet the Liberal Arts and Sciences General Studies requirement for humanities and fine arts. Required for admission to SED 478. Prerequisite: 12 hours of upper-division courses in 1 foreign language.

FLA 481 Technical and Scientific Translation. (3)
selected semesters
Resources, practices, strategies, and lexicon for translation of professional texts in subjects such as engineering, architecture, agriculture, computer technology, electronics, and physical and biological sciences. Prerequisite: FLA 401.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

FLA 482 Business and Financial Translation. (3)
selected semesters
Resources, practices, strategies, and lexicon for translation of professional texts in subjects such as economics, finance, insurance, management, marketing, accounting, advertising, and real estate. Prerequisite: FLA 401.

FLA 483 Medical and Legal Translation. (3)
selected semesters
Resources and strategies for translation of professional texts in subjects such as medicine, nursing, public health, criminal justice, and international law. May be repeated for a total of 6 semester hours. Prerequisite: FLA 401.

FLA 484 Internship. (1–12)
selected semesters

FLA 485 Problems of Literary Translation. (3)
selected semesters
Theory and practice with emphasis on application through individual translation projects. May be repeated for a total of 6 semester hours. Prerequisite: FLA 401 or instructor approval in the respective language area.

FLA 494 Special Topics. (1–4)
selected semesters
Various topics.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

ARABIC (ARB)

ARB 101 Elementary Arabic. (4)
fall
Reading, writing, speaking, and understanding basic Arabic. 4 hours lecture, 1 hour lab. Fee.

ARB 102 Elementary Arabic. (4)
spring
Reading, writing, speaking, and understanding basic Arabic. 4 hours lecture, 1 hour lab. Fee. Prerequisite: ARB 101 (or its equivalent).

ARB 201 Intermediate Arabic. (4)
fall
Review of Arabic grammar with emphasis on the development of the skills of listening comprehension, reading, speaking, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: ARB 102 (or its equivalent).
General Studies: G

ARB 202 Intermediate Arabic. (4)
spring
Review of Arabic grammar with emphasis on the development of the skills of listening comprehension, reading, speaking, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: ARB 201 (or its equivalent).
General Studies: G

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

SERBO-CROATIAN (BCS)

BCS 101 Elementary Serbo-Croatian. (4)
fall and summer
Structural grammar, basic vocabulary; introduction and reinforcement of aural/oral, reading, and writing skills. 4 hours lecture, 1 hour lab. Lecture, lab, group activities.

BCS 102 Elementary Serbo-Croatian. (4)
spring and summer
See BCS 101. Lecture, lab, group activities. Prerequisite: BCS 101 (or its equivalent).

BCS 201 Intermediate Serbo-Croatian. (4)
fall and summer
Systematic review of grammar. Development of vocabulary through reading and writing. Drill in aural/oral skills. 4 hours lecture, 1 hour lab. Lecture, lab, group activities. Prerequisite: BCS 102 (or its equivalent).

BCS 202 Intermediate Serbo-Croatian. (4)
spring and summer
See BCS 201. Lecture, lab, group activities. Prerequisite: BCS 201 (or its equivalent).

BCS 298 Serbo-Croatian Practicum. (2)
summer
On-site summer practicum in Yugoslavia following intensive summer Serbo-Croatian language study in the ASU Critical Languages Institute. Lecture, lab, group activities. Prerequisite: BCS 102 (or its equivalent).

BCS 495 Serbo-Croatian for Heritage Speakers. (1–6)
selected semesters
Generates professional proficiency by developing communicative and written competency in standard literary Serbo-Croatian. Lecture, lab, tutorial. Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

CHINESE (CHI)

CHI 101 First-Year Chinese I. (5)
fall
Pronunciation, grammar, elementary conversation, and development of basic reading and writing skills. Standard dialect. 5 class hours. Fee.

CHI 102 First-Year Chinese II. (5)
spring
See CHI 101. Fee. Prerequisite: CHI 101 (or its equivalent).

CHI 201 Second-Year Chinese I. (5)
fall
Systematic review of grammar. Development of vocabulary through reading and writing. Drill in aural/oral skills. 5 class hours. Fee. Prerequisite: CHI 102 (or its equivalent).
General Studies: G

CHI 202 Second-Year Chinese II. (5)
spring
See CHI 201. Fee. Prerequisite: CHI 201 (or its equivalent).
General Studies: G

CHI 205 Chinese Calligraphy. (1)
fall and spring
Introduces styles and techniques of Chinese writing. Requires no knowledge of Chinese or Japanese.

CHI 309 Chinese Conversation. (2)
fall
Aural/oral drills using contemporary stories, articles, and essays. For students with lower-level proficiency. Prerequisite: CHI 202.

CHI 310 Chinese Conversation. (2)
spring
See CHI 309. Prerequisite: CHI 202.

CHI 311 Chinese Conversation. (2)
fall
Intensive aural/oral practice in modern Chinese. For students who have lived in China or a Chinese-speaking environment. Discussion, drill. Prerequisite: CHI 202.

CHI 312 Chinese Conversation. (2)
spring
See CHI 311. Discussion, drill. Prerequisite: CHI 202.

CHI 313 Third-Year Chinese I. (3)
fall
Expansion of proficiency in listening comprehension, speaking, reading, and writing. Lecture, 3 hours discussion, drill. Prerequisite: CHI 202 (or its equivalent).
General Studies: G

CHI 314 Third-Year Chinese II. (3)
spring
Continuation of CHI 313. Prerequisite: CHI 313 (or its equivalent).
General Studies: G

CHI 321 Chinese Literature. (3)
fall
Masterworks of the tradition from the 6th century B.C.E. through the 13th century. Readings, lectures, and examinations are in English.
General Studies: L/HU

CHI 322 Chinese Literature. (3)
spring
Masterpieces from the later tradition and its transition to modern times. Readings, lectures, and examinations are in English.
General Studies: L/HU, G

CHI 345 Chinese Film and Civilization. (3)
once a year
Screening and discussion of recent films from China, Taiwan, and Hong Kong in the context of modern Chinese civilization. Lecture, discussion, screening.

CHI 413 Introduction to Classical Chinese. (3)
fall
Reading in various genres of pre-20th century literature (wen-yen), with analysis of the structure of the classical writings. Prerequisite: CHI 314 or instructor approval.
General Studies: HU

CHI 414 Introduction to Classical Chinese. (3)
spring
Continuation of CHI 413. Prerequisite: CHI 413.
General Studies: HU

CHI 494 Special Topics. (1–4)
selected semesters

CHI 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

FRENCH (FRE)

FRE 101 Elementary French. (4)
fall, spring, summer
Intensive aural/oral drill in class and laboratory; basic grammar supplemented by simple prose readings. Not open to students with credit for FRE 111. 4 hours lecture, 1 hour lab. Fee.

FRE 102 Elementary French. (4)
fall, spring, summer
See FRE 101. Fee. Prerequisite: FRE 101 (or its equivalent).

FRE 107 French for International Professions I. (8)
fall
Accelerated alternative to FRE 101 and 102 or FRE 111. Functional approach. Emphasizes communicative competence for international professions. Fee.

FRE 111 Fundamentals of French. (4)
fall and spring
Primarily for students with two years of high school French who need review to enter second year study. Not open to students with credit for FRE 101 or 102 or 107. 4 hours lecture, 1 hour lab. Fee.

FRE 201 Intermediate French I. (4)
fall, spring, summer
Grammar review, with emphasis on development of skills of speaking, reading, writing, and listening comprehension. 4 hours lecture; 1 hour lab. Fee. Prerequisite: FRE 102 or 111 (or its equivalent).
General Studies: G

FRE 202 Intermediate French II. (4)
fall, spring, summer
Continuation of grammar review with emphasis on development of skills in speaking, reading, writing, and listening comprehension. 4 hours lecture, 1 hour lab. Fee. Prerequisite: FRE 201 (or its equivalent).
General Studies: G

FRE 205 Readings in French Literature. (3)
fall, spring, summer
Designed to teach reading with facility and comprehension. Vocabulary building and textual analysis of literary genres are major elements. Prerequisite: FRE 202 (or its equivalent).
General Studies: G

FRE 207 French for International Professions II. (8)
spring
Continuation of FRE 107, alternative to FRE 201, 202 sequence. Expansion of communicative proficiency in specific areas of international professions. Fee. Prerequisite: FRE 107 or instructor approval.
General Studies: G

FRE 311 French Conversation. (3)
fall and spring
Further practice in speaking French, emphasizing current usage and promoting facility in the expression of ideas. Prerequisite: 8 hours of 200-level French (or its equivalent).
General Studies: G

FRE 312 French Composition. (3)
fall and spring
Further practice in writing French, emphasizing current usage and promoting facility in the expression of ideas. Prerequisite: 8 hours of 200-level French (or its equivalent).
General Studies: G

FRE 315 French Phonetics. (3)
fall
Practice and theory of French pronunciation. Emphasizes standard French, although an overview of regional varieties is offered. Lecture, lab. Prerequisite: FRE 311 (or its equivalent).

FRE 319 Business French. (3)
spring
Introduces the structure, vocabulary, and practices of the French business world. Prerequisite: FRE 312 or instructor approval.
General Studies: G

FRE 321 French Literature. (3)
fall and spring
Representative masterpieces and significant movements of French literature of the Middle Ages through the 18th century. Prerequisite: FRE 205 (or its equivalent).
General Studies: L/HU, H

FRE 322 French Literature. (3)
fall and spring
Literature of the 19th and 20th centuries. Prerequisite: FRE 205 (or its equivalent).
General Studies: L/HU

FRE 411 Advanced Spoken French. (3)
fall and spring
Improvement of spoken French. Prerequisites: FRE 311 and 6 hours of 300-level French (or their equivalents).
General Studies: G

FRE 412 Advanced Written French. (3)
fall and spring
Improvement of composition skills. Prerequisites: FRE 312 and 6 hours of 300-level French (or their equivalents).
General Studies: G

FRE 415 French Civilization I. (3)
spring
Political, intellectual, social, economic, and artistic development of France from its origins to the end of the 17th century. Prerequisite: 6 hours of upper-division French.
General Studies: HU

FRE 416 French Civilization II. (3)
spring
Political, intellectual, social, economic, and artistic development of France from the 18th century to present. Prerequisite: 6 hours of upper-division French.
General Studies: HU, G

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

FRE 421 Structure of French. (3)
fall
Phonology, morphology, syntax, semantics, and varieties of French. Prerequisites: both FRE 311 and 312 or only instructor approval.

FRE 422 Applied French Linguistics. (3)
spring
Applies linguistic theory and second language acquisition theory to teaching of French. Prerequisite: ASB 480 or ENG 213 or FLA 400.

FRE 423 French Syntax. (3)
spring
Analyzes French syntactic structure by contemporary theoretical models. Prerequisite: ASB 480 or ENG 213 or FLA 400.

FRE 424 French Phonology. (3)
selected semesters
Introduces phonological theory and its application to French. Prerequisites: both FRE 311 and 312 or only instructor approval.

FRE 441 French Literature of the 17th Century. (3)
fall
From 1600 to 1660. Prerequisites: both FRE 321 and 6 hours of 300-level French or only instructor approval.
General Studies: HU

FRE 442 French Literature of the 17th Century. (3)
spring
From 1660 to 1700. Prerequisites: both FRE 321 and 6 hours of 300-level French or only instructor approval.
General Studies: HU, H

FRE 445 French Literature of the 18th Century. (3)
selected semesters
Contributions of the philosophers and the development of the novel and drama. Prerequisites: both FRE 321 and 6 hours of 300-level French or only instructor approval.
General Studies: L/HU

FRE 451 French Poetry of the 19th Century. (3)
spring
From Romanticism to Parnassian poetry to Symbolism. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.

