

College of Engineering and Applied Sciences

David C. Chang, Ph.D.
Dean

PURPOSE

The purpose of the College of Engineering and Applied Sciences is to provide a university education of such fundamental background and scope that a student may achieve competency in engineering, agribusiness and environmental resources, technology, computer science, or construction. Every effort is made to carry on well-rounded, well-integrated programs that not only give the student proficiency for a professional career but also develop character, judgment, ideals, breadth of view, and appropriate cultural attitudes. Students are taught to recognize that their professional efforts will cause change and that they must accept responsibility for the social consequences of those efforts.

ORGANIZATION

The College of Engineering and Applied Sciences is composed of the following units:

School of Agribusiness and Environmental Resources

Del E. Webb School of Construction

School of Engineering

Department of Chemical, Bio and
Materials Engineering
Department of Civil Engineering
Department of Computer Science
and Engineering
Department of Electrical
Engineering
Department of Industrial and
Management Systems
Engineering
Department of Mechanical and
Aerospace Engineering

School of Technology

Department of Aeronautical
Technology
Department of Electronics and
Computer Technology
Department of Manufacturing and
Industrial Technology

The Office of the Dean administers programs in engineering special and interdisciplinary studies.

Research Centers. The college is committed to becoming one of national prominence in research. In addition, it is the policy of the college to encourage exceptional upper-division undergraduate students and graduate students to participate with faculty in research ac-

tivity. Most faculty are conducting research on government or industry-sponsored projects. Research activities include aerodynamics, agribusiness, arid land agriculture, bioengineering, biomedical, biotechnology, CAD/CAM, computer design, computer science and applications, computer-integrated manufacturing, environmental, materials science, microelectronics manufacturing, natural resource management, nuclear radiation, power systems, rotor dynamics, semiconductor materials and devices, signal processing, solar energy, solid-state electronic devices, structural dynamics, structures, telecommunications, thermosciences, transportation systems, and turbine design. These activities are carried out under the academic divisions or departments listed in the following catalog material and also through the interdisciplinary research centers listed below:

Aerospace Research Center
Center for Advanced Transportation
Systems Research
Center for Agribusiness Policy
Studies
Center for Energy Systems Research
Center for Solid State Electronics
Research
Computer-Integrated Manufacturing
Systems Research Center
Systems Science and Engineering
Research Center
Telecommunications Research
Center

Center for Professional Development. The Center for Professional Development in the College of Engineering and Applied Sciences establishes a cooperative focus with the college's academic departments and research centers to provide a wide variety of technical conferences, institutes, seminars, short courses, research briefings, and televised and satellite-transmitted programs to enable engineers, scientists, and technical managers locally, nationally, and internationally to continue their lifelong learning in a constantly changing technical world.

Programs may be conducted on campus in the center's conference room, at various off-campus locations, or at company sites upon request.

For more information, contact the Center for Professional Development, located in ECG 148, at 602/965-1740.

ADMISSION

Students who wish to be admitted to freshman standing in the College of Engineering and Applied Sciences should present certain secondary units that are specified in the requirements of each of the four schools. Students who have omissions or deficiencies in secondary school subject matter preparation may be required to complete additional university course work that may not be applied toward their degrees.

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 such courses are required in their degree programs and the students have the proper course prerequisites.

Entrance requirements of this college may differ from those of other ASU academic units. Students may be admitted under one of two different classifications, professional or preprofessional.

Professional Status. For admission to *professional status*, Arizona residents must meet one of the requirements as listed in the “Professional Status Requirements for Residents” table.

For admission to professional status, a nonresident must meet one of the requirements as listed in the “Professional Status Requirements for Non-residents” table. In addition, an international student must satisfy minimum TOEFL score requirements as shown in the table.

Students admitted to the university by the General Education Development (GED) are required to take either the ACT or the SAT in order to be admitted to professional status.

Preprofessional Status. A student not admissible to professional status within the college but otherwise regularly admissible to ASU as stated on page 31, “Undergraduate Admission,” may be admitted as a *preprofessional* student to any one of the departments or schools of the college. International students whose TOEFL scores do not meet the minimum required as shown in the tables below also may be admitted to preprofessional status. 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. *International students must also submit a TOEFL score equivalent to that required for admission to professional status* (refer to the tables below). Preprofessional students are not permitted to register for 300- and 400-level courses in the College of Engineering and Applied Sciences until their status is changed to the professional classification.

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 below. A student who does not meet these requirements may request admission to preprofessional status, subject to the restrictions shown above.

Transfer into and within the College. Students transferring into or between schools or departments within the college or from other colleges within the university must meet both the cumulative GPA requirement and the catalog requirements of the new school or department 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 entering 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 study carefully the sections under this college 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 international transfer students to the professional program are listed in the “Professional Status Requirements for

Professional Status Requirements for Residents

School	High School Rank	Minimum Scores	
		ACT	SAT
Agribusiness and Environmental Resources	Upper 50%	22	930
Construction	Upper 50%	23	1050
Engineering	Upper 25%	23	1050
Technology	Upper 50%	22	930

Professional Status Requirements for Nonresidents

School	High School Rank	Minimum Scores		
		ACT	SAT	TOEFL*
Agribusiness and Environmental Resources	Upper 25%	24	1010	500
Construction	Upper 25%	24	1050	550
Engineering	Upper 25%	24	1050	550
Technology	Upper 25%	24	1010	500

* For international students (see page 35).

Professional Status Requirements for Transfer Students

School	Transfer GPA ¹		TOEFL ²
	Resident	Nonresident	
Agribusiness and Environmental Resources	2.00	2.50	500
Construction	2.25	2.50	550
Engineering	2.50	2.50	550
Technology	2.25	2.50	500

¹ The cumulative GPA is calculated using all credits from ASU and from other colleges and universities.

² For international students (see page 35).

Transfer Students” table. The departments and schools may impose additional admission and graduation requirements to those minimums 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 senior residence 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. Prospective Arizona community college transfer students should consult their advisors and refer to the annual *Arizona Higher Education Course Equivalency Guide* for a listing of the acceptable courses transferable to the various college degree programs.

It should be noted that some courses taken in other colleges of this university or other universities may be acceptable for general university credit but may not be acceptable toward the degree requirements of this college. Determination of those particular courses acceptable to a specific degree program is made within the appropriate department or school with the approval of the dean.

Cooperative Education. The co-op program is a study-work plan of education that alternates periods of academic study with periods of employment in business, industry, and government directly related to a student’s major. 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 upon completion of 45 or more hours of classes in the selected major. Certain positions may require completion of specific courses of study. 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.

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. For more information, contact the director of Student Academic Services at 602/965-5150 (ECG 115) or the Career Services office at 602/965-2350 (SSV C359).

ADVISEMENT

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 in order to avoid academic problems.

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

Minority Engineering Program. The Minority Engineering Program staff is available to assist prospective, newly admitted, and continuing students with academic and professional development through a variety of support services. In addition, advisement is provided in the procurement of financial aid, scholarships, and employment.

DEGREES

Majors. Programs leading to the B.S. and B.S.E. degrees are offered by the College of Engineering and Applied Sciences, with majors in the subjects shown in the “College of Engineering and Applied Sciences Degrees, Majors, and Concentrations” table, pages 225–227. 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.

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.

**College of Engineering and Applied Sciences
Degrees, Majors, and Concentrations**

Major	Degree	Administered by
Baccalaureate Degrees		
School of Agribusiness and Environmental Resources		
Agribusiness Concentrations: agribusiness, computer analysis, pre-veterinary medicine	B.S.	School of Agribusiness and Environmental Resources
Environmental Resources in Agriculture Concentration: natural resource management	B.S.	School of Agribusiness and Environmental Resources
Del E. Webb School of Construction		
Construction Options: general building construction, heavy construction, military construction, specialty construction	B.S.	Del E. Webb School of Construction
School of Engineering		
Aerospace Engineering Emphases: aerodynamics, aerospace materials, aerospace structures, computer methods, design, mechanical, propulsion, system dynamics and control	B.S.E.	Department of Mechanical and Aerospace Engineering
Bioengineering Emphases: biochemical engineering, bioelectrical engineering, biomaterials engineering, biomechanical engineering, bionuclear engineering, biosystems engineering, molecular and cellular bioengineering, pre-medical engineering	B.S.E.	Department of Chemical, Bio and Materials Engineering
Chemical Engineering Emphases: biochemical, biomedical, environmental, materials, pre-medical, process engineering, semiconductor processing	B.S.E.	Department of Chemical, Bio and Materials Engineering
Civil Engineering Emphases: construction, environmental engineering, geotechnical engineering, structural engineering, transportation engineering, water resources engineering	B.S.E.	Department of Civil Engineering
Computer Science	B.S.	Department of Computer Science and Engineering
Computer Systems Engineering	B.S.E.	Department of Computer Science and Engineering
Electrical Engineering	B.S.E.	Department of Electrical Engineering
Engineering Interdisciplinary Studies Option: geological engineering	B.S.	School of Engineering
Engineering Special Studies Options: engineering mechanics, manufacturing engineering, pre-medical engineering	B.S.E.	School of Engineering
Industrial Engineering	B.S.E.	Department of Industrial and Management Systems Engineering
Materials Science and Engineering Emphases: chemical processing and energy systems, electronic materials, manufacturing and materials processing, mechanical metallurgy, physical metallurgy, polymers and composites	B.S.E.	Department of Chemical, Bio and Materials Engineering

* This program is administered by the Graduate College. See the "Graduate College" section of this catalog.