FRE 452 French Novel of the 19th Century. (3)
fall
From Constant, Hugo, Balzac, Stendhal, and Sand to Flaubert and Zola, with emphasis on major literary movements. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.
General Studies: HU

FRE 453 Theater of the 19th Century. (3)
spring
From Romantic drama to the Symbolist Theater. Representative plays of Hugo, Musset, Vigny, Dumas, Becque, Rostand, Feydeau, and Mirbeau. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.
General Studies: L/HU

FRE 461 Modern Narrative. (3)
fall
Representative authors from Gide to the new Nouveau Roman. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.
General Studies: HU

FRE 462 Modern Poetry. (3)
spring
Representative authors from Mallarme to Bonnefoy. Lecture, discussion. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.
General Studies: HU

FRE 471 The Literature of Francophone Africa and the Caribbean. (3)
fall
Selected prose, poetry, and drama of black authors from Africa and the Caribbean. Prerequisites: both FRE 322 and 6 hours of 300-level French or only instructor approval.
General Studies: L/HU

FRE 472 Franco-Canadian Civilization. (3)
spring
Study of the civilization of Quebec in particular through its history, language, literature, music, and customs. Prerequisite: 9 hours of 300-level French or instructor approval.

FRE 480 Translation Theory and Practice. (3)
spring
Theoretical and practical approaches to the fundamentals of meaning-based translation. Lecture, seminar. Prerequisite: FRE 412 or instructor approval.

FRE 482 Business Translation. (3)
fall
Practical approach to meaning-based translation through exposure to a variety of business texts. Prerequisite: FRE 312 or instructor approval.

FRE 485 Literary Translation. (3)
spring
Theory and practice of literary translation with emphasis on application through individual translation project. Prerequisite: FRE 480.

FRE 494 Special Topics. (1–4)
selected semesters

FRE 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

GERMAN (GER)

GER 101 Elementary German. (4)
fall, spring, summer
Reading, writing, speaking, and understanding of basic German, with emphasis on pronunciation and grammar. Credit is allowed for only GER 101 or 111. 4 hours lecture, 1 hour lab. Fee.

GER 102 Elementary German. (4)
fall, spring, summer
See GER 101. Credit is allowed for only GER 102 or 111. Fee. Prerequisite: GER 101 (or its equivalent).

GER 111 Fundamentals of German. (4)
fall and spring
Primarily for students with two years of high school German who need review to enter second-year study. Credit is allowed for only GER 111 or both GER 101 and 102. 4 hours lecture, 1 hour lab. Fee.

GER 201 Intermediate German. (4)
fall, spring, summer
Intensive review of grammar, with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: GER 102 or 111 (or its equivalent).
General Studies: G

GER 202 Intermediate German. (4)
fall, spring, summer
See GER 201. Fee. Prerequisite: GER 201 (or its equivalent).
General Studies: G

GER 303 Scientific German. (3)
selected semesters
Acquisition of a specialized vocabulary through the reading of German scientific publications. Prerequisite: GER 202 (or its equivalent).

GER 304 Scientific German. (3)
selected semesters
See GER 303. Prerequisite: GER 202 (or its equivalent).

GER 311 German Conversation. (3)
fall
Expansion of idiom through oral practice dealing with contemporary articles, essays, and stories. 3 semester hours limit for majors. Prerequisite: GER 202 (or its equivalent).
General Studies: G

GER 312 German Conversation. (3)
spring
See GER 311. Prerequisite: GER 202 (or its equivalent).
General Studies: G

GER 313 German Composition. (3)
spring
Intensive practice in writing, emphasizing style and grammar. Prerequisite: GER 202 (or its equivalent).
General Studies: G

GER 314 Introduction to German Literature. (3)
fall
Beginning study of German poetry, drama, the novel, and the *Novelle*. Prerequisite: GER 202 (or its equivalent).

GER 319 Business Correspondence and Communication. (3)
selected semesters
Organization and presentation of clear, effective business communications; vocabulary applicable to modern business usage. Prerequisite: GER 313 or instructor approval.
General Studies: G

GER 394 Special Topics. (1–4)
selected semesters

GER 411 Advanced Grammar and Conversation. (3)
fall
Improvement of diction and idiom through intensive oral review. Prerequisite: GER 311 or 312 (or its equivalent).
General Studies: G

GER 412 Advanced Grammar and Composition. (3)
spring
Improvement of writing ability. Prerequisite: GER 313 (or its equivalent).
General Studies: G

GER 415 German Civilization. (3)
spring
Aspects of political, social, and cultural life of the German-speaking world from the beginning through 1600. Prerequisite: a 300-level course in German or instructor approval.
General Studies: HU, H

GER 416 German Civilization. (3)
fall
From 1600 through 1945. Prerequisite: a 300-level course in German or instructor approval.
General Studies: HU, H

GER 421 German Literature. (3)
fall
From the beginning to Classicism. Prerequisite: 6 hours of 300-level German.
General Studies: HU

GER 422 German Literature. (3)
spring
From Romanticism to the present. Prerequisite: 6 hours of 300-level German.
General Studies: L/HU

GER 445 German Literature: Enlightenment to Classicism. (3)
selected semesters
Major works of the literary epochs in the century. Prerequisite: GER 421 or instructor approval.

GER 451 German Literature: Biedermeier to Naturalism. (3)
selected semesters
Representative works of prose and poetry from 1820 to 1890. Prerequisite: GER 422 or instructor approval.

GER 453 German Literary Masterpieces on Film. (3)
fall, spring, summer
Film and literature in their correlation to each other and to cultural, political, and social trends in German-speaking countries. Special arrangements for graduate students and those without a knowledge of German. Lecture, discussion.
General Studies: HU, G, H

GER 461 Contemporary German Literature. (3)
spring and summer
German writers since 1945. Prerequisite: GER 422 or instructor approval.

GER 494 Special Topics. (1–4)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

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ANCIENT GREEK (GRK)

GRK 101 Elementary Ancient Greek. (4)
fall
Ancient Greek grammar and vocabulary with an emphasis on developing reading skills. For beginning students only.

GRK 201 Intermediate Ancient Greek. (4)
spring
Continuation of GRK 101. Ancient Greek syntax and grammar. Prerequisite: GRK 101.

GRK 301 Ancient Greek Literature I. (3)
fall
Readings in ancient Greek prose; advanced grammar. May be repeated for credit. Prerequisite: GRK 201.
General Studies: HU

GRK 302 Ancient Greek Literature II. (3)
spring
Continuation of GRK 301. Readings in ancient Greek poetry. Prerequisite: GRK 301.
General Studies: HU

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

HEBREW (HEB)

HEB 101 Elementary Modern Hebrew. (4)
fall
Reading, writing, speaking, and understanding of basic modern Hebrew, with emphasis on pronunciation and grammar. 4 hours lecture, 1 hour lab. Fee.

HEB 102 Elementary Modern Hebrew. (4)
spring
Reading, writing, speaking, and understanding of basic modern Hebrew, with emphasis on pronunciation and grammar. 4 hours lecture, 1 hour lab. Fee. Prerequisite: HEB 101 (or its equivalent).

HEB 201 Intermediate Modern Hebrew. (4)
fall
Intensive review of grammar, with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: HEB 102 (or its equivalent).
General Studies: G

HEB 202 Intermediate Modern Hebrew. (4)
spring
Intensive review of grammar, with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: HEB 201 (or its equivalent).
General Studies: G

HEB 313 Advanced Modern Hebrew. (4)
fall
Continued development of ability to communicate orally and in writing. Reading of selected literary works. Prerequisite: HEB 202 (or its equivalent).

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

HEB 314 Advanced Modern Hebrew. (4)
spring
Continued development of ability to communicate orally and in writing. Reading of selected literary works. Prerequisite: HEB 313 (or its equivalent).

HEB 375 Contemporary Culture of Israel. (3)
fall and spring
Intense study of aspects of historical, social, political, and cultural modern life in Israel. Beginning of Zionism to present day. Lecture, discussion.
General Studies: HU, G

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

INDONESIAN (IDN)

IDN 101 Elementary Indonesian I. (5)
fall
Basic communication, reading, and writing skills. Intensive oral/aural classroom drill supplemented by prose reading. 4 hours lecture, 1 hour lab. Fee.

IDN 102 Elementary Indonesian II. (5)
spring
Basic communication, reading, and writing skills. Intensive oral/aural classroom drill supplemented by prose reading. 4 hours lecture, 1 hour lab. Fee. Prerequisite: IDN 101 (or its equivalent).

IDN 201 Intermediate Indonesian I. (5)
fall
Systematic review of grammar. Continued development of communication skills with increased emphasis on reading and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: IDN 102 (or its equivalent).
General Studies: G

IDN 202 Intermediate Indonesian II. (5)
spring
Systematic review of grammar. Continued development of communication skills with increased emphasis on reading and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: IDN 201 (or its equivalent).
General Studies: G

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

ITALIAN (ITA)

ITA 101 Elementary Italian. (5)
fall, spring, summer
Aural/oral drill in class and laboratory. Basic grammar supplemented by simple prose readings. 5 hours lecture, 1 hour lab. Fee.

ITA 102 Elementary Italian. (5)
fall, spring, summer
Aural/oral drill in class and laboratory. Basic grammar supplemented by simple prose readings. 5 hours lecture, 1 hour lab. Fee. Prerequisite: ITA 101 (or its equivalent).

ITA 201 Intermediate Italian. (3)
fall, spring, summer
Systematic review of grammar. Development of vocabulary through reading, listening, speaking, and writing. 3 hours lecture, 1 hour lab. Fee. Prerequisite: ITA 102 (or its equivalent).
General Studies: G

ITA 202 Intermediate Italian. (3)
fall, spring, summer
Systematic review of grammar. Development of vocabulary through reading, listening, speaking, and writing. 3 hours lecture, 1 hour lab. Fee. Prerequisite: ITA 201 (or its equivalent).
General Studies: G

ITA 311 Italian Composition and Conversation. (3)
fall and spring
Development of writing ability and oral expression. Prerequisite: ITA 202 (or its equivalent).
General Studies: G

ITA 312 Italian Composition and Conversation. (3)
fall and spring
See ITA 311. Prerequisite: ITA 202 (or its equivalent).
General Studies: G

ITA 314 Advanced Italian. (3)
selected semesters
Advanced grammar and composition with readings of selected literary works. Prerequisite: ITA 202 or instructor approval.
General Studies: G

ITA 315 Italian for Business. (3)
fall
Conversation and composition course in Italian; focuses on business, culture, and communication in Italy. Readings, discussion, research, lab (computer and audio-video), blackboard support. Prerequisite: ITA 202 or instructor approval.

ITA 325 Introduction to Italian Literature. (3)
fall
Italian literature through the interpretation of representative works in drama, poetry, and novel. Prerequisite: ITA 202 or instructor approval.
General Studies: HU

ITA 394 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Commercial Italian. (3)

ITA 415 Italian Civilization. (3)
selected semesters
General survey of history, literature, art, and music, emphasizing Italy's cultural contribution to Western civilization. Prerequisites: ITA 311, 312 (or 314).
General Studies: L/HU, G

ITA 420 Italian Cinema. (3)
fall
Major trends of Italian cinema from the post-war period to the present.

ITA 425 Italian American Culture. (3)
selected semesters
Analyzes representations of Italian American history and culture in several media, including literature, film, and television. Lecture, discussion.
General Studies: L

ITA 430 Italian Literature of the Middle Ages. (3)
selected semesters
Emphasizes "Stil Novo," Dante's minor works, Petrarch, and Boccaccio. Prerequisite: ITA 325 or instructor approval.
General Studies: HU

ITA 441 Dante: *Divina Commedia*. (3)
selected semesters
Critical reading of the three *Cantiche (Inferno, Purgatorio, and Paradiso)*. Prerequisite: ITA 325.
General Studies: L/HU

ITA 443 Italian Literature of the Renaissance. (3)
selected semesters
Emphasizes Lorenzo de'Medici, Poliziano Castiglione, Machiavelli, Ariosto, and Tasso. Prerequisite: ITA 325 or instructor approval.
General Studies: HU, H

ITA 446 Italian Literature of the 18th and 19th Centuries. (3)
selected semesters
Goldoni, Parini, Alfieri, the poetry of Foscolo and Leopardi, and the sociohistorical novels of Foscolo, Manzoni, and Verga. Prerequisite: ITA 325 or instructor approval.
General Studies: HU

ITA 449 20th-Century Italian Literature. (3)
selected semesters
Major works, figures, and movements of contemporary Italian literature. Prerequisite: ITA 325.
General Studies: HU, G

ITA 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Italian/American Culture. (3)

ITA 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

JAPANESE (JPN)

JPN 101 First-Year Japanese I. (5)
fall
Communication skills and basic skills in grammar, reading, and writing, including hiragana, katakana, and about 75 kanji. 5 hours per week. Fee.

JPN 102 First-Year Japanese II. (5)
spring
Continuation of JPN 101. Additional 99 kanji. Continued development of communication skills in speaking, listening, reading, writing, and culture. Fee. Prerequisite: JPN 101 (or its equivalent).

JPN 201 Second-Year Japanese I. (5)
fall
Continued development of communication skills. Increased emphasis on reading and writing. Review of fundamentals of structure to increase abilities in composition and translation. 5 hours per week. Fee. Prerequisite: JPN 102 (or its equivalent).
General Studies: G

JPN 202 Second-Year Japanese II. (5)
spring
Continuation of JPN 201. Fee. Prerequisite: JPN 201 (or its equivalent).
General Studies: G

JPN 206 Calligraphy. (1)
selected semesters
Introduces the practice of calligraphy in Japan, with emphasis on the derivation of Japanese kana syllabaries from Chinese characters. Prerequisite: CHI 205 or JPN 101.

JPN 309 Intermediate Japanese Conversation. (2)
fall
Practice in current usage in expression of ideas. Recommended especially for those who have not had the opportunity to practice Japanese in Japan. Prerequisite: JPN 202.

JPN 310 Intermediate Japanese Conversation. (2)
spring
Continuation of JPN 309. Prerequisite: JPN 309.

JPN 311 Japanese Conversation and Composition. (3)
fall
Intensive aural/oral practice leading toward conversational fluency. Practice in writing Japanese, emphasizing current usage. Prerequisite: JPN 202.
General Studies: G

JPN 312 Japanese Conversation and Composition. (3)
spring
See JPN 311. Prerequisite: JPN 202.
General Studies: G

JPN 313 Third-Year Japanese I. (3)
fall
Continued development of basic skills with greater emphasis on reading. JPN 313 and 314 must be taken in sequence. Prerequisite: JPN 202 (or its equivalent).
General Studies: G

JPN 314 Third-Year Japanese II. (3)
spring
Continued development of basic skills with continued emphasis on reading. JPN 313 and 314 must be taken in sequence. Prerequisite: JPN 313 or instructor approval.
General Studies: G

JPN 321 Japanese Literature. (3)
selected semesters
Readings in modern literature, changing yearly. May be repeated for credit. Prerequisite: preferably JPN 314 (or 313) or instructor approval.
General Studies: L/HU, G

JPN 394 Special Topics. (1–4)
selected semesters

JPN 414 Introduction to Classical Japanese. (3)
spring
Readings from various genres of pre-20th-century literature, with analysis of the structure of the classical language. Prerequisite: JPN 313 or instructor approval.

JPN 435 Advanced Readings. (3)
selected semesters
Readings in history, art, religious studies, economics, or other fields. Lecture, discussion. Prerequisite: JPN 314 (or its equivalent).

JPN 485 Problems of Translation. (3)
selected semesters
Theories and practice of translation: strategies for handling a variety of Japanese texts. Lecture, discussion. Prerequisite: JPN 314 (or its equivalent).

JPN 494 Special Topics. (1–4)
selected semesters

JPN 499 Individualized Instruction. (1–3)
selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

KOREAN (KOR)

KOR 101 First-Year Korean I. (5)
fall
Pronunciation, grammar, elementary conversation, and development of basic reading and writing skills, including Han'gul. Lecture, recitation.

KOR 102 First-Year Korean II. (5)
spring
Continuation of KOR 101. Lecture, recitation. Prerequisite: KOR 101 (or its equivalent).

KOR 201 Second-Year Korean I. (5)
fall
Continual development of communication skills. Increased emphasis on reading and writing, vocabulary building, and review of fundamentals. Lecture, recitation. Prerequisite: KOR 102 (or its equivalent).
General Studies: G

KOR 202 Second-Year Korean II. (5)
spring
Continuation of KOR 201. Lecture, recitation. Prerequisite: KOR 201 (or its equivalent).
General Studies: G

KOR 250 Korean Culture and Society. (3)
once a year
Survey of Korean culture and society, covering history, religious traditions, gender, and popular culture. Lecture, discussion.
General Studies: HU, G

KOR 313 Third-Year Korean I. (3)
fall
Continued development of ability to communicate orally and in writing. Exposure to a variety or Korean written styles. Reading, writing, discussion. Prerequisite: KOR 202 (or its equivalent).

KOR 314 Third-Year Korean II. (5)
spring
Continuation of KOR 313. Reading, writing, discussion. Prerequisite: KOR 313 (or its equivalent).

KOR 347 Korean Film and Literature. (3)
fall
Introduces aspects of Korean history, culture, and society through Korean film and literature. Lecture, discussion.
General Studies: HU

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

KOR 350 Women of Korea. (3)
spring
Examines the changing role and status of women in modern Korea in relation to political and cultural changes. Lecture, discussion.
General Studies: H

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

LATIN (LAT)

LAT 101 Elementary Latin. (4)
fall and spring
Basic Latin grammar with an emphasis on developing reading skills. For beginning students only.

LAT 102 Elementary Latin. (4)
fall and spring
Continuation of LAT 101. Prerequisite: LAT 101 (or its equivalent).

LAT 201 Intermediate Latin I. (4)
fall and spring
Final semester of grammar. Prerequisite: LAT 102 or instructor approval.
General Studies: HU

LAT 202 Intermediate Latin II. (4)
fall and spring
Beginning reading of Latin authors. Prerequisite: LAT 201 (or its equivalent) or instructor approval.
General Studies: HU

LAT 421 Roman Literature. (3)
fall
Readings in the Latin masterpieces. Authors read change each year in accordance with needs of the class. May be repeated for credit. Prerequisite: LAT 202 or instructor approval.
General Studies: HU

LAT 422 Roman Literature. (3)
spring
See LAT 421. Prerequisite: LAT 202 or instructor approval.
General Studies: HU

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

MACEDONIAN (MAK)

MAK 101 Elementary Macedonian. (4)
summer
Structural grammar, basic vocabulary; introduction and reinforcement of aural/oral, reading, and writing skills. 4 hours lecture, 1 hour lab. Lecture, lab, group activities.

MAK 102 Elementary Macedonian. (4)
summer
See MAK 101. Lecture, lab, group activities. Prerequisite: MAK 101 (or its equivalent).

MAK 201 Intermediate Macedonian. (4)
summer
Systematic review of grammar. Development of vocabulary through reading and writing. Drill in aural/oral skills. 4 hours lecture, 1 hour lab. Lecture, lab, group activities. Prerequisite: MAK 102 (or its equivalent).

MAK 202 Intermediate Macedonian. (4)
summer
See MAK 201. Lecture, lab, group activities. Prerequisite: MAK 201 (or its equivalent).

MAK 298 Macedonian Practicum. (2)
summer
On-site summer practicum in Macedonia following intensive summer Macedonian language study in the ASU Critical Languages Institute. Lecture, lab, group activities. Prerequisite: MAK 102 (or its equivalent).

MAK 311 Macedonian Composition and Conversation. (1–8)
once a year
Advanced communicative proficiency and writing development. Intended for students enrolled in "ASU Study Abroad University of Ss. Kiril and Metodij." Tutorial. Prerequisite: MAK 202 (or its equivalent).

MAK 312 Macedonian Composition and Conversation. (1–8)
once a year
Advanced communicative proficiency and writing development. Intended for students enrolled in "ASU Study Abroad University of Ss. Kiril and Metodij." Tutorial. Prerequisite: MAK 202 (or its equivalent).

MAK 411 Advanced Macedonian Composition and Conversation. (1–8)
once a year
Improves self-expression in oral and written skills, emphasizing vocabulary building and use of newspapers and other materials published in Macedonia. Tutorial. Prerequisite: MAK 312 (or its equivalent).

MAK 412 Advanced Macedonian Composition and Conversation. (1–8)
once a year
Improves self-expression in oral and written skills, emphasizing vocabulary building and use of newspapers and other materials published in Macedonia. Tutorial. Prerequisite: MAK 411 (or its equivalent).

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

NORWEGIAN (NOR)

NOR 101 Elementary Norwegian. (4)
fall
Reading, writing, speaking, and understanding of basic Norwegian. 4 hours lecture, 1 hour lab. Fee.

NOR 102 Elementary Norwegian. (4)
spring
Reading, writing, speaking, and understanding of basic Norwegian. 4 hours lecture, 1 hour lab. Fee. Prerequisite: NOR 101 (or its equivalent).

NOR 201 Intermediate Norwegian. (4)
fall
Reviews Norwegian grammar with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: NOR 102 (or its equivalent).

NOR 202 Intermediate Norwegian. (4)
spring
Reviews Norwegian grammar with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: NOR 201 (or its equivalent).

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

PORTUGUESE (POR)

POR 101 Elementary Portuguese. (5)
fall
Basic grammar with intensive drills in class and laboratory directed toward conversational fluency. 5 hours lecture, 1 hour lab. Fee. Prerequisite: 1 year of Spanish or French or Italian or instructor approval.

POR 201 Intermediate Portuguese. (5)
spring
Continuation of POR 101. Intensive drill of fundamentals in class and laboratory directed toward conversational fluency. 5 hours lecture, 1 hour lab. Fee. Prerequisite: POR 101 or instructor approval.
General Studies: G

POR 313 Portuguese Composition and Conversation. (3)
fall
Develops skill in written Portuguese and corrected oral expression. Must be taken in sequence. Prerequisite: POR 201 or instructor approval.
General Studies: G

POR 314 Portuguese Composition and Conversation. (3)
spring
Continuation of POR 313. Prerequisite: POR 313 or instructor approval.
General Studies: G

POR 321 Luso-Brazilian Literature. (3)
selected semesters
Representative masterpieces of Portuguese and Brazilian literature from the beginning to the present. Prerequisite: POR 313 or instructor approval.
General Studies: HU

POR 472 Luso-Brazilian Civilization. (3)
selected semesters
Lectures, readings, and discussion of important aspects of Luso-Brazilian civilization. Topics from music, art, folklore, literature, history, and politics. Prerequisite: POR 313 or instructor approval.
General Studies: HU, G

POR 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Advanced Portuguese Composition and Conversation
- Brazilian Film

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

ROMANIAN (ROM)

ROM 101 Elementary Romanian. (5)
fall and spring
Basic grammar with intensive drills in class and laboratory directed toward conversational fluency. 5 hours lecture, 1 hour lab.

ROM 201 Intermediate Romanian. (5)
fall and spring
Continuation of ROM 101. Intensive drill of fundamentals in class and laboratory directed toward conversational fluency. 5 hours lecture, 1 hour lab. Prerequisite: ROM 101 or instructor approval.

ROM 313 Romanian Composition and Conversation. (3)
fall and spring
Develops skills in written Romanian and correct oral expression. Must be taken in sequence with ROM 314. Prerequisite: ROM 201 or instructor approval.

ROM 314 Romanian Composition and Conversation. (3)
spring
Continuation of ROM 313. Develops skills in written Romanian and correct oral expression. Must be taken in sequence. Prerequisite: ROM 313 or instructor approval.

ROM 494 Special Topics. (1–4)
once a year

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

RUSSIAN (RUS)

RUS 101 Elementary Russian. (4)
fall, spring, summer
Structural grammar and basic vocabulary. Introduces and reinforces aural/oral reading and writing skills. 4 hours lecture, 1 hour lab. Fee.

RUS 102 Elementary Russian. (4)
spring and summer
See RUS 101. Fee. Prerequisite: RUS 101 (or its equivalent).