Major	Degree	Administered by
Mechanical Engineering Emphases: aerospace; biomechanical; computer methods; control and dynamic systems; design; energy systems; engineering mechanics; manufacturing; stress analysis, failure prevention, and materials; thermosciences	B.S.E.	Department of Mechanical and Aerospace Engineering
School of Technology		
Aeronautical Engineering Technology Option: aeronautical technology	B.S.	Department of Aeronautical Technology
Aeronautical Management Technology Options: <i>ab initio</i> airline pilot flight management, airway science aircraft systems management, airway science management	B.S.	Department of Aeronautical Technology
Electronics Engineering Technology Options: computer systems, electronic systems, microelectronics, telecommunications	B.S.	Department of Electronics and Computer Technology
Industrial Technology Emphases: graphic communications, industrial management, interactive computer graphics	B.S.	Department of Manufacturing and Industrial Technology
Manufacturing Engineering Technology Emphases: computer-integrated manufacturing engineering technology, manufacturing engineering technology, mechanical engineering technology, robotic and automation engineering technology, welding engineering technology	B.S.	Department of Manufacturing and Industrial Technology
Graduate Degrees		
School of Agribusiness and Environmental Resources		
Agribusiness Concentrations: agribusiness management and marketing, food quality assurance	M.S.	School of Agribusiness and Environmental Resources
Environmental Resources in Agriculture	M.S.	School of Agribusiness and Environmental Resources
Del E. Webb School of Construction		
Construction Concentrations: construction science, facilities, management	M.S.	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.	Department of Chemical, Bio and Materials Engineering
Chemical Engineering Concentrations: biomedical and clinical engineering, chemical process engineering, chemical reactor engineering, energy and materials conversion, environmental control, solid state processing, transport phenomena	M.S., M.S.E., Ph.D.	Department of Chemical, Bio and Materials Engineering
Civil Engineering Concentrations: environmental/sanitary, geotechnical/soil mechanics, structures, transportation, water resources/hydraulics	M.S., M.S.E., Ph.D.	Department of Civil Engineering

* This program is administered by the Graduate College. See the "Graduate College" section of this catalog.

Major	Degree	Administered by
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 Science	M.S., M.S.E., Ph.D.	School of Engineering
Industrial Engineering Concentrations: computer-aided processes, computer-integrated manufacturing, human factors, information systems, operations research, organization control, quality control/reliability	M.S., M.S.E., Ph.D.	Department of Industrial and Management Systems Engineering
Mechanical Engineering	M.S., M.S.E., Ph.D.	Department of Mechanical and Aerospace Engineering
Science and Engineering of Materials	Ph.D.*	Committee on the Science and Engineering of Materials
School of Technology Technology	M.Tech.	
Concentrations: aeronautical engineering technology, aeronautical management technology		Department of Aeronautical Technology
Concentration: electronics engineering technology		Department of Electronics and Computer Technology
Concentrations: graphic communications technology, industrial management and supervision, manufacturing engineering technology, mechanical engineering technology, welding engineering technology		Department of Manufacturing and Industrial Technology

* This program is administered by the Graduate College. See the "Graduate College" section of this catalog.

Graduate Degrees

Deficiencies for admission to the graduate degree programs are specified at the time of admission. The Graduate Record Examination (GRE)—the verbal, quantitative, and analytical components—is recommended but not required unless specified by the respective academic unit. TOEFL scores must be submitted by foreign student applicants before admission is considered. The minimum required score is determined by each academic unit.

Master of Computer Science Degree (M.C.S.)

The M.C.S. program provides a professionally oriented, graduate-level education in computer science and engineering. All of the Graduate College entrance requirements and departmental academic performance and preparation requirements must be satisfied for admission. The applicant must have a

baccalaureate degree in computer science, computer engineering, or a closely related field. The M.C.S. program requires a minimum of 30 semester hours of approved graduate-level course work. At the end of the program of study, the student must pass a final comprehensive examination over the graduate course work taken for the degree and over the appropriate undergraduate prerequisites. Details of the content and format of the examination are available from the department.

Master of Science Degree (M.S.)

Agribusiness and Environmental Resources. This program provides competent students with opportunities to complete advanced studies with emphasis on research. Areas of study in Agribusiness may be management, marketing, finance, international agriculture, and food industry. Areas of study in Environmental Resources in Agriculture may be natural resource

management and range ecology. Admission requires completion of 18 semester hours in agribusiness and environmental resources or closely related course work. Scores from the GRE or Miller Analogies Test (MAT) are required. The Graduate Management Admission Test (GMAT) is accepted for agribusiness students only. A minimum of 30 semester hours of approved graduate course work is required, including a thesis. An oral examination in defense of the thesis is required.

Computer Science. This graduate program provides opportunities for qualified students holding a baccalaureate degree in computer science or related fields to complete advanced studies with emphasis on research. A minimum of 30 semester hours of approved course work is required, including a thesis. An oral examination in defense of the thesis is required.

Construction. This graduate program provides opportunities for qualified students holding a baccalaureate degree in construction, engineering, architecture, or a related discipline to complete advanced studies with emphasis on management and research. The construction science concentration allows candidates whose primary interest is field engineering or supervision of heavy and industrial construction projects to pursue a more technically oriented course of study. The construction management concentration allows candidates pursuing upper-level management positions in various sectors of the construction industry to improve their competency in project, program, and company management areas. The facilities management concentration supports the needs of the student whose aim is to pursue careers in the maintenance, operation, renovation, or decommissioning of existing facilities.

Engineering Science. These research-oriented graduate-degree programs provide opportunities to highly competent students to major in aerospace, chemical, civil, electrical, industrial, or mechanical engineering, bioengineering, or engineering science. Options in aerospace engineering, biotechnology, engineering mechanics, engineering science, and materials science and engineering are available under the Engineering Science major. M.S.E. and Ph.D. degree programs are also available in these options.

The M.S. degree program (including all options) is administered through the office of the college associate dean for academic affairs. Admission normally requires an appropriate undergraduate engineering degree and satisfaction of all Graduate College admission requirements and special department requirements. A minimum of 30 semester hours of approved graduate course work is required, which must include a thesis and an oral examination at the completion of the program. Students writing a thesis must enroll in a combination of both 592 Research and 599 Thesis, totaling six semester hours.

Master of Science in Engineering Degree (M.S.E.)

These professionally oriented graduate degree programs are intended as a preparation for a career in professional practice. Two options are available within the Master of Science in Engi-

neering degree programs. Option 1 (thesis option) is designed primarily for full-time students. A thesis (engineering report or research paper) is required of students following this option. Option 2 (no thesis, no report option) is designed primarily for students who hold full-time jobs and must attend university classes on a part-time basis or for full-time students who do not have an approved thesis topic. Both options require a minimum of 30 semester hours of approved graduate-level course work. For entry the student must satisfy all Graduate College admission requirements and special department requirements and must have a baccalaureate degree in engineering or another closely related degree program.

Master of Technology Degree (M.Tech.)

This degree program is designed for flexibility, permitting the student to select a combination of courses in technology and supporting areas to meet individual career goals. Selected areas of concentration are designed to provide graduates with technical and professional skills for use in preparation for and advancement in leadership positions found in industry and education. The Master of Technology is offered by the Departments of Aeronautical Technology, Electronics and Computer Technology, and Manufacturing and Industrial Technology. Admission requires an appropriate baccalaureate degree with a minimum of 30 semester hours in technology or equivalent. A minimum of 32 semester hours of approved course work is required, including a practicum or applied project. An oral examination in defense of the practicum or applied project is required.

Doctor of Philosophy Degree

The Ph.D. degree is awarded in engineering or Computer Science upon the satisfactory completion of an approved program of graduate study, research, and dissertation. For specific reference to this degree, see the "Graduate College" section of this catalog or the *Graduate Catalog*.

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 ensuing pages.

English Proficiency Requirement.

As a minimum, completion of both ENG 101 and 102 or ENG 105 with a grade of "C" or better is required for graduation from ASU in any baccalaureate program (see page 40); but 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. See "First-Year Composition Requirement," page 71.

Pass/Fail Grades. Students enrolled in the College of Engineering and Applied Sciences 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. Each request is judged on its particular merits.

Entry into Upper-Division Courses.

Before enrolling in courses at the 300 level and above, a student in good academic standing must secure the approval of his or her advisor. A student who is not in good academic standing must secure the approval of his or her advisor and director or department chair. 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.

Course Work Currency. 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.

GENERAL STUDIES REQUIREMENTS

Higher education should provide the student not only with competency in the chosen subject field, but also with experiences that facilitate the student's growth in ability to perceive significant relationships, to make intelligent value judgments, to express ideas with ease,

clarity, and good taste, and to develop the qualities of character and personality requisite for a successful career.