RUS 201 Intermediate Russian. (4)
fall and summer
Systematic review of grammar. Develops vocabulary through reading and writing. Drill in aural/oral skills. 4 hours lecture, 1 hour lab. Fee. Prerequisite: RUS 102 (or its equivalent).
General Studies: G

RUS 202 Intermediate Russian. (4)
spring and summer
See RUS 201. Fee. Prerequisite: RUS 201 (or its equivalent).
General Studies: G

RUS 211 Basic Russian Conversation. (3)
fall
Intensive aural/oral drill to supplement reading and grammatical skills acquired in RUS 101, 102, 201, and 202. Required of Russian majors. Fee. Prerequisite: RUS 102.
General Studies: G

RUS 212 Basic Russian Conversation. (3)
spring
See RUS 211. Fee. Prerequisite: RUS 102.
General Studies: G

RUS 303 Scientific Russian. (3)
fall
Acquisition of scientific vocabulary through reading from current Russian scientific publications. Does not satisfy the Liberal Arts and Sciences language requirement for B.A. degree. Prerequisite: RUS 102.

RUS 311 Russian Composition and Conversation. (3)
fall
Develops writing ability and oral expression. Prerequisite: RUS 202.
General Studies: G

RUS 312 Russian Composition and Conversation. (3)
spring
See RUS 311. Prerequisite: RUS 202.
General Studies: G

RUS 321 Foundations of Russian Literature. (3)
selected semesters
Literary movements, prose, poetry, and drama from early Kievan writings to 19th-century works of Pushkin, Lermontov, Gogol. Open to nonmajors. Prerequisite: readings in translation.
General Studies: HU, H

RUS 322 Great Russian Writers of the 19th Century. (3)
selected semesters
Surveys the great age of prerevolutionary Russian prose, including works of Gogol, Turgenev, Dostoevski, Tolstoy, and Chekhov. Open to nonmajors. Prerequisite: readings in translation.
General Studies: L/HU

RUS 323 Modern Russian Literature and the Soviet Legacy. (3)
selected semesters
See also FLA 323. 20th-century Russian writers: their prose, poetry, drama; problems of the writer in Soviet and post-Soviet society. Open to nonmajors. Prerequisite: readings in translation.
General Studies: L/HU, G

RUS 411 Advanced Composition and Conversation I. (3)
fall
Improves aural discrimination and self-expression in oral and written skills, emphasizing vocabulary building. Subject materials drawn from current post-Soviet-Russian publications. Prerequisite: RUS 312.
General Studies: G

RUS 412 Advanced Composition and Conversation II. (3)
spring
See RUS 411. Prerequisite: RUS 312.
General Studies: G

RUS 417 Applied Russian Phonetics. (2)
selected semesters
General improvement in language skills through aural/oral training in Russian phonology and an analysis of Russian orthography. Prerequisite: RUS 102.

RUS 420 Russian Poetry. (3)
selected semesters
Development of Russian poetry from its beginnings to the present, including both native and émigré poets. Topics in criticism and the study of poetics. Prerequisite: RUS 312 or instructor approval.
General Studies: L/HU

RUS 421 Pushkin. (3)
selected semesters
Pushkin's poetry, plays, and prose fiction, including *Eugene Onegin, The Little Tragedies, Tales of Belkin, Queen of Spades,* and *The Captain's Daughter.* Taught in English. Does not satisfy the Liberal Arts and Sciences language requirement for B.A. degree.
General Studies: L/HU

RUS 423 Dostoyevsky. (3)
selected semesters
Dostoyevsky's major works of fiction, including *Crime and Punishment* and *Brothers Karamazov.* Taught in English. Does not satisfy the Liberal Arts and Sciences language requirement for B.A. degree.
General Studies: L/HU

RUS 424 Tolstoy. (3)
selected semesters
Tolstoy's major works, including *War and Peace* and *Anna Karenina.* Taught in English. Does not satisfy the Liberal Arts and Sciences language requirement for B.A. degree.
General Studies: L/HU

RUS 425 Chekhov. (3)
selected semesters
Chekhov's major works, representative short stories and major plays, including *The Cherry Orchard* and *Three Sisters.* Taught in English. Does not satisfy the Liberal Arts and Sciences language requirement for B.A. degree.
General Studies: L/HU

RUS 430 Russian Short Story. (3)
selected semesters
Detailed study of representative works of the Russian short story genre. Includes authors from both Imperial and Soviet Russia. Prerequisite: RUS 312 or instructor approval.
General Studies: L/HU

RUS 441 Survey of Russian Culture. (3)
selected semesters
Interplay of artistic, social, and political forces in the development of Russian culture from the Kievan period to the present. Exclusive use of Russian language source materials. Prerequisite: RUS 312 or instructor approval.
General Studies: L/HU, G, H

RUS 493 Honors Thesis. (1–6)
selected semesters

RUS 494 Special Topics. (1–4)
selected semesters

RUS 495 Russian for Heritage Speakers. (1–6)
selected semesters
Generates professional proficiency by developing advanced communicative and written competency in standard literary Russian. Lecture, lab, tutorial. Prerequisite: instructor approval.

RUS 498 Pro-Seminar. (1–7)
selected semesters
Topics may include the following:
- Senior Seminar. (3)

RUS 499 Individualized Instruction. (1–3)
selected semesters

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SCANDINAVIAN (SCA)

SCA 250 Introduction to Scandinavian Culture. (3)
spring
Scandinavian identity from an interdisciplinary perspective with historic overview. Lecture, discussion.
General Studies: HU, G, H

SCA 314 Medieval Scandinavia. (3)
fall and spring
Study in English translation of the Sagas, Edda, and Skaldic poetry, history and mythology of the Vikings.

SCA 315 Old Norse. (3)
fall and spring
Readings and study of grammatical structures of Medieval Scandinavian with emphasis on the Sagas and Edda poetry and historical writings.

SCA 316 Scandinavian Cinema. (3)
fall and spring
Presents Scandinavian films, with English subtitles, as representatives of contemporary and historical culture.
General Studies: HU, G

SCA 450 Masterpieces of Scandinavian Literature. (3)
spring
Scandinavian literature in translation in its cultural and historical contexts.
General Studies: L/HU

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

SLAVIC (SLV)

SLV 304 Computational Linguistics of Slavic Languages. (3)
spring
Information technology and Slavic languages, including Web design, digitalized resources, information retrieval, math/statistical analysis, and PERL. Lecture, lab.

SLV 426 Contemporary East European and Eurasian Literatures. (3)
selected semesters
Readings in non-Russian literatures and literary criticism from Eastern Europe and Eurasia: Milosz, Mrozek, Kis, Andric, Kadare, Ajtmatov. Lecture, discussion.
General Studies: L/HU, G

SLV 440 History of Slavic Languages. (3)
selected semesters
Comparative evolution of East Slavic, West Slavic, and South Slavic languages from the earliest record to the standardizing of national languages in the 19th and 20th centuries. Lecture, discussion.

SLV 498 Pro-Seminar. (1–7)
selected semesters
Topics may include the following:
- Senior Seminar. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

SPANISH (SPA)

SPA Note 1. Students who have completed their secondary education in a school where Spanish was the official language of instruction should begin their studies at the 325 level or above. No student who has completed more than two years of high school in a Spanish-speaking country, where Spanish is the medium of instruction in the school, is allowed to register in a Spanish language class below the 400 level.

SPA 101 Elementary Spanish. (4)
fall, spring, summer
Fundamentals of the language. Emphasizes listening, speaking, reading, and writing. Credit is allowed for only SPA 101 or 111. 4 hours lecture, 1 hour lab. Fee. See SPA Note 1.

SPA 102 Elementary Spanish. (4)
fall, spring, summer
See SPA 101. Credit is allowed for only SPA 102 or 111. Fee. See SPA Note 1. Prerequisite: SPA 101 (or its equivalent).

SPA 107 Spanish for International Professions I. (8)
fall
Accelerated program alternative to SPA 101, 102 sequence. Functional approach to needs of international professions. Fee. See SPA Note 1.

SPA 111 Fundamentals of Spanish. (4)
fall and spring
Primarily for students with two years of high school Spanish who need review to enter second-year study. Credit is allowed for only SPA 111 or both SPA 101 and 102. 4 hours lecture, 1 hour lab. Fee. See SPA Note 1.

SPA 201 Intermediate Spanish. (4)
fall, spring, summer
Continuation of fundamentals. Emphasizes the development of the skills of reading, listening comprehension, speaking, writing, and culture. 4 hours lecture, 1 hour lab. Fee. See SPA Note 1. Prerequisite: SPA 102 or 111.
General Studies: G

SPA 202 Intermediate Spanish. (4)
fall, spring, summer
See SPA 201. Fee. See SPA Note 1. Prerequisite: SPA 201 (or its equivalent).
General Studies: G

SPA 203 Intermediate Spanish for Bilinguals. (4)
fall
For Spanish-speaking students, in lieu of SPA 201. Composition, literature, conversation, grammar fundamentals. 4 hours lecture, 1 hour lab. Fee. See SPA Note 1. Prerequisite: SPA 102 or 111 or placement examination.
General Studies: G

SPA 204 Intermediate Spanish for Bilinguals. (4)
spring
For Spanish-speaking students, in lieu of SPA 202. Composition, literature, conversation, grammar fundamentals. 4 hours lecture, 1 hour lab. See SPA Note 1. Prerequisite: SPA 203 (or its equivalent).
General Studies: G

SPA 207 Spanish for International Professions II. (8)
spring
Continuation of SPA 107, alternative to SPA 201, 202 sequence. Expansion of communicative proficiency in specific areas of international professions. Fee. See SPA Note 1. Prerequisite: SPA 107 or instructor approval.
General Studies: G

SPA 311 Spanish Conversation. (3)
fall and spring
Designed primarily for nonmajors to promote vocabulary building and communicative expression in Spanish through discussions based on cultural readings. See SPA Note 1. Prerequisite: SPA 202 (or its equivalent).

SPA 312 Spanish Conversation. (3)
fall and spring
See SPA 311. See SPA Note 1. Prerequisite: SPA 311 (or its equivalent).

SPA 313 Spanish Conversation and Composition. (3)
fall, spring, summer
Designed to develop skill and accuracy in spoken and written Spanish. Required of majors; SPA 313 and 314 must be taken in sequence. See SPA Note 1. Prerequisite: SPA 202 (or its equivalent).
General Studies: G

SPA 314 Spanish Conversation and Composition. (3)
fall, spring, summer
See SPA 313. See SPA Note 1. Prerequisite: SPA 313 (or its equivalent).
General Studies: G

SPA 315 Spanish Conversation and Composition for Bilinguals. (3)
fall
Emphasizes comparing standard Spanish with regional Southwest Spanish. May be taken in lieu of SPA 313 and 314. See SPA Note 1. Prerequisite: SPA 202 or 204 or instructor approval.

SPA 316 Spanish Conversation and Composition for Bilinguals. (3)
spring
See SPA 315. See SPA Note 1. Prerequisite: SPA 315 (or its equivalent).

SPA 319 Business Correspondence and Communication. (3)
selected semesters
Organization and presentation of clear, effective business communications; vocabulary applicable to modern business usage. See SPA Note 1. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: G

SPA 325 Introduction to Hispanic Literature. (3)
fall and spring
Critical approach to and analysis of literary types, including poetry, drama, short story, and novel. Required of all majors. See SPA Note 1. Prerequisite: SPA 313.
General Studies: HU

SPA 400 Introduction to Spanish Linguistics. (3)
fall
Introduces the discipline and methods of linguistics through the study of Spanish data. Prerequisite: SPA 412 (or its equivalent).

SPA 412 Advanced Conversation and Composition. (3)
fall and spring
Oral and written Spanish communication skills, with particular attention given to developing fluency and facility. Required of majors. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: G

SPA 413 Advanced Spanish Grammar. (3)
fall
Intensive analysis of the Spanish language. Required of teaching majors. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: G

SPA 417 Spanish Phonetics and Phonology. (3)
fall
Introduces the theory and practice of Spanish phonetics and phonology. Prerequisite: SPA 412.