The development of moral, ethical, and social concepts and a sound professional attitude is required. It is expected that the attainment of an interest and pleasure in the above pursuits will inspire continued study. Courses are selected with the aid of an advisor to provide planned sequences and to place emphasis on the interrelationships that exist among fields of knowledge.

Specific attention should be directed to the university general studies requirements shown on pages 50–52. Additional requirements and recommended course selections are shown in appropriate catalog sections for the schools and departments of this college.

School of Engineering majors have some restrictions on the selections of course work used to fulfill the general studies requirements in humanities and fine arts (HU), social and behavioral sciences (SB), and lower-division literacy and critical inquiry (L1). Please refer to pages 239–240 for details.

General studies courses are regularly reviewed. To determine whether a course meets one or more general studies course credit requirements, see the listing of courses by core and awareness area, pages 53–71. General studies courses are also identified within the course description according to the “Key to General Studies Credit Abbreviations,” page 52.

GRADUATION REQUIREMENTS

Graduation requirements in this college are listed under the description of each school or major.

ACADEMIC STANDARDS

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

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

Students not meeting department standards are placed on probation at the department’s discretion.

Students on probation are subject to disqualification if (1) they do not attain a semester GPA of 2.25 (2.50 for pre-professional students in the School of Engineering) and their cumulative GPA is below 2.00 at the end of the probationary semester or (2) they are placed on probation for two consecutive semesters.

Courses completed during the summer sessions may not be used to re-evaluate 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 associate director of Student Academic Services in ECG 115. 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 of Engineering and Applied Sciences 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 the above 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 pertinent courses in the discipline at a com-

munity college with better than average grades.

STUDENT RESPONSIBILITIES

Course Prerequisites. It is expected that students consult the *Schedule of Classes* and the catalog with regard to 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 effected 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, there is no monetary reimbursement to the student. However, such withdrawal is considered to be unrestricted as described on page 46 and does not count against the number of restricted withdrawals allowed.

SPECIAL PROGRAMS

Student Academic Services. The dean’s office of the College of Engineering and Applied Sciences maintains a special office staffed to assist students in various matters. This office coordinates the work of the College Admissions and Standards Committee and administers the probation, disqualification, and readmission processes for students who are academically deficient.

Academic Honors. Students completing baccalaureate degree requirements receive the appropriate honors designations on their diplomas consistent with the requirements specified by the university.

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:

1. Alpha Pi Mu—Industrial Engineering Honor Society;
2. Alpha Zeta—Agriculture Honor Society;
3. Chi Epsilon—Civil Engineering Honor Society;
4. Eta Kappa Nu—Electrical Engineering Honor Society;

5. Pi Tau Sigma—Mechanical Engineering Honor Society;
6. Sigma Lambda Chi—Construction Honor Society;
7. Tau Alpha Pi—National Honor Society, Engineering Technologies;
8. Tau Beta Pi—National Engineering Honor Society; and
9. Upsilon Pi Epsilon—National Computer Science Honor Society.

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

University Honors College. The College of Engineering and Applied Sciences participates with the University Honors College, which affords superior undergraduates opportunities for enhanced educational experiences. Participating students can major in any academic program. A description of the requirements and the opportunities offered by the University Honors College can be found on pages 79–81 of this catalog.

Scholarships. Academic scholarships for continuing students in this college may be applied for by contacting the Student Academic Services office or the various department or school offices. Other scholarships may be available through the university Student Financial Assistance Office.

ASU 3+2 Programs. Students desiring to earn a baccalaureate degree from Grand Canyon University (Phoenix, Arizona) in Mathematics, Chemistry, Construction, or Physics or from Southwestern University (Georgetown, Texas) in Physical Science and a baccalaureate degree in one of the engineering majors or the Construction major from ASU can take advantage of a 3+2 program approved by these institutions. Such students complete the first three years of study at their respective college or university and the last two years of study at ASU. At the end of the fourth or fifth year, assuming all degree requirements have been met, the baccalaureate degree is awarded by the student's respective college or university and the appropriate engineering or construction baccalaureate degree is awarded by ASU.

A similar 3+2 program is available to qualified students from Long Island University/C.W. Post Campus, College of Arts and Sciences, who wish to earn both a Bachelor of Science degree from C.W. Post in Mathematics or Physics and a Bachelor of Science in Engineering degree from ASU in Civil, Chemical, Electrical, Industrial, or Mechanical Engineering.

More information can be obtained by writing to one of the following offices:

OFFICE OF THE ADMINISTRATIVE
VICE PRESIDENT
GRAND CANYON UNIVERSITY
3300 W CAMELBACK RD
PHOENIX AZ 85017-1097

PROVOST AND DEAN OF THE BROWN
COLLEGE OF ARTS AND SCIENCES
SOUTHWESTERN UNIVERSITY
GEORGETOWN TX 78626

DEAN, COLLEGE OF ARTS AND
SCIENCES
C.W. POST CAMPUS
LONG ISLAND UNIVERSITY
BROOKVILLE NY 11548

OFFICE OF THE DEAN
COLLEGE OF ENGINEERING AND
APPLIED SCIENCES
ARIZONA STATE UNIVERSITY
BOX 875506
TEMPE AZ 85287-5506

The Del E. Webb School of Construction also has 2+2 agreements with several selected out-of-state colleges and universities. For a listing and additional information, call 602/965-3615, or write

DIRECTOR, DEL E. WEBB SCHOOL OF
CONSTRUCTION
ARIZONA STATE UNIVERSITY
BOX 870204
TEMPE AZ 85287-0204

ROTC Students. Students pursuing a commission through either the Air Force or Army ROTC programs are required to take from 12 to 20 hours 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 engineering or engineering technology degree credit as either social and behavioral science or humanities and fine arts under general studies. ROTC students must also meet all other degree requirements of this college.

A military construction option is available in the Del E. Webb School of Construction. See page 239 for details.

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. Examples: agribusiness and environmental resources, construction, engineering, and technology.

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

Area of Emphasis (Technical Electives), Option, 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 a number of the majors, the technical electives must be chosen from preselected groups. For this reason the choice of specific technical electives for an area of emphasis should be done with the advice and counsel of an advisor. Example: major—Mechanical Engineering; area of emphasis—thermosciences.

School of Agribusiness and Environmental Resources

Eric P. Thor
Director
 (AG 281) 602/965-3585

PROFESSORS

BRADY, BROCK, CHALQUEST,
 EDWARDS, GORDON, KAGAN,
 STILES, THOR

ASSOCIATE PROFESSORS

CONKLIN, W. MILLER, RACCACH,
 SEPERICH, WHYSONG

ASSISTANT PROFESSOR

GREEN

PROFESSORS EMERITI

BARRETT, LYTTLE, MADDY,
 V. MILLER, MOODY, RASMUSSEN,
 RICHARDSON, ROBINSON, TAYSOM

PURPOSE

The School of Agribusiness and Environmental Resources provides academic programs directed toward agribusiness and the environmental aspects of agriculture. Agribusiness is a dynamic industry that provides employment to about 23% of the U.S. labor force. Environmental resources emphasizes both the conservation of wildland resources for the needs of future generations and their use to meet present-day needs. Courses in the School of Agribusiness and Environmental Resources are designed to prepare students for the wide range of job opportunities that exist in the agricultural industries and governmental agencies. The academic programs are especially designed to meet the needs of the urban student who has had little or no previous agriculture experience. An interest in plants, animals, or foods can be the starting point for career development in agricultural industries or natural resource management. The undergraduate programs also provide the necessary training for students preparing to enter graduate degree programs.

ORGANIZATION

The academic programs are organized into two separate majors: (1) Agribusiness and (2) Environmental Resources in Agriculture. Options for specialization within these majors are

Agribusiness and Environmental Resources in Agriculture Concentrations and Options

Major	Concentration	Option
Agribusiness	Agribusiness	Food industry General agribusiness International agribusiness
Environmental Resources in Agriculture	Computer analysis Pre-veterinary medicine Natural resource management	Range ecology Wildlife habitat management

shown in the “Agribusiness and Environmental Resources in Agriculture Concentrations and Options” table.

Center for Agribusiness Policy Studies

The Center for Agribusiness Policy Studies carries out research and development relating to agribusiness, rural development, multiple use of scarce resources, and public policy. The center addresses regional, national, and international development in the context of global and competitive markets for agricultural products and inputs. Of particular interest is the development of private sector strategies and public policy alternatives that go beyond traditional government subsidy programs to find innovative, market-oriented ways to enhance competitiveness in international markets, increase rural incomes and create new jobs. A related center concern is the development of “win-win” strategies for environmental management and the multiple use of scarce natural resources by competing interest groups. The goal of such policy development is to resolve or manage conflict regionally, nationally, or globally and to promote long-term, sustainable agriculture in terms of regional economic growth. Of particular interest to the center are innovative rural credit programs for developing nations, strategic marketing to identify profitable “niche” markets and further processing to create jobs and add value to agricultural products. For more information, contact the director of the Center for Agribusiness Policy Studies at 602/965-3585 (AG 281).