SPA 420 Applied Spanish Linguistics. (3)
spring
Applies linguistic principles to the teaching of Spanish. Prerequisites: FLA 400 (or its equivalent); SPA 412.
General Studies: L

SPA 421 Spanish in the Southwest. (3)
fall
Discussion and linguistic analysis of Southwest Spanish. Prerequisite: SPA 412.
General Studies: L/SB, C

SPA 425 Spanish Literature. (3)
fall and spring
Surveys Spanish literature from its beginning to 1700. Prerequisite: SPA 325.
General Studies: HU

SPA 426 Spanish Literature. (3)
fall and spring
Surveys Spanish literature from 1700 to the present. Prerequisite: SPA 325.
General Studies: HU

SPA 427 Spanish American Literature. (3)
fall and spring
Surveys major works, figures, and movements from Colonial period to 1880. Prerequisite: SPA 325.
General Studies: L

SPA 428 Spanish American Literature. (3)
fall and spring
Surveys major works, figures, and movements from 1880 to the present. Prerequisite: SPA 325.
General Studies: L, G

SPA 429 Mexican Literature. (3)
selected semesters
Selected readings from pre-Columbian writers/poets (e.g., Macuilxóchitl) through the novel of the Revolution to the present. Prerequisite: SPA 325.

SPA 434 Drama of the Golden Age. (3)
spring
Dramatic works of Lope de Vega, Calderón de la Barca, and their contemporaries. Prerequisite: SPA 325.

SPA 435 Cervantes—*Don Quijote*. (3)
fall
Don Quijote and the development of the novel. Prerequisite: SPA 325.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

SPA 454 19th-Century Spanish American Narrative. (3)
fall
Principal works in the novel, short story, narrative fiction, and narrative (Gauchesque) poetry. Prerequisite: SPA 325.

SPA 456 20th-Century Spanish American Fiction. (3)
spring
Major works and movements. Prerequisite: SPA 325.

SPA 464 Mexican American Literature. (3)
fall
Representative literature in Spanish and English by Mexican Americans, emphasizing sociocultural as well as literary values. Prerequisite: SPA 325.
General Studies: HU

SPA 471 Civilization of the Spanish Southwest. (3)
spring
Political, intellectual, social, economic, and artistic development of the Spanish-speaking people of the Southwest. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: HU

SPA 472 Spanish American Civilization. (3)
fall
Growth of the institutions and cultures of Spanish American people. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: HU, G, H

SPA 473 Spanish Civilization. (3)
spring
Political, intellectual, social, economic, and artistic development of the Spanish nation from its origin to the present. Prerequisite: SPA 314 or 316 or instructor approval.
General Studies: HU/SB, G

SPA 474 Mexican Culture. (3)
fall and spring
Examines diverse aspects of Mexican culture since the 1910 Revolution. Lecture, discussion. Prerequisite: SPA 325.

SPA 485 Mexican American Short Story. (3)
selected semesters
Critical study of contemporary short stories by Mexican American authors, with emphasis on their Spanish-language writings. Prerequisite: SPA 325 or instructor approval.
General Studies: L

SPA 486 Mexican American Novel. (3)
selected semesters
Social and literary contexts of representative novelists, emphasizing their Spanish-language writings. Prerequisite: SPA 325 or instructor approval.

SPA 487 Mexican American Drama. (3)
selected semesters
Representative dramatic works, with emphasis on the history and development of this genre from its regional origins to the present. Prerequisite: SPA 325 or instructor approval.

SPA 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Lexicography. (3)
- Introduction to Hispanic Linguistics. (3)

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Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

SWEDISH (SWE)

SWE 101 Elementary Swedish. (4)
fall
Reading, writing, speaking, and understanding of basic Swedish. 4 hours lecture, 1 hour lab. Fee.

SWE 102 Elementary Swedish. (4)
spring
Reading, writing, speaking, and understanding of basic Swedish. 4 hours lecture, 1 hour lab. Fee. Prerequisite: SWE 101 (or its equivalent).

SWE 201 Intermediate Swedish. (4)
fall
Reviews Swedish grammar with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: SWE 102 (or its equivalent).

SWE 202 Intermediate Swedish. (4)
spring
Reviews Swedish grammar with emphasis on the development of the skills of speaking, listening comprehension, reading, and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: SWE 201 (or its equivalent).

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

THAI (THA)

THA 101 Elementary Thai I. (5)
fall
Basic communication, reading, and writing skills. Intensive oral/aural classroom drill supplemented by prose readings in Thai script. 4 hours lecture, 1 hour lab. Fee.

THA 102 Elementary Thai II. (5)
spring
Basic communication, reading, and writing skills. Intensive oral/aural classroom drill supplemented by prose reading. 4 hours lecture, 1 hour lab. Fee. Prerequisite: THA 101 (or its equivalent).

THA 201 Intermediate Thai I. (5)
fall
Systematic review of grammar. Continued development of communication skills with increased emphasis on reading and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: THA 102 (or its equivalent).
General Studies: G

THA 202 Intermediate Thai II. (5)
spring
Systematic review of grammar. Continued development of communication skills with increased emphasis on reading and writing. 4 hours lecture, 1 hour lab. Fee. Prerequisite: THA 201 (or its equivalent).
General Studies: G

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

VIETNAMESE (VTN)

VTN 101 Elementary Vietnamese I. (5)
fall
Basic skills in modern conversational Vietnamese and development of basic reading and writing skills, with special emphasis on tones. 4 hours lecture, 1 hour lab.

VTN 102 Elementary Vietnamese II. (5)
spring
Basic skills in modern conversational Vietnamese and development of basic reading and writing skills, with special emphasis on tones. 4 hours lecture, 1 hour lab. Prerequisite: VTN 101 (or its equivalent).

VTN 201 Intermediate Vietnamese I. (5)
fall
Improves speaking, listening, reading, and writing competence through dialogues, reading passages, pattern drill, and grammar and communicative exercises. 4 hours lecture, 1 hour lab. Prerequisite: VTN 102 (or its equivalent).
General Studies: G

VTN 202 Intermediate Vietnamese II. (5)
spring
Improves speaking, listening, reading, and writing competence through dialogues, reading passages, pattern drill, and grammar and

communicative exercises. 4 hours lecture, 1 hour lab. Prerequisite: VTN 201 (or its equivalent).
General Studies: G

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Department of Mathematics and Statistics

math.la.asu.edu
480/965-3951
PS A216

Andrew Bremner, Chair

Professors: Armbruster, Bremner, Bustoz, Gardner, Hoppensteadt, Ihrig, Z. Jackiewicz, Kadell, Kawski, Kierstead, Kostelich, Kuang, Kuiper, Lai, Leonard, Lohr, Mittelmann, Nicolaenko, Quigg, Renaut, Ringhofer, H.A. Smith, H.L. Smith, Thieme, Young

Associate Professors: Baer, Barcelo, Blount, Carlson, Childress, Farmer, Gelb, Hurlbert, D. Jones, J. Jones, Kurtz, Lopez, Mahalov, McCarter, Moore, Nikitin, Prewitt, Spielberg, Suslov, Taylor, Welfert

Assistant Professors: Czygrinow, Kaliszewski, Oehrtman, Oleson, Zandieh

Senior Lecturers: Abramson, Isom, Kolossa, Rody, Trapuzzano, Vaz, A. Zhu

Lecturers: Ashbrook, Bloom, Coombs, Downs, Gust, E. Jackiewicz, E. Jones, Kellgren, Kim, Maris, Martin, Masilamani, Miller, Odish, Pecuch-Herrero, Reynolds, Ruedemann, Shelton, Surgent, Tracogna, Turner, Ward, Williams

The Department of Mathematics and Statistics offers the B.A. and B.S. degrees in Mathematics. Students who plan to attend graduate school in mathematics or statistics should choose the B.S. degree.

The department also offers the B.S. degree in Computational Mathematical Sciences.

The department also offers a minor in Mathematics and an academic specialization in mathematics for students pursuing the B.A.E. degree in Secondary Education.

Related Field Course List. All students majoring in Mathematics need to refer to the related field course list. It is available from an advisor in PS A211, or from the department Web site at math.la.asu.edu/~undergrd/underprog/degree/related-fields.html.

MATHEMATICS—B.A.

The B.A. degree in Mathematics requires a minimum of 36 semester hours of course work in mathematics and statistics, and additional course work in closely related fields, for a total of 51 semester hours. A grade of "C" or higher is required in all courses taken for the major. MAT 370 and 371 may not both be used to satisfy these degree requirements. The required course work has the following components:

Core Courses

MAT	270 Calculus with Analytic Geometry I *MA*	4
MAT	271 Calculus with Analytic Geometry II *MA*	4
MAT	272 Calculus with Analytic Geometry III *MA*	4
MAT	300 Mathematical Structures *L*	3
MAT	342 Linear Algebra	3
MAT	370 Intermediate Calculus	3
	or MAT 371 Advanced Calculus I (3)	
Total		21

Computer Science Requirement

CSE	100 Principles of Programming with C++ *CS*	3
	or CSE 200 Concepts of Computer Science *CS* (3)	
Total		3

Advanced Courses in Mathematics and Statistics

Two courses from the following list, both preferably taken from the same grouping 6

Algebra, Topology, and Number Theory
- MAT 410 Introduction to General Topology (3)
- MAT 442 Advanced Linear Algebra (3)
- MAT 443 Introduction to Abstract Algebra (3)
- MAT 444 Intermediate Abstract Algebra (3)
- MAT 445 Theory of Numbers (3)

Analysis and Applications
- MAT 372 Advanced Calculus II (3)
- MAT 461 Applied Complex Analysis (3)
- MAT 472 Intermediate Real Analysis I (3)

Applied Mathematics and Dynamics
- MAT 451 Mathematical Modeling *CS* (3)
- MAT 452 Introduction to Chaos and Nonlinear Dynamics (3)
- MAT 455 Introduction to Fractals and Applications (3)

Computational Mathematics
- MAT 420 Scientific Computing (3)
- MAT 421 Applied Computational Methods *CS* (3)
- MAT 423 Numerical Analysis I *CS* (3)
- MAT 425 Numerical Analysis II *CS* (3)
- MAT 427 Computer Arithmetic *CS* (3)

Differential Equations
- MAT 462 Applied Partial Differential Equations (3)
- MAT 475 Differential Equations (3)
- MAT 476 Partial Differential Equations (3)

Discrete Mathematics
- MAT 415 Introduction to Combinatorics (3)
- MAT 416 Introduction to Graph Theory (3)
- MAT 419 Introduction to Linear Programming *CS* (3)

Statistics and Probability
- STP 420 Introductory Applied Statistics *CS* (3)
- STP 421 Probability (3)
- STP 425 Stochastic Processes (3)
- STP 427 Mathematical Statistics (3)
- STP 429 Experimental Statistics *CS* (3)

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

Additional Course Work in Mathematics and Statistics
Three courses in mathematics and statistics[1] 9

Related Field Course Work
Course work in mathematics, statistics, or related fields[2] 12

[1] Acceptable mathematics courses are MAT 274 and upper-division MAT courses, with the exception of MAT 362, 485, and ASU West MAT 411. Acceptable statistics courses are upper-division STP courses.

[2] See "Related Field Course List," page 393.

MATHEMATICS—B.S.

The Department of Mathematics and Statistics has three avenues for earning a B.S. degree. The B.S. requirements are similar to the B.A. requirements, but they require more extensive courses in advanced mathematics. The program is flexible enough to allow students to focus their studies on mathematics, applied mathematics, or statistics. The statistics concentration offers extensive preparation in applied and theoretical statistics. The requirements for the B.S. degree with the statistics concentration are a subset of those for the B.S. degree. The requirements for the B.S. degree and for the B.S. degree with the computational mathematical sciences concentration are distinct; neither is a subset of the other.