DEGREES

Bachelor of Science (B.S.). The School of Agribusiness and Environmental Resources offers the Bachelor of

Science degree in Agribusiness and in Environmental Resources in Agriculture.

Master of Science (M.S.). The School of Agribusiness and Environmental Resources offers the Master of Science degree in Agribusiness and in Environmental Resources in Agriculture. The program includes research and the preparation of a thesis. A minimum of 30 semester hours of graduate-level course work is required for the degree. Additional details for this degree are given in the *Graduate Catalog*.

ADMISSION

See pages 30-35, 47-48, 224-225, and 230 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, students who are beginning their initial college work in the School of Agribusiness and Environmental Resources should present secondary school units in accordance with the minimum university requirements. There are no secondary school agricultural course requirements.

GRADUATION REQUIREMENTS

The completion of a minimum of 126 semester hours—including university general studies, the school and major cores, and option courses—leads to the B.S. degree. An overall GPA of 2.00 is required. Of the semester hours required for graduation, 40% (a minimum of 50 semester hours) must be upper division. Also see special graduation requirements under the pre-veterinary medicine concentration described on page 235.

MAJORS

The Agribusiness major is an applied, industry-oriented curriculum. The study of animals, plants, and their utilization in the food and fiber system forms the base of the program. Students learn to analyze firms involved in input supply activities, commodity processing, food manufacturing, and food distribution. Students also study government agricultural programs and national policy activities that affect agribusiness. Because of the U.S. role in supplying commodity and food products to the world markets, international aspects of agribusiness development and trade are emphasized.

The natural resource management concentration within the Environmental Resources in Agriculture major emphasizes the study of wildland ecosystem management. Application of the systems approach in a wide variety of resource management situations is emphasized. Students pursue an ecological emphasis in the range ecology option or the wildlife habitat management option. In both cases, students are trained to apply ecological principles to management of wildlands. Students with particular interest in vegetation, water, and soil resources should pursue the range ecology option. Students with a particular interest in animal resources should pursue the wildlife habitat option.

The baccalaureate degree requirements in Agribusiness and Environmental Resources in Agriculture include the general studies, the School of Agribusiness and Environmental Resources core, a proficiency core, the major core, and the option courses and elective courses to complete the graduation requirement of 126 semester hours. Before entering the junior year, each student, with the aid of an advisor, is expected to select a concentration and an option.

DEGREE REQUIREMENTS

All students pursuing a B.S. degree in the School of Agribusiness and Environmental Resources must satisfy English proficiency and general studies requirements as follows:

English Proficiency	<i>Semester Hours</i>
ENG 101, 102 First-Year Composition ¹	6
or ENG 105 Advanced First-Year Composition (3)	

General Studies

<i>Literacy and Critical Inquiry</i> ²	
L1 course	3
L2 course	3
<i>Numeracy</i> ¹	
Numeracy courses	6
<i>Humanities and Fine Arts and Social and Behavioral Sciences</i> ²	
(15 semester hours minimum)	
At least one course must be upper division, two courses must be from the same department, and two departments or more must be represented in the total selection.	
HU courses	6-9
SB courses	6-9
<i>Natural Sciences</i> ¹	
S1/S2 courses	8
Total general studies	35

NOTE: Six semester hours taken in two of the three awareness areas² are required in the final list of courses offered in the student's graduation program of study. If desired, these courses can be included in the HU and SB course selections.

¹ See the school academic advisor for approved courses.
² See pages 53-71 for the acceptable courses in these categories.

Agribusiness and Environmental Resources in Agriculture Core

All students pursuing a B.S. degree in the school must complete the following general core courses:

		<i>Semester Hours</i>
AGB 300	Livestock Management	3
AGB 302	Introduction to Agribusiness	3
AGB 310	Crop Management	3
ERA 346	Natural Resource Conservation	3
Total		12

The following proficiency core courses are required of all students except those in the computer analysis and pre-veterinary medicine concentrations:

		<i>Semester Hours</i>
BIO 181, 182	General Biology	8
	or AGB 150 Animal Science (3) and ERA 130 Environmental Resources Science and Humans (4)	
CHM 101	Introductory Chemistry ¹	4
	or CHM 113 General Chemistry (4) and CHM 115 General Chemistry with Qualitative Analysis (5)	

ECN 111	Macroeconomic Principles ¹ ...	3
ERA 350	Applied Quantitative Methods ¹	3
MAT 117	College Algebra ¹	3
	or MAT 210 Brief Calculus (3)	
	Computer course ²	3
Total		23-29

¹ These courses satisfy part of the general studies requirements.
² A list of acceptable courses is available in School of Agribusiness and Environmental Resources Office.

AGRIBUSINESS

The Agribusiness major offers several concentrations and options. It combines business and technical agriculture as they relate to the management, marketing, and financial objectives of agribusiness firms. Topics of interest include the supplying of input resources and services to agricultural producers, the management of crop and livestock enterprises, the processing of raw agricultural products and the management and quality assurance of food manufacturing. Food distribution is examined from the points of view of food wholesalers and retailers as well as food service firms, which include restaurants and specialized food firms. The study of agribusiness also includes analysis of the critical roles of government in regulating certain aspects of agribusiness and promoting international trade in agribusiness products.

Agribusiness. The agribusiness concentration contains the general agribusiness, international agribusiness, and food industry options.

General agribusiness integrates the knowledge and skills needed to manage people, products, and services in agribusiness enterprises. Agribusiness management combines the agricultural sciences, behavioral science, and common sense. Functional, institutional, and behavioral aspects of marketing are examined while studying the flows of products and services through the various market channels for agricultural inputs, commodities, and food. Emphasis is placed on up-to-date management/marketing methods that allow graduates to meet challenges in the food and fiber industries. Graduates are qualified to make significant contributions in a broad range of career opportunities that

exist in agribusiness. Many start career paths that lead to upper-level agribusiness management/marketing positions.

International agribusiness relates worldwide agricultural resources to the requirements and potentials of the various nations. Particular emphasis is given to economic development and to the international trade of food and fiber products. Special courses are offered to form a unique curriculum that is designed to train either the U.S. or foreign student to work in the enhancement of agricultural programs of foreign countries. Provided is a basic knowledge of U.S. agricultural techniques that is extended to the global aspects of agriculture. Graduates in this area are particularly qualified to aid in the development of the world's agricultural potential to provide food to meet the expanding populations. Jobs exist in commercial industries and in government agencies—national, international, and foreign. A language capability in addition to English is recommended.

Food industry focuses on the scientific and technical competence required for employment in this field. Strong emphasis is given to basics such as food chemistry, food processing, and food safety. This unique program offers employment opportunities for graduates in food industries, regulatory agencies, and consumer organizations.

Students selecting the agribusiness concentration are required to take the following courses:

	<i>Semester Hours</i>
ACC 230 Introductory Accounting I 3 or AGB 390 Agribusiness Accounting (3)	3
AGB 312 Agribusiness Marketing	3
AGB 332 Agribusiness Finance	3
AGB 342 Agribusiness Management I ..	4
AGB 364 Agribusiness Technology	3
AGB 412 Agricultural Commodities	3
AGB 443 Agribusiness Management II	3
AGB 444 Agribusiness Analysis	3
AGB 455 Agricultural Marketing Channels	3
AGB 458 International Agribusiness	3
AGB 474 Agribusiness Policy and Government Regulations	3
AGB 490 Recent Advances in Agribusiness	1
ECN 112 Microeconomic Principles	3
Total	38

Typical Curriculum for the Agribusiness Concentration

First Year

	<i>Semester Hours</i>
AGB 150 Animal Science	3
CHM 101 Introductory Chemistry	4
ENG 101, 102 First-Year Composition	6
ERA 130 Environmental Resources Science and Humans	4
MAT 117 College Algebra	3
General elective courses	5
SB courses*	6
Total	31

Second Year

ACC 230 Introductory Accounting I 3 or AGB 390 Agribusiness Accounting (3)	3
AGB 302 Introduction to Agribusiness	3
ECN 111 Macroeconomic Principles	3
ECN 112 Microeconomic Principles	3
Agribusiness electives courses	9
General elective courses	6
HU courses*	6
Total	33

Third Year

AGB 300 Livestock Management	3
AGB 310 Crop Management	3
AGB 312 Agribusiness Marketing	3
AGB 332 Agribusiness Finance	3
AGB 342 Agribusiness Management I ..	4
AGB 364 Agribusiness Technology	3
ERA 346 Natural Resource Conservation	3
ERA 350 Applied Quantitative Methods	3
Option courses	6
Total	31

Fourth Year

AGB 412 Agricultural Commodities	3
AGB 443 Agribusiness Management II	3
AGB 444 Agribusiness Analysis	3
AGB 455 Agricultural Marketing Channels	3
AGB 458 International Agribusiness	3
AGB 474 Agribusiness Policy and Government Regulations	3
AGB 490 Recent Advances in Agribusiness	1
General elective courses	3
Option courses	9
Total	31

* See pages 53–71 for the requirements and the approved list.

Computer Analysis. This concentration gives students the necessary background to move into a wide variety of

career opportunities involving the use of computers in the agribusiness industries. A basic core of agricultural science courses is combined with a proficiency core of agribusiness marketing, management, finance, and critical computer science courses. A graduate of this program is prepared to handle the problems agribusiness firms and organizations face in applying the latest computer technology to operations.

Students choosing the computer analysis concentration are required to take the following proficiency core courses:

	<i>Semester Hours</i>
AGB 312 Agribusiness Marketing	3
AGB 332 Agribusiness Finance	3
AGB 342 Agribusiness Management I ..	4
BIO 181, 182 General Biology	8
CSE 100 Introduction to Computer Science I	3
CSE 101 Introduction to Computer Science II	3
CSE 120 Digital Design Fundamentals	3
CSE 201 Application Languages Pro- gramming Laboratory	1
CSE 310 Data Structures	3
CSE 340 Structure of Programming Languages	3
ERA 350 Applied Quantitative Methods	3
MAT 243 Discrete Mathematical Structures	3
MAT 271 Calculus with Analytic Geometry II	4
or MAT 290 Calculus I (5)	4
MAT 272 Calculus with Analytic Geometry III	4
or MAT 291 Calculus II (5)	4
MAT 342 Linear Algebra	3
Total	51–53

Typical Curriculum for the Computer Analysis Concentration

First Year

	<i>Semester Hours</i>
CSE 100 Introduction to Computer Science I	3
CSE 101 Introduction to Computer Science II	3
ENG 101, 102 First-Year Composition	6
MAT 243 Discrete Mathematical Structures	3
MAT 270 Calculus with Analytic Geometry I	4
MAT 271 Calculus with Analytic Geometry II	4
HU courses*	6
SB courses*	3
Total	32

Second Year

AGB 302	Introduction to Agribusiness	3
BIO 181, 182	General Biology	8
CSE 120	Digital Design Fundamentals	3
CSE 201	Application Languages Programming Laboratory	1
CSE 310	Data Structures	3
MAT 272	Calculus with Analytic Geometry III	4
	General elective courses	9
Total	.....	31

Third Year

AGB 300	Livestock Management	3
AGB 310	Crop Management	3
AGB 312	Agribusiness Marketing	3
AGB 332	Agribusiness Finance	3
AGB 342	Agribusiness Management I ..	4
CSE 340	Structure of Programming Languages	3
ERA 350	Applied Quantitative Methods	3
MAT 342	Linear Algebra	3
SB courses*	.....	6
Total	.....	31

Fourth Year

ERA 346	Natural Resource Conservation	3
	General elective courses	13
	Supporting courses	16
Total	.....	32

* See pages 53–71 for the requirements and the approved list.

Pre-veterinary Medicine. This concentration is primarily designed to meet the entrance requirements of professional veterinary medical schools in the United States and Canada. Selection of this area permits students to complete the pre-veterinary requirements for entrance to professional veterinary school. The curriculum permits the student to obtain some course work in agribusiness, especially as it relates to professional practice and industry. This background also provides an important alternative for the student who does not actually enter veterinary school. Completion of all requirements for a B.S. degree in Agribusiness at ASU is provided by completing additional credits, if desired. A pre-veterinary medicine student who has been accepted to a school of veterinary medicine and who also elects to earn a Bachelor of Science degree in the School of Agribusiness and Environmental Resources may do so by completing a minimum of 30 semester hours at ASU and by completing the

Agribusiness and Environmental Resources in Agriculture and general studies requirements. The student may then receive a written statement from the dean of the College of Engineering and Applied Sciences giving senior-in-absentia privileges. The student is eligible to receive the B.S. degree after the Office of the Registrar receives a recommendation from the dean of the professional school and a transcript of credit indicating the student has completed a total of 126 semester hours with a cumulative GPA of 2.00 or better.

Although this concentration is primarily intended for the student preparing to enter professional veterinary medicine as a career, it is also an excellent basis for future graduate degree programs or many of the scientifically related jobs in agribusiness and government.

Students selecting the pre-veterinary medicine concentration are required to take the following proficiency core courses:

		<i>Semester Hours</i>
BIO 181, 182	General Biology	8
CHM 113	General Chemistry	4
CHM 115	General Chemistry with Qualitative Analysis	5
CHM 231	Elementary Organic Chemistry	4
	or CHM 331 General Organic Chemistry, 335 General Organic Chemistry Laboratory, 332 General Organic Chemistry, and 336 General Organic Chemistry Laboratory (8)	
ERA 350	Applied Quantitative Methods	3
MAT 117	College Algebra	3
	or MAT 210 Brief Calculus (3)	
MIC 206	Microbiology Laboratory	1
MIC 220	Biology of Microorganisms	3
Total	.....	31–35

Typical Curriculum for the Pre-Veterinary Medicine Concentration

First Year

		<i>Semester Hours</i>
CHM 113	General Chemistry	4
CHM 115	General Chemistry with Qualitative Analysis	5
ENG 101, 102	First-Year Composition	6
MAT 117	College Algebra	3
	or MAT 210 Brief Calculus (3)	
HU courses ¹	.....	6
SB courses ¹	.....	6
Total	.....	30

Second Year

AGB 300	Livestock Management	3
AGB 353	Wildlife and Domestic Animal Nutrition	3
BIO 181, 182	General Biology	8
CHM 231	Elementary Organic Chemistry	4
	or CHM 331 General Organic Chemistry, 335 General Organic Chemistry Laboratory, 332 General Organic Chemistry, and 336 General Organic Chemistry Laboratory (8)	
	General elective courses	9
	HU courses ¹	3
Total	.....	30–34

Third Year

AGB 439	Veterinary Practices	3
BIO 340	General Genetics	4
CHM 361	Principles of Biochemistry	3
CHM 367	Elementary Biochemistry Laboratory	1
ERA 346	Natural Resource Conservation	3
ERA 350	Applied Quantitative Methods	3
MIC 206	Microbiology Laboratory	1
MIC 220	Biology of Microorganisms	3
PHY 111	General Physics	3
PHY 113	General Physics Laboratory ..	1
PHY 112	General Physics	3
PHY 114	General Physics Laboratory ..	1
	General elective courses	4
Total	.....	33

Fourth Year²

	General elective courses	6
	Supporting courses	15
	Upper-division courses	12
Total	.....	33

¹ See pages 53–71 for the requirements and the approved list.

² Assuming the student has applied and has been accepted to a veterinary college during the beginning of the third year, the courses from the first year of the veterinary program are substituted for the classes of the fourth year for the B.S. degree.

ENVIRONMENTAL RESOURCES IN AGRICULTURE

The primary emphasis of the Environmental Resources in Agriculture major is natural resource management and conservation. Particular attention is given to the study of ecosystem characteristics as they relate to man's use of renewable resources. Applications of ecological principles to resource management are considered using examples

drawn from Arizona's forest, range, and agricultural ecosystems. Employment opportunities in environmental resource management, range ecology, land reclamation, soil conservation, and agribusiness exist with both private firms and government resource management agencies.

Natural Resource Management. This concentration includes the range ecology and wildlife habitat management options.

Range ecology emphasizes the study of renewable rangeland resources based on a strong background of agricultural and biological sciences. The specific areas of plant, animal, and soil sciences with strong supporting courses in ecology constitute primary training in this option. Students may choose careers as professional range or soil conservationists for federal and state agencies or in private industry. Range and soil conservationists both perform work concerned with inventorying, analyzing, improving, protecting, and managing the natural resources of rangelands and related wildlands.

Wildlife habitat management emphasizes the interaction of renewable resources with the wildlife populations that inhabit them. Primary training is in the areas of ecology, plant, and soil science, with strong supporting courses in wildlife. Students completing this option may choose careers as professional wildlife habitat managers for federal and state agencies or in the private sector.

Students selecting the natural resource management concentration are required to take the following courses:

	<i>Semester Hours</i>
BIO 320	Fundamentals of Ecology 3
BOT 370	The Flora of Arizona 4
ENG 301	Writing for the Professions 3
ERA 325	Soils 3
ERA 326	Soils Laboratory 1
ERA 333	Water Resources Management 3
ERA 360	Range Ecosystem Management 4
ERA 402	Range Habitat Inventory 4
ERA 407	Range Plants and Habitats 4
ERA 420	Range Habitat Improvements 3
ERA 475	Wildlife and Range Animal Management 3
ERA 490	Recent Advances in Environmental Resources 1
Total	..... 36

**Typical Curriculum for
Environmental Resources in
Agriculture**

First Year

	<i>Semester Hours</i>
BIO 181, 182	General Biology 8
CHM 101	Introductory Chemistry 4
ENG 101, 102	First-Year Composition 6
MAT 210	Brief Calculus 3
Computer course ¹	..... 3
General elective courses	..... 7
Total	..... 31

Second Year

BOT 370	The Flora of Arizona 4
ERA 325	Soils 3
ERA 326	Soils Laboratory 1
HU courses ²	..... 8
Option requirements ³	..... 7
SB courses ²	..... 8
Total	..... 31

Third Year

AGB 300	Livestock Management 3
AGB 302	Introduction to Agribusiness 3
AGB 310	Crop Management 3
ERA 346	Natural Resource Conservation 3
ERA 350	Applied Quantitative Methods 3
ERA 360	Range Ecosystem Management 4
Option requirements ³	..... 14
Total	..... 33

Fourth Year

ERA 490	Recent Advances in Environmental Resources 1
General elective courses	..... 4
Option requirements ³	..... 26
Total	..... 31

¹ A list of acceptable courses is available in School of Agribusiness and Environmental Resources Office.