B.S. Requirements. The B.S. degree in Mathematics requires a minimum of 42 semester hours of course work in mathematics and statistics, and additional course work in closely related fields, for a total of 55 semester hours. A grade of "C" or higher is required in all courses taken for the major. MAT 370 and 371 may not both be used to satisfy these degree requirements. The required course work has the following components:

Core Courses
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 300 Mathematical Structures *L* 3
MAT 342 Linear Algebra 3
MAT 371 Advanced Calculus I 3
Total 21

Computer Science Requirement
CSE 200 Concepts of Computer Science *CS* 3
Total 3

Depth Requirement
Two courses chosen from the following list of advanced courses 6
MAT 415 Introduction to Combinatorics (3)
MAT 416 Introduction to Graph Theory (3)
MAT 423 Numerical Analysis I *CS* (3)
MAT 425 Numerical Analysis II *CS* (3)
MAT 442 Advanced Linear Algebra (3)
MAT 444 Intermediate Abstract Algebra (3)
MAT 462 Applied Partial Differential Equations (3)
MAT 472 Intermediate Real Analysis I (3)
MAT 473 Intermediate Real Analysis II (3)
MAT 475 Differential Equations (3)
MAT 476 Partial Differential Equations (3)
STP 421 Probability (3)
STP 427 Mathematical Statistics (3)

Advanced Courses in Mathematics and Statistics[1]
Two courses from the following list, both preferably taken from the same grouping 6

Algebra, Topology, and Number Theory
MAT 410 Introduction to General Topology (3)
MAT 442 Advanced Linear Algebra (3)
MAT 443 Introduction to Abstract Algebra (3)
MAT 444 Intermediate Abstract Algebra (3)
MAT 445 Theory of Numbers (3)

Analysis and Applications
MAT 372 Advanced Calculus II (3)
MAT 461 Applied Complex Analysis (3)
MAT 472 Intermediate Real Analysis I (3)

Applied Mathematics and Dynamics
MAT 451 Mathematical Modeling *CS* (3)
MAT 452 Introduction to Chaos and Nonlinear Dynamics (3)
MAT 455 Introduction to Fractals and Applications (3)

Computational Mathematics
MAT 420 Scientific Computing (3)
MAT 421 Applied Computational Methods *CS* (3)
MAT 423 Numerical Analysis I *CS* (3)
MAT 425 Numerical Analysis II *CS* (3)
MAT 427 Computer Arithmetic *CS* (3)

Differential Equations
MAT 462 Applied Partial Differential Equations (3)
MAT 475 Differential Equations (3)
MAT 476 Partial Differential Equations (3)

Discrete Mathematics
MAT 415 Introduction to Combinatorics (3)
MAT 416 Introduction to Graph Theory (3)
MAT 419 Introduction to Linear Programming *CS* (3)

Statistics and Probability
STP 420 Introductory Applied Statistics *CS* (3)
STP 421 Probability (3)
STP 425 Stochastic Processes (3)
STP 427 Mathematical Statistics (3)
STP 429 Experimental Statistics *CS* (3)

Additional Course Work in Mathematics and Statistics[2]
Three courses in mathematics and statistics 9

Related Fields Course Work[3]
Course work in mathematics, statistics, or related fields 10

[1] Students who contemplate graduate work in mathematics should choose additional courses listed under the depth requirement to satisfy the advanced courses requirement.

[2] Acceptable mathematics courses are MAT 274 and upper division MAT courses, with the exception of MAT 310, 362, 485, and ASU West MAT 411. Acceptable statistics courses are 400-level STP courses.

[3] See "Related Field Course List," page 393.

B.I.S. CONCENTRATION

A concentration in Mathematics is available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

COMPUTATIONAL MATHEMATICAL SCIENCES—B.S.

The B.S. degree in Computational Mathematical Sciences curriculum strives to provide students with a background in computer science and the natural or physical sciences in addition to a core of course work in mathematics. The requirements for the B.S. Degree in Computational Mathematical Sciences and for the B.S. degree in mathematics are distinct; neither is a subset of the other. A minimum grade of "C" is required in all courses taken for the major.

The B.S. degree in Computational Mathematical Sciences requires a minimum of 32 semester hours of course work in mathematics and statistics, a minimum of 12 to 14 semester hours in science, nine hours in computer science, and a three hour advanced science course or internship/research credit. This adds up to a minimum of 56 to 58 semester hours of study related to the major.

Core Courses

MAT 243 Discrete Mathematical Structures 3
or MAT 300 Mathematical Structures *L* (3)
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
Total 11

Core Courses in Computational Mathematics

MAT 274 Elementary Differential Equations *MA** 3
or MAT 275 Modern Differential Equations *MA* (3)
MAT 342 Linear Algebra* 3
or MAT 343 Applied Linear Algebra (3)
MAT 420 Scientific Computing 3
MAT 421 Applied Computational Methods *CS* 3
Total 12

* MAT 275 and MAT 343 are recommended.

Advanced Courses in Mathematics and Statistics

Choose one course from group one and two from group two 9

Group One

MAT 362 Advanced Mathematics for Engineers and Scientists (3)
MAT 370 Intermediate Calculus (3)
MAT 371 Advanced Calculus I (3)
MAT 460 Vector Calculus (3)

Group Two

MAT 351 Mathematical Methods for Genetic Analysis *CS* (3)
MAT 415 Introduction to Combinatorics (3)
MAT 416 Introduction to Graph Theory (3)
MAT 419 Introduction to Linear Programming *CS* (3)
MAT 423 Numerical Analysis I *CS* (3)
MAT 425 Numerical Analysis II *CS* (3)
MAT 447 Cryptography (3)
MAT 451 Mathematical Modeling *CS* (3)
MAT 452 Introduction to Chaos and Nonlinear Dynamics (3)
MAT 455 Introduction to Fractals and Applications (3)
MAT 461 Applied Complex Analysis (3)
MAT 462 Applied Partial Differential Equations (3)
MAT 475 Differential Equations (3)
MAT 476 Partial Differential Equations (3)
STP 420 Introductory Applied Statistics *CS* (3)
STP 421 Probability (3)
STP 425 Stochastic Processes (3)
STP 427 Mathematical Statistics (3)
STP 429 Experimental Statistics *CS* (3)

Computer Science Requirement

CSE 200 Concepts of Computer Science *CS* 3
CSE 210 Object-Oriented Design and Data Structures *CS* 3
CSE 240 Introduction to Programming Languages 3
or CSE 310 Data Structures and Algorithms (3)
Total 9

Science Requirement. Two one-year science course and lab sequences (for a total of 14–17 hours) are required. Upon advisor approval, two advanced courses for which the first one-year science and lab sequence is a prerequisite may be substituted for the second one-year science and lab sequence. Allowable one-year sequences include the following:

Astrophysics

Astrophysics sequence 8
AST 113 Astronomy Laboratory I *SQ*[1] (1)
AST 114 Astronomy Laboratory II *SQ*[1] (1)
AST 321 Introduction to Planetary and Stellar Astrophysics *SQ*[1] (3)
AST 322 Introduction to Galactic and Extragalactic Astrophysics *SQ*[1] (3)

Biology

Choose one of the following sequences 8
BIO 187 General Biology I *SG* (4)
BIO 188 General Biology II *SQ* (4)
— *or* —
BIO 188 General Biology II *SQ* (4)
BIO 193 The Nature of Biological Science *SQ* (4)

Chemistry

Choose one of the following sequences 5–9
CHM 113 General Chemistry *SQ* (4)
CHM 115 General Chemistry with Qualitative Analysis *SQ* (5)
— *or* —
CHM 113 General Chemistry *SQ* (4)
CHM 116 General Chemistry *SQ* (4)
— *or* —
CHM 115 General Chemistry with Qualitative Analysis *SQ*[2] (4)
CHM 117 General Chemistry for Majors I *SQ*[2] (4)
— *or* —
CHM 114 General Chemistry for Engineers *SQ*[3] (4)
CHM 231 Elementary Organic Chemistry *SQ*[4] (3)
CHM 235 Elementary Organic Chemistry Laboratory *SQ*[3] (1)

Geology

Geology sequence 8
GLG 101 Introduction to Geology I (Physical) *SQ, G*[4] (3)
GLG 103 Introduction to Geology I—Laboratory *SG*[4] (1)
GLG 102 Introduction to Geology II (Historical) *SG, H*[4] (3)
GLG 104 Introduction to Geology II—Laboratory *SG*[4] (1)

Microbiology and Molecular Biosciences/Biotechnology

Choose one of the following sequences 4
MIC 205 Microbiology *SG*[5] (3)
MIC 206 Microbiology Laboratory *SG* (1)
— *or* —
MIC 206 Microbiology Laboratory *SG* (1)
MIC 220 Biology of Microorganisms (3)

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

— *or* —
MBB 245 Cellular and Molecular Biology *SQ*[6] (3)
MBB 246 Cellular and Molecular Biology Laboratory *SQ*[6] (1)

Physics
Choose one of the following sequences 8
PHY 121 University Physics I: Mechanics *SQ*[7] (3)
PHY 122 University Physics Laboratory *SQ*[7] (1)
PHY 131 University Physics II: Electricity and Magnetism *SQ*[7] (3)
PHY 132 University Physics Laboratory II *SQ*[7] (1)
— *or* —
PHY 150 Physics I *SQ* (4)
PHY 151 Physics II *SQ* (4)

Plant Biology
Choose one of the following sequences 4
PLB 200 Biology of Plants *SQ*[8] (3)
PLB 201 Biology of Plants Laboratory *SQ*[8] (1)
— *or* —
MBB 245 Cellular and Molecular Biology *SQ*[6] (3)
MBB 246 Cellular and Molecular Biology Laboratory *SQ*[6] (1)

Internship, Research, or Advanced Science Requirement
Choose one of the following courses 3
MAT 484 Internship[9] (3)
MAT 493 Honors Thesis/Research[10] (3)
MAT 494 ST: Independent Study/Research[9] (3)
One advanced course in science for which a one-year sequence in the same science is required

[1] Both AST 113 and 321 or both AST 114 and 322 must be taken to secure SQ credit.
[2] CHM 115 and 117 are strongly recommended for qualified students.
[3] Both CHM 231 and 235 must be taken to secure SQ credit.
[4] Both GLG 101 and 103 must be taken to secure SQ credit, and both GLG 102 and 104 must be taken to secure SG credit.
[5] Both MIC 205 and MIC 206 must be taken to secure SG credit.
[6] Both MBB 245 and 246 must be taken to secure SQ credit.
[7] Both PHY 121 and 122 and both PHY 131 and 132 must be taken to secure SQ credit.
[8] Both PLB 200 and 201 must be taken to secure SQ credit.
[9] This course requires prior department approval.
[10] Enrollment is restricted to students in the Barrett Honors College.

Restrictions: MAT 342 and 343 may not both be counted toward major requirements in Computational Mathematical Sciences. MAT 370 and 371 may not both be counted toward major requirements in Computational Mathematical Sciences. Credit may not be earned for both MAT 274 and 275.

Statistics Concentration Requirements. The B.S. degree in Mathematics with the concentration in statistics requires a minimum of 42 semester hours of course work in mathematics and statistics, plus a minimum of 13 semester hours in computer science and related fields, for a minimum of 55 semester hours of course work related to the major. A grade of "C" or higher is required in all courses taken for the major. MAT 370 and 371 may not both be used to satisfy these requirements. The course work has the following components:

Core Courses
MAT 270 Calculus with Analytic Geometry I *MA* 4
MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 300 Mathematical Structures *L* 3
MAT 342 Linear Algebra 3
MAT 371 Advanced Calculus I 3
STP 420 Introductory Applied Statistics *CS* 3
STP 421 Probability 3
STP 427 Mathematical Statistics 3
STP 429 Experimental Statistics *CS* 3
Total 33

Computer Science Requirement
CSE 200 Concepts of Computer Science *CS* 3
Total 3

Additional Advanced Courses in Mathematics and Statistics
Three courses from the following list 9
MAT 274 Elementary Differential Equations *MA* (3)
MAT 372 Advanced Calculus II (3)
MAT 423 Numerical Analysis I *CS* (3)
MAT 442 Advanced Linear Algebra (3)
STP 425 Stochastic Processes (3)

Required Related Field Course Work
Statistics/probability, mathematics, or related fields* 10

* See "Related Field Course List," page 393.

Actuarial Science. The faculty in the Department of Mathematics and Statistics offer courses that cover the content of the mathematical examinations of the Society of Actuaries. See the department's actuarial advisor for more information.