² See pages 53-71 for the requirements and the approved list.

³ Option requirements as listed for individual programs.

AGRIBUSINESS

AGB 101 Food Chain. (2) F
Dependence of the quality, quantity, and cost of national food supplies on technology, marketing, and world agricultural policies. *General studies: G.*

150 Animal Science. (3) F
Comparative growth, development, and propagation of farm animals. Lecture, lab.

160 Veterinary Medicine Today. (3) F
Introduction to the role of the veterinarian as related to the fields of food supply and veterinary medicine.

300 Livestock Management. (3) F
Methods of managing livestock enterprises, economics, loss prevention, and marketing. Prerequisites: BIO 181, 182.

302 Introduction to Agribusiness. (3) F
Impact of national policy and world agriculture on the cost, quantity, and quality of the U.S. food resources.

305 Cultural Diversity in Agribusiness. (3) F, S
A critical look at how different cultural traditions as practiced in the Southwest have impacted and continue to shape regional agricultural economies. Prerequisites: ENG 101, 102.

310 Crop Management. (3) S
Crop production, management principles, and their application to crop growth and development. Prerequisites: BIO 181, 182.

312 Agribusiness Marketing. (3) F
Marketing arrangements for agricultural products. Prerequisite: AGB 342.

332 Agribusiness Finance. (3) S
Agribusiness investment management and financial institutions that serve agriculture. Prerequisites: AGB 342; ECN 111.

335 Establishing an Agribusiness. (3) F
Establishing entrepreneurship in agriculture, including legal status, financing, planning, marketing, and management. Prerequisite: junior standing.

342 Agribusiness Management I. (4) S
Principles of management, including planning, organizing, integrating, measuring, and developing people in agribusiness organizations. Lecture, computer lab.

353 Wildlife and Domestic Animal Nutrition. (3) S
Feedstuffs, feeding standards, and their application in meeting nutritional needs of animals producing food and fiber.

364 Agribusiness Technology. (3) S
Biotechnology and other technologies of the three sectors of agribusiness, including input, production, and commodity/food processing and distribution. Prerequisites: BIO 181 and 182 or instructor approval.

368 Food Processing. (3) F
An introduction to processed food quality assurance, statistical sampling, and inspection procedures. Prerequisites: AGB 364; ERA 350.

369 Food Analysis. (3) F
Processing control and scientific instrumentation used in food quality assurance laboratories. Lecture, lab. Prerequisites: CHM 225, 226.

370 Companion Animals to Man. (3) N
Selection, breeding, health, and care of pets. Includes their social and economic impact on urban living.

390 Agribusiness Accounting. (3) N
Introduction to managerial accounting for agribusiness using computerized accounting systems for the development of financial data required for management decision making. Prerequisite: computer literacy.

- 402 Agricultural Cooperatives.** (3) N Organization, operation, and management of agricultural cooperatives.
- 404 Sales and Merchandising in Agribusiness.** (3) N The principles and techniques of selling and commodity merchandising in the agricultural industries. Lecture, lab.
- 412 Agricultural Commodities.** (3) F Trading on futures markets. Emphasis on the hedging practices with grains and meats. Prerequisite: AGB 312 or 1 marketing or finance course.
- 413 Financial Commodities.** (3) S Trading on futures markets. Emphasis on the hedging practices with financial and currency instruments. Prerequisite: AGB 332 or FIN 300.
- 414 Advanced Commodity Trading.** (3) N Advanced analysis of trading techniques, with emphasis on hedging in the futures markets. Prerequisite: AGB 412 or 413.
- 423 Food and Industrial Microbiology.** (4) F Food and industrial related microorganisms; deterioration and preservation of industrial commodities. Lecture, lab. Prerequisite: MIC 205 or 206 or instructor approval.
- 424 Food and Industrial Fermentations.** (4) S Management, manipulation, and metabolic activities of industrial microbial cultures and their processes. Lecture, lab. Prerequisite: AGB 423 or instructor approval.
- 425 Food Safety.** (3) S Control, prevention, and prediction of microbial and chemical food borne diseases. Prerequisite: AGB 423 or instructor approval.
- 426 Food Chemistry.** (4) S The biochemical and chemical interactions that occur in raw and processed foods. Lecture, lab. Prerequisites: CHM 115, 231.
- 428 Comparative Nutrition.** (3) N Effects of nutrition on animal systems and metabolic functions. Prerequisite: CHM 231.
- 433 Diseases of Domestic Animals.** (3) N Control and prevention of infectious and non-infectious diseases of domestic animals. Prerequisite: MIC 206 or 220.
- 435 Animal Physiology I.** (4) F Control and function of the nervous, muscular, cardiovascular, respiratory, and renal systems of domestic animals. Lecture, lab. Cross-listed as BME 435. Prerequisites: BIO 181; CHM 113.
- 439 Veterinary Practices.** (3) F, S Observation of and participation in veterinary medicine and surgery supervised by local veterinarians. Prerequisite: advanced pre-veterinary student.
- 440 Food Marketing.** (3) S Food processing, packaging, distribution, market research, new food research and development, and social implications. Prerequisite: AGB 312.
- 443 Agribusiness Management II.** (3) F Principles of human resource management, with emphasis on the special problems of agribusiness systems. Prerequisite: AGB 342.
- 444 Agribusiness Analysis.** (3) S Analysis of agribusiness firm decisions in the ecological, economic, social, and political environments. Special emphasis on ethical issues surrounding food production and consumption. Prerequisites: AGB 312 and 332 or equivalents. *General studies: L2.*
- 450 International Agricultural Development.** (3) F Transition of developing countries from subsistence to modern agriculture. Technology transfer and food improvement programs are emphasized. Prerequisite: AGB 312.
- 452 World Food Dynamics.** (3) N Transition and development of raw agricultural commodities into nutritional food products. Emphasis given to food expansion in developing countries. Prerequisite: AGB 302.
- 453 World Agricultural Resources.** (3) S World production and consumption of agricultural products, international relationships, and agencies concerned with world agricultural development problems. Prerequisite: AGB 302. *General studies: G.*
- 454 International Agricultural Trade.** (3) N Dimensions, locations, mix, methods, and changes of international trade in agricultural products. Prerequisite: AGB 312.
- 455 Agricultural Marketing Channels.** (3) S Operational stages of agricultural commodities in normal distribution systems and implementation of marketing strategies. Prerequisite: AGB 312.
- 458 International Agribusiness.** (3) N Identification and analysis of methods, problems, and future of international agribusiness operations. Emphasizes special problems associated with international agribusiness systems. Prerequisite: AGB 312.
- 460 Agribusiness Management Systems.** (4) S The development and use of decision support systems for agribusiness management and marketing. Lecture, lab. Prerequisites: AGB 332, 342; ERA 350.
- 474 Agribusiness Policy and Government Regulations.** (3) F The development and implementation of government food, drug, pesticide, and farm policies and regulations that affect the management of agribusiness. Prerequisites: AGB 312, 342, 412.
- 490 Recent Advances in Agribusiness.** (1) F, S Reports and discussions of current topics and problems associated with agribusiness. May be repeated for credit.
- 505 Commodity Analysis.** (3) N Analysis of commodity markets. Prerequisite: 1 year of economics or marketing.
- 508 Advanced Agribusiness Marketing.** (3) F Theory and analysis of marketing farm commodities, risks, and the effect of future trading on cash prices.
- 509 Advanced Agribusiness Marketing Channels.** (3) S Analysis of agribusiness market channel systems. Formulation of marketing strategies.
- 510 Advanced Agribusiness Management I.** (4) F Managing and financing agribusiness emphasizing environmental and economic sustainability in a global economy undergoing radical change. Prerequisite: AGB 342.
- 511 Advanced Agribusiness Management II.** (3) S Analysis of organization behavior, change, and resource requirements within agribusiness systems. Prerequisite: AGB 342.
- 512 Food Industry Management.** (3) S Operations and management of food-processing factories, food distribution centers, and retail food-handling firms.
- 516 International Agricultural Techniques.** (3) N Coordination of production and marketing techniques to consumption objectives with agricultural products in foreign countries.
- 518 World Agricultural Development.** (3) N Factors that influence production, processing, and marketing of agricultural products in developing countries.
- 520 Advanced Agribusiness Analysis I.** (4) S Vertical integration and differentiation in food and agricultural industries. Lecture, recitation. Prerequisites: AGB 508 and 510 and 532 or equivalents.
- 521 Agribusiness Coordination.** (4) N Organizational alternatives for agribusiness, with emphasis on cooperatives and trading companies. Lecture, recitation. Prerequisites: AGB 508 and 510 and 532 or equivalents.
- 525 Advanced Agribusiness Management Systems.** (3) N Development and use of decision support systems for agribusiness management decision making. Prerequisites: AGB 510, 532.
- 527 Agribusiness Research Methods.** (3) N The use of model building, hypothesis testing, and empirical analysis in solving agribusiness problems.
- 530 Advanced Agribusiness Policy.** (3) N Policy-making history, structure, and process. Prerequisite: AGB 508.
- 532 Advanced Agribusiness Finance.** (3) F Financial management of agribusiness firms; agribusiness financial analysis, investment analysis, agricultural risk management, and introduction to agricultural financial intermediaries. Prerequisites: computer literacy and 1 finance course or instructor approval.
- 535 Advanced Food Science.** (3) N Chemical and physical nature of processed foods. Emphasis on food product development. Prerequisite: AGB 364.
- Omnibus Courses:** See page 44 for omnibus courses that may be offered.