MINORS IN MATHEMATICS AND STATISTICS

The minor in Mathematics consists of a minimum of 20 semester hours. Required courses are as follows:

MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 342 Linear Algebra 3
Total 11

Electives must be upper-division courses in mathematics (MAT) or Statistics and Probability (STP). Students may not apply MAT 485 or a course not offered at the ASU main campus to the math minor, unless otherwise approved by a math department advisor. Students not in the College of Engineering and Applied Sciences cannot use MAT 362 unless otherwise approved by the math department advisor.

The minor in Statistics consists of a minimum of 20 semester hours. Required courses are the following:

MAT 271 Calculus with Analytic Geometry II *MA* 4
MAT 272 Calculus with Analytic Geometry III *MA* 4
MAT 300 Mathematical Structures *L* 3
STP 420 Introductory Applied Statistics *CS* 3
STP 421 Probability 3
STP 427 Mathematical Statistics 3
or STP 429 Experimental Statistics *CS* (3)
Total 20

The minor in Computational Mathematical Sciences consists of a minimum of 20 semester hours. Required courses are the following:

MAT	271	Calculus with Analytic Geometry II *MA* 4
MAT	272	Calculus with Analytic Geometry III *MA* 4
MAT	342	Linear Algebra 3
MAT	420	Scientific Computing 3
MAT	421	Applied Computational Methods *CS* 3
MAT	423	Numerical Analysis I *CS* 3
		or MAT 425 Numerical Analysis II *CS* (3)
Total		 20

It is recommended that students take MAT 243 Discrete Mathematical Structures.

B.I.S. CONCENTRATIONS

Concentrations in computational mathematical sciences, mathematics, and statistics are available under the Bachelor of Interdisciplinary Studies (B.I.S.) degree, a program intended for the student who has academic interests that might not be satisfied with existing majors. Building on two academic concentrations (or one double concentration) and an interdisciplinary core, students in the B.I.S. program take active roles in creating their educational plans and defining their career goals. For more information, see "Bachelor of Interdisciplinary Studies," page 116.

SECONDARY EDUCATION—B.A.E.

Mathematics. This degree is offered through the Initial Teacher Certification program in the College of Education. Students pursuing a major in Secondary Education have an advisor in the College of Education and an advisor within the department of their academic specialization area.

See "College of Education," page 180, for information on admission eligibility requirements, admission deadlines, field experiences, and student teaching. For more information, or to schedule an appointment with an advisor, call the Office of Student Services in the College of Education at 480/965-5555.

The academic specialization consists of the following required courses:

CSE	100	Principles of Programming with C++ *CS* 3
		or CSE 200 Concepts of Computer Science *CS* (3)
MAT	270	Calculus with Analytic Geometry I *MA* 4
MAT	271	Calculus with Analytic Geometry II *MA* 4
MAT	272	Calculus with Analytic Geometry III *MA* 4
MAT	300	Mathematical Structures *L* 3
MAT	310	Introduction to Geometry 3
MAT	342	Linear Algebra 3
MAT	370	Intermediate Calculus 3
		or MAT 371 Advanced Calculus I (3)
MAT	443	Introduction to Abstract Algebra 3
		or MAT 445 Theory of Numbers (3)
MTE	483	Mathematics in the Secondary School 3
STP	420	Introductory Applied Statistics *CS* 3
Total		 36

The methods in academic specialization courses for mathematics are MTE 482 Methods of Teaching Mathematics in Secondary School and MTE 494 ST: Advanced Methods of Teaching Secondary Mathematics. They are required as part of the Initial Teacher Certification program but cannot be counted as part of the 36-hour major requirement.

Minor Teaching Field. The minor teaching field is a minor in mathematics for presecondary teachers, consisting of the following required courses:

MAT	271	Calculus with Analytic Geometry II *MA* 4
MAT	272	Calculus with Analytic Geometry III *MA* 4
MAT	300	Mathematical Structures *L* 3
MAT	310	Introduction to Geometry 3
MAT	342	Linear Algebra 3
MAT	370	Intermediate Calculus 3
		or MAT 371 Advanced Calculus I (3)
Total		 20

GRADUATE PROGRAMS

The faculty in the Department of Mathematics and Statistics offer programs leading to the degrees of Master of Natural Science, M.A., and Ph.D. See the *Graduate Catalog* for requirements.

MATHEMATICS (MAT)

MAT 106 Intermediate Algebra. (3)
fall, spring, summer
Topics from basic algebra such as linear equations, polynomials, factoring, exponents, roots, and radicals. Credit is allowed for only MAT 106 or 113. Prerequisite: 1 year of high school algebra.

MAT 113 College Algebra Plus. (5)
fall and spring
A union of topics from intermediate algebra and college algebra, including exponents, factoring, graphing, polynomials, logarithmic, and exponential functions. Credit is allowed for only MAT 113 or 106 or 117. Prerequisite: 1 year of high school mathematics.

MAT 114 College Mathematics. (3)
fall, spring, summer
Applications of basic college-level mathematics to real-life problems. Appropriate for students whose major does not require MAT 117 or 170. Prerequisite: MAT 106 or 2 years of high school algebra.
General Studies: MA

MAT 117 College Algebra. (3)
fall, spring, summer
Linear and quadratic functions, systems of linear equations, logarithmic and exponential functions, sequences, series, and combinatorics. Credit is allowed for only MAT 117 or 113. Fee (online only). Prerequisite: MAT 106 or 2 years of high school algebra.
General Studies: MA

MAT 119 Finite Mathematics. (3)
fall, spring, summer
Topics from linear algebra, linear programming, combinatorics, probability, and mathematics of finance. Prerequisite: MAT 113 or 117 (or its equivalent).
General Studies: MA

MAT 170 Precalculus. (3)
fall, spring, summer
Intensive preparation for calculus (MAT 260, 270, and 290). Topics include functions (including trigonometric), matrices, polar coordinates, vectors, complex numbers, and mathematical induction. Prerequisite with a grade of "B" or higher: MAT 106. Prerequisite with a grade of "C" or higher: MAT 113 or 117 (or its equivalent) or 2 years of high school algebra.
General Studies: MA

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MAT 210 Brief Calculus. (3)
fall, spring, summer
Differential and integral calculus of elementary functions with applications. Not open to students with credit for MAT 260, 270, or 290. Fee (online only). Prerequisite: MAT 113 or 117 (or its equivalent).
General Studies: MA

MAT 242 Elementary Linear Algebra. (2)
fall, spring, summer
Introduces matrices, systems of linear equations, determinants, vector spaces, linear transformations, and eigenvalues. Emphasizes development of computational skills. Prerequisite: 1 semester of calculus or instructor approval.

MAT 243 Discrete Mathematical Structures. (3)
fall, spring, summer
Logic, sets, functions, elementary number theory and combinatorics, recursive algorithms, and mathematical reasoning, including induction. Emphasizes connections to computer science. Prerequisite: 1 semester of calculus or computer programming.

MAT 251 Calculus for Life Sciences. (3)
fall and spring
Differential and integral calculus of elementary functions. Introduces differential and difference equations. Emphasizes applications to the life sciences. Not open to students with credit for MAT 210, 260, or 270. Prerequisite: MAT 170 (or its equivalent).
General Studies: MA

MAT 260 Technical Calculus I. (3)
selected semesters
Analytic geometry, differential, and integral calculus of elementary functions, emphasizing physical interpretation and problem solving. Not open to students with credit for MAT 210, 270, or 290. Prerequisite: MAT 170 (or its equivalent).
General Studies: MA

MAT 261 Technical Calculus II. (3)
selected semesters
Continuation of MAT 260. Prerequisite: MAT 260 or instructor approval.
General Studies: MA

MAT 262 Technical Calculus III. (3)
selected semesters
Infinite series, an introduction to differential equations and elementary linear algebra. Prerequisite: MAT 261 (or its equivalent).
General Studies: MA

MAT 270 Calculus with Analytic Geometry I. (4)
fall, spring, summer
Real numbers, limits and continuity, and differential and integral calculus of functions of 1 variable. Not open to students with credit for MAT 290. The sequence MAT 270 and 271 may be substituted for MAT 290 to satisfy requirements of any curriculum. Fee. Prerequisite with a grade of "C" or higher: MAT 170 or satisfactory score on placement examination.
General Studies: MA

MAT 271 Calculus with Analytic Geometry II. (4)
fall, spring, summer
Methods of integration, applications of calculus, elements of analytic geometry, improper integrals, sequences, and series. Not open to students with credit for MAT 291. The sequence MAT 270, 271, 272 may be substituted to satisfy requirements for MAT 290 and 291. Fee. Prerequisite with a grade of "C" or higher: MAT 270 (or its equivalent).
General Studies: MA

MAT 272 Calculus with Analytic Geometry III. (4)
fall, spring, summer
Vector-valued functions of several variables, multiple integration, and introduction to vector analysis. The sequence MAT 270, 271, 272 may be substituted to satisfy requirements for MAT 290 and 291. Fee. Prerequisite with a grade of "C" or higher: MAT 271 (or its equivalent).
General Studies: MA

MAT 274 Elementary Differential Equations. (3)
fall, spring, summer
Introduces ordinary differential equations, adapted to the needs of students in engineering and the sciences. Credit allowed for MAT 274 or 275. Prerequisites: MAT 271 (or its equivalent); MAT 272 (or its equivalent) recommended.
General Studies: MA

MAT 275 Modern Differential Equations. (3)
fall and spring
Introduces differential equations, theoretical and practical solution techniques. Applications. Problem solving using Matlab. Credit allowed for MAT 275 or 274. Lecture, computing lab. Fee. Pre- or corequisite: MAT 271 (or its equivalent).
General Studies: MA

MAT 290 Calculus I. (5)
selected semesters
Differential and integral calculus of elementary functions; topics from analytic geometry essential to the study of calculus. Prerequisite: MAT 170 (or its equivalent).
General Studies: MA

MAT 291 Calculus II. (5)
selected semesters
Further applications of calculus, partial differentiation, multiple integrals, and infinite series. Prerequisite: MAT 290 (or its equivalent).

MAT 294 Special Topics. (1–4)
selected semesters

MAT 300 Mathematical Structures. (3)
fall and spring
Logic and set theory, induction, functions, order and equivalence relations, cardinality. Emphasizes writing proofs. Prerequisite: 1 semester of calculus or instructor approval.
General Studies: L

MAT 310 Introduction to Geometry. (3)
spring
Congruence, area, parallelism, similarity and volume, and Euclidean and non-Euclidean geometry. Prerequisite: MAT 272 (or its equivalent).

MAT 340 Theory of Interest. (3)
fall and spring
Compound interest, discount rates, annuities, present values, depreciation, and bond valuations. Prerequisites: MAT 243 (or 300 or instructor approval); 1 semester of calculus.

MAT 342 Linear Algebra. (3)
fall, spring, summer
Linear equations, matrices, determinants, vector spaces, bases, linear transformations and similarity, inner product spaces, eigenvectors, orthonormal bases, diagonalization, and principal axes. Pre- or corequisite: MAT 272 (or its equivalent).

MAT 343 Applied Linear Algebra. (3)
fall and spring
Solving linear systems, matrices, determinants, vector spaces, bases, linear transformations, eigenvectors, norms, inner products, decompositions, applications. Problem solving using Matlab. Lecture, computing lab. Fee. Pre- or corequisite: MAT 271 (or its equivalent).

MAT 351 Mathematical Methods for Genetic Analysis. (3)
fall and spring
Discrete mathematics, probability, statistics, and associated computer packages. Applications to genomics, bioinformatics, forensics, and DNA/protein sequence patterns. Fee. Prerequisite: MAT 251 or 270 or instructor approval.
General Studies: CS

MAT 362 Advanced Mathematics for Engineers and Scientists. (3)
fall, spring, summer
Vector analysis, Fourier analysis, and partial differential equations. Prerequisites: MAT 272 and 274 (or their equivalents).

MAT 370 Intermediate Calculus. (3)
fall and spring
Theory behind basic 1-variable calculus: continuity, derivative, Riemann integral, sequences, and series. Not open to students who have received a "C" or higher in MAT 371. Students may not count both MAT 370 and 371 toward a mathematics degree. Prerequisites: MAT 272, 300.