ENVIRONMENTAL RESOURCES IN AGRICULTURE

- ERA 130 Environmental Resources Science and Humans.** (4) F, S Physical and biological laws underlying the production of natural resources, including air, water, soil, plants, and animals as influenced by humans. Lecture, lab.
- 325 Soils.** (3) F Fundamental properties of soils and their relation to plant growth and the nutrition of man and animals. Relation of soils to environmental quality. Prerequisite: CHM 101 or 113 or equivalent.
- 326 Soils Laboratory.** (1) F Selected exercises to broaden the background and understanding of basic soil principles. Lab. Corequisite: ERA 325.
- 332 Agricultural Chemicals.** (3) N Composition, properties, and use of agricultural commercial fertilizers and pesticides and their effects on soil, air, and water quality.

333 Water Resources Management. (3) S Sources, their development, and conservation in arid regions for agricultural, natural resources, and urban uses. Prerequisite: CHM 101 or 113.

346 Natural Resource Conservation. (3) S A global perspective on the conservation of wildland and agricultural resources. Development/resource conservation interrelationships. *General studies: G.*

350 Applied Quantitative Methods. (3) F Statistical methods with applications in natural resource management and the agricultural sciences. Use of digital computer. Prerequisite: MAT 117 or equivalent. *General studies: N2.*

360 Range Ecosystem Management. (4) F Interrelationships between vegetation, soils, and grazing animals. Evaluation of grazing animal impact (livestock and wildlife). Multiple use of rangeland resources. Lecture, recitation. Prerequisites: BIO 320 and ERA 346 or equivalents.

365 Watershed Management. (3) N Hydrologic, physical, biological, and ecological principles applied to watershed management. Impact of ecosystem manipulations on water yield and quality. 1 weekend field trip. Prerequisites: ERA 325, 346.

370 Forest Ecosystem Management. (3) N Silvicultural principles underlying the practice of forestry. Forest site evaluations, manipulation of stands to direct succession, forest measurements, and multiple use of forests. Lecture, lab. Prerequisites: BIO 320; ERA 346, 350.

402 Range Habitat Inventory. (4) S Vegetation sampling and inventory as related to animal-habitat relations. Lecture, lab, 1 weekend field trip. Prerequisites: ERA 350, 360.

407 Range Plants and Habitats. (4) F The distribution, ecological characteristics, identification of key plants, and values of habitats on western rangelands. Laboratory emphasis on grass identification. Lecture, lab. Prerequisite: BOT 370 or equivalent.

410 Wildlife Habitat Relations. (3) N Interactions among animal populations and their habitat. Systems simulation of population dynamics as influenced by competition and management strategies. Lecture, 1 weekend field trip. Prerequisite: ERA 360.

420 Range Habitat Improvements. (3) S Current practices in brush and weed control, revegetation, burning, water developments, fencing, and grazing as tools for range improvement. Lecture, 1 weekend field trip. Prerequisite: ERA 360.

425 Soil Classification and Management. (3) N Principles of soil genesis, morphology, and classification. Management and conservation practices will be presented. Prerequisite: ERA 325.

433 Riparian Ecosystem Management. (3) N Examination of the functions and components that make up riparian ecosystems and the management of these ecosystems. Lecture, field trip. Prerequisite: ERA 325 or instructor approval.

446 Soil Fertility. (3) S Ability of soils to retain and supply plant nutrients. Reactions of fertilizers in soils. Prerequisites: ERA 325, 326.

448 Soil Ecology. (3) N Soils viewed in an ecosystem context, soil-plant relationships, nutrient budgets, and abiotic factors that influence soil processes. Prerequisites: BIO 320 and ERA 325 and 326 or instructor approval.

452 Soil, Water, and Irrigation. (3) N Water measurement, conveyance, and conservation, with emphasis on crop production and soil-plant water relations. Prerequisite: ERA 325.

460 Applied Systems Ecology. (3) N The systems approach applied to analysis and management of natural resource ecosystems. Use of simulation models. Prerequisites: ERA 350 or equivalent; 1 course in ecology.

470 Land Reclamation. (3) N Problems of reestablishing vegetation on disturbed sites. Special revegetation techniques, surface modifications, and government regulations. 1 weekend field trip. Prerequisites: ERA 407 and 420 and 446 and 448 or instructor approval.

475 Wildlife and Range Animal Management. (3) N Principles and techniques for management of domestic and nondomestic animals using rangeland ecosystems. Emphasis on practical applications of management. Weekend field trips. Prerequisite: instructor approval.

480 Natural Resource Planning. (3) S Planning for management and conservation of wildland ecosystems. Ecological, economic, and social constraints on long-term sustainable resource development. Computer tools for resource planning. Lecture, 1 weekend field trip. Prerequisites: ERA 402 or equivalent; senior standing.

490 Recent Advances in Environmental Resources. (1) N Current literature and significant developments involving environmental resources. May be repeated for credit.

540 Plant Responses to Environmental Stresses. (3) N Reaction of plants to environmental stresses; herbivores, fire, pesticides, mechanical treatments, aerial pollutants, and soil amendments. 1 weekend field trip. Prerequisites: BOT 360 and ERA 420 or instructor approval.

548 Plants, Soils, and Environmental Quality. (3) N Effects of air quality on plants and soils, and their role in removing contaminants from the atmosphere. Prerequisite: ERA 325.

550 Vegetation Dynamics. (3) N Succession concept and its use in site evaluation. Habitat type concept. Herbivore as an ecological process. Prerequisite: BOT 420 or instructor approval.

560 Systems Ecology. (3) N Quantitative description and mathematical modeling of ecosystem structure and function. Techniques for model construction and simulation. Lecture, lab. Prerequisites: ERA 350 or equivalent; computer programming; 6 hours in ecological studies.

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

Del E. Webb School of Construction

William W. Badger
Director
(COB 268) 602/965-3615

PROFESSORS

BADGER, MULLIGAN

ASSOCIATE PROFESSORS

BASHFORD, MAYO, WEBER

VISITING ASSOCIATE PROFESSOR

ATWOOD

VISITING ASSISTANT PROFESSORS

KASHIWAGI, ROBSON

FACULTY ASSOCIATES

AULERICH, SNEED

PROFESSORS EMERITI

BURTON, HASTINGS, MICHELS,
PETERMAN, WARD, WOODING

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 options to suit individual backgrounds, aptitudes, and objectives. These options are not absolute but generally match major divisions of the construction industry.

DEGREES

Bachelor of Science (B.S.) Degree.

The Del E. Webb School of Construction offers the Bachelor of Science degree with a major in Construction. Four options are available: general building, heavy construction, military construction, and specialty construction.

Each option 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, technical courses basic to engineering and construction, and a broad range of applied management subjects fundamental to the business of construction contracting. The military construction option complements the heavy construction option but permits the use of 18 semester hours of ROTC credits for appropriate technical electives and management-type courses.

Master of Science (M.S.) Degree. The Del E. Webb School of Construction also offers the Master of Science degree with a major in Construction. Additional details for this degree are found in the *Graduate Catalog*.

ADMISSION

See pages 31–35 and 48–49 for information regarding requirements for admission, transfer, retention, qualification, and reinstatement. 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.

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 (ACCE).

SPECIAL PROGRAMS

ASU 2+2 Program. The Del E. Webb School of Construction maintains a cooperative agreement with most 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.

ASU 3+2 Program. The Del E. Webb School of Construction also participates in the ASU 3+2 program with Grand Canyon University and Southwestern University. See page 230 for details.

Student Organizations. The school has a chapter of Sigma Lambda Chi (SLC), 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 (AGC) student chapter.

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.

DEGREE REQUIREMENTS

Students complete the following basic requirements before registering for advanced courses: (1) all first-semester, first-year courses and the university English requirement (see page 40) 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.

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

Students in all options are required to complete a construction core of science-based engineering, construction, and management courses. Since the semester hours vary for some alternative courses in the core, any difference in credits is made up in the selected fields of specialization to achieve a minimum of 132 semester hours.