MAT 371 Advanced Calculus I. (3)
fall and spring
Real numbers, completeness, sequences/series, continuity, uniform theorems, derivative, Riemann integral, pointwise/uniform convergence, Taylor's theorem. Students may not count both MAT 370 and 371 toward a mathematics degree. Prerequisite: MAT 272 or 300 or instructor approval.

MAT 372 Advanced Calculus II. (3)
spring
Open, closed, compact sets in R^n continuity, differentiation, partial differentiation, integration in R^n. Inverse/implicit function theorems. Not open to students with credit for MAT 460. Prerequisite: MAT 371. Pre- or corequisite: MAT 342.

MAT 410 Introduction to General Topology. (3)
once a year
Topological spaces, metric spaces, compactness, connectedness, and product spaces. Prerequisite: MAT 300 or 371 or instructor approval.

MAT 415 Introduction to Combinatorics. (3)
fall
Topics include proof techniques, permutations, combinations; counting techniques, including recurrence relaxations, generating functions, inclusion-exclusion; Ramsey theory and combinatorial designs. Prerequisites: both MAT 300 (or 243) and 342 (or 242) or only instructor approval.

MAT 416 Introduction to Graph Theory. (3)
spring
Topics include trees, cycles, matchings, planarity, connectivity, hamiltonicity, colorings, graph algorithms, and other advanced topics. Prerequisites: both MAT 300 (or 243) and 342 (or 242) or only instructor approval.

MAT 419 Introduction to Linear Programming. (3)
spring
Simplex method, duality, and network flows. Applications to game theory, geometry, combinatorics, graph theory, and posets. Prerequisites: a combination of CSE 100 (or 200 or 210) and MAT 300 (or 243) and 342 (or 242) or only instructor approval.
General Studies: CS

MAT 420 Scientific Computing. (3)
fall
Surveys and applies programming languages, libraries, and scientific visualization tools. Programming assignments emphasize software development skills. Lecture, lab. Fee. Prerequisites: a combination of CSE 200 and MAT 274 and 342 (or their equivalents) or only instructor approval.

MAT 421 Applied Computational Methods. (3)
fall and spring
Numerical methods for quadrature, differential equations, roots of nonlinear equations, interpolation, approximation, linear equations, floating-point arithmetic, and roundoff error. Prerequisites: both MAT 271 (or its equivalent) and fluency in computer programming (preferably FORTRAN) or only instructor approval.
General Studies: CS

MAT 423 Numerical Analysis I. (3)
fall
Analysis and algorithms for numerical solutions linear/nonlinear equations, direct solvers, iterative procedures, optimization. Determination of eigenvalues. Elementary computer arithmetic. Prerequisites: both MAT 342 and fluency in computer programming or only instructor approval.
General Studies: CS

MAT 425 Numerical Analysis II. (3)
spring
Analysis of and algorithms for numerical interpolation, integration, and differentiation. Numerical solution of ordinary differential equations, and method of lines. Those seeking a methods survey course should take MAT 421. Prerequisites: both MAT 274 and fluency in computer programming or only instructor approval. MAT 371 recommended.
General Studies: CS

MAT 427 Computer Arithmetic. (3)
selected semesters
Number systems, hardware/software arithmetic, overflow, significance, rounding, multiple precision, and automatic error control; impact on languages, architectures, robust programming, and software development. Prerequisite: only CSE 100 (or 200) or both MAT 421 and 423 (or 425) or only instructor approval.
General Studies: CS

MAT 442 Advanced Linear Algebra. (3)
fall
Fundamentals of linear algebra, dual spaces, invariant subspaces, canonical forms, bilinear and quadratic forms, and multilinear algebra. Prerequisites: both MAT 300 and 342 or only instructor approval.

MAT 443 Introduction to Abstract Algebra. (3)
fall
Introduces concepts of abstract algebra. Not open to students with credit for MAT 444. Prerequisites: both MAT 300 and 342 or only instructor approval.

MAT 444 Intermediate Abstract Algebra. (3)
spring
Basic theory of groups, rings, and fields, including an introduction to Galois theory. Appropriate as preparation for MAT 543. Prerequisite: MAT 443 or graduate standing or instructor approval.

MAT 445 Theory of Numbers. (3)
spring
Prime numbers, unique factorization theorem, congruences, Diophantine equations, primitive roots, and quadratic reciprocity theorem. Prerequisites: both MAT 300 and 342 or only instructor approval.

MAT 447 Cryptography. (3)
fall and spring
Block ciphers, stream ciphers, congruence arithmetic, information theory, public key cryptosystems, key exchange, electronic signatures. Prerequisites: MAT 242 (or 342), 300.

MAT 451 Mathematical Modeling. (3)
spring
Detailed study of 1 or more mathematical models that occur in the physical or biological sciences. May be repeated for credit with instructor approval. Prerequisites: both MAT 242 (or 342) and 274 or only instructor approval.
General Studies: CS

MAT 452 Introduction to Chaos and Nonlinear Dynamics. (3)
fall
Properties of nonlinear dynamical systems; dependence on initial conditions; strange attractors; period doubling; bifurcations; symbolic dynamics; Smale-Birkhoff theorem; and applications. Prerequisites: MAT 274, 342 (or 242); MAT 371 is recommended.

MAT 455 Introduction to Fractals and Applications. (3)
spring
Fractals; self-similar structures, fractals with iterated function systems of maps, computing fractals, fractal dimensions, chaotic dynamics on fractals, applications. Prerequisites: MAT 274, 342 (or 242); MAT 371 recommended.

MAT 460 Vector Calculus. (3)
spring
Vectors, curvilinear coordinates, Jacobians, implicit function theorem, line and surface integrals, Green's, Stokes', and divergence theorems. Not open to students with credit for MAT 372. Prerequisites: MAT 242 (or 342), 272, 274.

MAT 461 Applied Complex Analysis. (3)
fall and summer
Analytic functions, complex integration, Taylor and Laurent series, residue theorem, conformal mapping, and harmonic functions. Prerequisite: MAT 272 (or its equivalent).

MAT 462 Applied Partial Differential Equations. (3)
spring
Second-order partial differential equations, emphasizing Laplace, wave, and diffusion equations. Solutions by the methods of characteristics, separation of variables, and integral transforms. Prerequisites: MAT 242 (or 342), 274.

MAT 472 Intermediate Real Analysis I. (3)
fall
Introduces analysis in metric spaces with emphasis on the real line. Appropriate as preparation for MAT 570. Prerequisites: MAT 300, 342.

L literacy and critical inquiry / **MA** mathematics / **CS** computer/statistics/quantitative applications / **HU** humanities and fine arts / **SB** social and behavioral sciences / **SG** natural science—general core courses / **SQ** natural science—quantitative / **C** cultural diversity in the United States / **G** global / **H** historical / See "General Studies," page 85.

MAT 473 Intermediate Real Analysis II. (3)
spring
Analysis in R^n: implicit function theorem, introduction to manifolds, Lebesque integration, change of variables formula, convergence theorems for integrals. Prerequisite: MAT 472 or instructor approval.

MAT 475 Differential Equations. (3)
fall
Linear and nonlinear ordinary differential equations, asymptotic behavior of solutions, stability, existence and uniqueness, limit sets, Poincar-Bendixson theorem. Prerequisites: MAT 242 (or 342 or 343), 274 (or 275), 370 (or 371) (or their equivalents) or instructor approval.

MAT 476 Partial Differential Equations. (3)
spring
First-order quasilinear, second-order linear (wave, Laplace, heat). Characteristics, harmonic functions, maximum principles, Fourier series, separation of variables. Prerequisites: MAT 242 (or 342 or 343), 274 (or 275 or 475), 370 (or 371) (or their equivalents) or instructor approval.

MAT 484 Internship. (1–12)
selected semesters

MAT 485 History of Mathematics. (3)
selected semesters
Topics from the history of the origin and development of mathematical ideas. Prerequisite: MAT 272 (or its equivalent).

MAT 493 Honors Thesis/Research. (3)
selected semesters

MAT 494 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Independent Study/Research. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

MATHEMATICS EDUCATION (MTE)

MTE 180 Theory of Elementary Mathematics. (3)
fall, spring, summer
Number systems, intuitive geometry, elementary algebra, and measurement. Intended for prospective elementary school teachers. Prerequisites: MAT 113, 114 (or 117 or its equivalent).

MTE 181 Theory of Elementary Mathematics. (3)
once a year
Continuation of MTE 180. Fee. Prerequisite: MTE 180 or instructor approval.

MTE 380 Arithmetic in the Elementary School. (3)
once a year
Historical numeration systems, overview of elementary number theory, including primes, factorization, divisibility, bases, modular systems, linear congruence, and continued fractions. Prerequisite: MTE 181 or instructor approval.

MTE 381 Geometry in the Elementary School. (3)
selected semesters
Informal geometry, including concepts of length, area, volume, similarity, and congruence. Classification of figures, straightedge and compass constructions, and motion geometry. Prerequisite: MTE 380 or instructor approval.

MTE 482 Methods of Teaching Mathematics in Secondary School. (3)
fall
Examines secondary school curricular material and analyzes instructional devices. Teaching strategies, evaluative techniques, diagnosis, and remediation and problem solving. Fee. Prerequisite: instructor approval.

MTE 483 Mathematics in the Secondary School. (3)
spring
Topics in geometry, number theory, algebra, and analysis. Emphasizes unifying principles. Prerequisite: MAT 310 or instructor approval.

MTE 484 Internship. (1–12)
selected semesters
Topics may include the following:
- Theory of Elementary Mathematics Internship. (1–4)
  fall and spring
  Employs hands-on activities and manipulatives to advance mathematical understanding in second- to fourth-grade students.
- Service Learning
  fall, spring, summer
  Fee.

MTE 494 Special Topics. (1–4)
fall and spring
Topics may include the following:
- Advanced Methods of Teaching Secondary Mathematics. (3)
  Continuation of MTE 482. Prerequisite: MTE 482.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 56.

Graduate-Level Courses. For information about courses numbered from 500 to 799, see the *Graduate Catalog*, or access www.asu.edu/aad/catalogs on the Web. In some situations, undergraduate students may be eligible to take these courses; for more information, see "Graduate-Level Courses," page 56.

STATISTICS AND PROBABILITY (STP)

STP 220 Conceptual Statistics. (3)
fall and spring
Treats the concepts and vocabulary needed to evaluate statistical reports on health, technology, and society. Aggressively emphasizes understanding over computation. Lecture, teamwork. Prerequisites: MAT 113, 114 (or 117 or its equivalent).
General Studies: CS

STP 226 Elements of Statistics. (3)
fall, spring, summer
Basic concepts and methods of statistics, including descriptive statistics, significance tests, estimation, sampling, and correlation. Not open to majors in mathematics or the physical sciences. Prerequisites: MAT 113, 114 (or 117 or its equivalent).
General Studies: CS

STP 294 Special Topics. (1–4)
selected semesters
Topics may include the following:
- Statistics for Biosciences. (3)

STP 326 Intermediate Probability. (3)
fall and spring
Probability models and computations, joint and conditional distributions, moments, and families of distributions. Topics in stochastic processes, simulation, and statistics. Prerequisite: MAT 210 (or its equivalent).
General Studies: CS

STP 420 Introductory Applied Statistics. (3)
fall, spring, summer
Introductory probability, descriptive statistics, sampling distributions, parameter estimation, tests of hypotheses, chi-square tests, regression analysis, analysis of variance, and nonparametric tests. Prerequisite: MAT 113 or 117 (or its equivalent).
General Studies: CS

STP 421 Probability. (3)
fall
Laws of probability, combinatorial analysis, random variables, probability distributions, expectations, moment-generating functions, transformations of random variables, and central limit theorem.
Prerequisite: MAT 272 (or its equivalent).

STP 425 Stochastic Processes. (3)
spring
Markov chains, stationary distributions, pure jump processes, 2D order processes, and other topics in stochastic processes. Prerequisites: MAT 342; STP 421.

STP 427 Mathematical Statistics. (3)
spring
Limiting distributions, interval estimation, point estimation, sufficient statistics, and tests of hypotheses. Prerequisites: a combination of MAT 371 and STP 420 and 421 or only instructor approval.