		<i>Semester Hours</i>
English Proficiency (6 semester hours minimum)		
ENG 101, 102	First-Year Composition ¹	6
	or ENG 105 Advanced First-Year Composition (3)	
General Studies Requirements (36 semester hours minimum)		
<i>Literacy and Critical Inquiry</i> ² (6 semester hours minimum)		
COM 225	Public Speaking ¹	3
ETC 400	Technical Communications ¹	3

<i>Numeracy</i> (6 semester hours minimum)		
ECE 106	Introduction to Computer- Aided Engineering ¹	3
MAT 270	Calculus with Analytic Geometry I ¹	4
	or MAT 260 and 261	

*Humanities and Fine Arts and Social and Behavioral Sciences*²
(15 semester hours minimum)
At least one course must be of upper-division level, two courses must be from the same department, and two or more departments must be represented in the total selection.

HU course(s)	3–6	
CON 101	Construction and Culture: A Built Environment	3
	Social and behavioral sciences	0–3
ECN 111	Macroeconomic Principles ¹	3
ECN 112	Microeconomic Principles ¹	3
<i>Natural Sciences</i> (8 semester hours minimum)		
PHY 111	General Physics ¹	3
PHY 112	General Physics ¹	3
PHY 113	General Physics Laboratory ¹	1
PHY 114	General Physics Laboratory ¹	1

Total general studies 36

NOTE: Six semester hours in two of the three awareness areas² are required in the final list of courses offered in the student’s graduation program of study. If desired, these hours can be included in the HU/SB course selections.

¹ Required for graduation.

² See pages 53–71 for the requirements and the approved list.

**Construction Core Requirements
Common to All Options**

		<i>Semester Hours</i>
ACC 230	Uses of Accounting Information I	3
CEE 310	Testing of Materials for Construction	3
CEE 450	Soil Mechanics in Construction	3
CON 221	Applied Engineering Mechanics: Statics	3
CON 243	Heavy Construction Equip- ment, Methods, and Materials	3
CON 244	Construction Graphics	2
CON 251	Microcomputer Applications for Constructors	3
CON 252	Building Construction Methods, Materials, and Equipment	3
CON 273	Electrical Construction Fundamentals	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	3
CON 424	Structural Design	3
CON 463	Foundations and Concrete Structures	3
CON 495	Construction Planning and Scheduling	3
CON 496	Construction Contract Administration	3
ECE 105	Introduction to Languages of Engineering	3
STP 226	Elements of Statistics	3
Science elective		4
Total common to all options		66

Secondary Core for General Building, Heavy, and Specialty Construction Options

		<i>Semester Hours</i>
CEE 340	Hydraulics and Hydrology	3
CON 453	Construction Labor Management	3
LES 306	Business Law	3
Technical elective		3
Total secondary core required		12

Secondary Core for the Military Option

		<i>Semester Hours</i>
CON 344	Route Surveying	3
CON 486	Heavy Construction Estimating	3
Total secondary core required		6

Advisor-approved alternates/transfer credits for courses listed above may vary from the total required semester hours indicated. Such variances do not reduce the minimum of 132 semester hours required for the degree.

The course work for the first two years is the same for the general, heavy, and specialty options. The specific lower-division requirements are shown below:

		<i>Semester Hours</i>
First Semester		
CON 101	Construction and Culture: A Built Environment	3
ECN 111	Macroeconomic Principles	3
ENG 101	First-Year Composition	3
MAT 270	Calculus with Analytical Geometry	4
PHY 111	General Physics	3
PHY 113	General Physics Laboratory	1
Total		17

Second Semester

ECE 105	Introduction to Languages of Engineering	3
ECN 112	Microeconomic Principles	3
ENG 102	First-Year Composition	3
PHY 112	General Physics	3
PHY 114	General Physics Laboratory	1
HU elective		3
Total		16

Third Semester

CON 221	Applied Engineering Mechanics: Statics	3
CON 243	Heavy Construction Equipment, Methods, and Materials	3
ECE 106	Introduction to Computer-Aided Engineering	3
STP 226	Elements of Statistics	3
Basic science elective		4
Total		16

Fourth Semester

ACC 230	Uses of Accounting Information I	3
CON 244	Construction Graphics	2
CON 251	Microcomputer Applications for Constructors	3
CON 252	Building Construction Methods, Materials, and Equipment	3
CON 273	Electrical Construction Fundamentals	3
CON 323	Strength of Materials	3
Total		17

Option in General Building Construction

The general building option 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 residential, 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.

		<i>Semester Hours</i>
Requirements		
CON 472	Development Feasibility Reports	3
CON 483	Advanced Building Estimating	3
LES 411	Real Estate Law	3
REA 251	Real Estate Principles	3
Total		12

Option in Heavy Construction

The heavy construction option 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

		<i>Semester Hours</i>
CON 344	Route Surveying	3
CON 482	Cost Engineering	3
CON 486	Heavy Construction Estimating	3
LES 307	Business Law	3
Total		12

Option in Military Construction

The military construction option is open only to students in the four-year ROTC program leading to a commission in the U.S. Army. The option prepares students for careers in either the military or engineering/highway construction field.

Requirements

		<i>Semester Hours</i>	
Approved military science courses			18
Total		18	

Option in Specialty Construction

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

Requirements

		<i>Semester Hours</i>
CON 455	Construction Office Methods	3
CON 468	Conceptual and Electrical Estimating	3
CON 482	Cost Engineering	3
Approved technical elective		3
Total		12

CONSTRUCTION

CON 101 Construction and Culture: A Built Environment. (3) F, S

An analysis of 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, field trips. *General studies: HU, G.*

221 Applied Engineering Mechanics: Statics. (3) F, S, SS

Vectors, forces and moments, force systems, equilibrium, analysis of basic structures and structural components, friction, centroids, and moments of inertia. Cross-listed as ETC 211. Prerequisites: MAT 261 or equivalent; PHY 111, 113.

243 Heavy Construction Equipment, Methods, and Materials. (3) F, S

Emphasis on "Horizontal" construction. Fleet operations, maintenance programs, methods, and procedures to construct tunnels, roads, dams, and the excavation of buildings. Lab, field trips.

244 Construction Graphics. (2) F, S
Sketching and architectural drafting of building materials and systems. Computer graphic applications for construction. Lecture, lab, field trips. Prerequisite: ECE 106 or equivalent.

251 Microcomputer Applications for Constructors. (3) F, S

Application of the microcomputer as a problem-solving tool for the constructor. Characteristics of microcomputer hardware and operating systems. Use of spreadsheets, statistical packages, database management, and software. Prerequisite: ECE 106.

252 Building Construction Methods, Materials, and Equipment. (3) F, S

Emphasis on "Vertical" construction. Methods, materials, codes, and equipment used in building construction corresponding to the 16 division "Master Format." Lecture, lab.

273 Electrical Construction Fundamentals. (3) F, S

Circuits and machinery. Power transmission and distribution, with emphasis on secondary distribution systems. Measurements and instrumentation. Field trips. Prerequisites: MAT 270 or equivalent; PHY 112, 114.

323 Strength of Materials. (3) F, S

Analysis of strength and rigidity of structural members in resisting applied forces. Stress, strain, shear, moment, deflections, combined stresses, connections, and moment distribution. Both US and SI units of measurement. Prerequisite: CON 221.

341 Surveying. (3) F, S

Theory and field work in construction and land surveys. Lecture, lab. Prerequisite: MAT 118.

344 Route Surveying. (3) S

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.

345 Mechanical Systems. (3) F, S

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.

371 Construction Management and Safety. (3) F, S

Organization and management theory applied to the construction process. Leadership functions. Safety procedures and equipment. OSHA requirement for construction. Prerequisite: CON 252.

383 Construction Estimating. (3) F, S

Methods and techniques used in estimating construction costs. Standard approach to quantity surveys emphasized. Practice in takeoffs, costing, and final-bid preparation. Microcomputer usage for semester project. Lecture, project workshop. Prerequisites: CON 243, 244, 251, 252; Construction major or instructor approval.

389 Construction Cost Accounting and Control. (3) F, S

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; CON 251. *General studies: N3.*

424 Structural Design. (3) F, S

Economic use of steel, reinforced concrete, and wood in building and engineered structures. Design of beams, columns, and connections. Elastic and ultimate strength design. Student design projects. Field trips. Prerequisite: CON 323.

453 Construction Labor Management. (3) F, S

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. *General studies: H.*

455 Construction Office Methods. (3) S

Administrative systems and procedures for the construction company office, including methods improvement and work simplification, office layout, business forms and design, and office manuals. Prerequisite: CON 389.

463 Foundations and Concrete Structures. (3) F, S

Subsurface construction theory and practice for foundations of buildings and engineered facilities. Concrete form design for foundations and structural frames. Underpinning, piling, dry and wet excavating, dewatering, cofferdams, and caissons. Lecture, recitation, field trips. Prerequisites: CEE 450; CON 424.

468 Conceptual and Electrical Estimating. (3) F

System of estimating construction costs before design has been initiated. Cost estimating for large projects. Analysis and organization of electrical estimate. Prerequisite: CON 383.

472 Development Feasibility Reports. (3) S

Integration of economic location theory, development cost data, market research data, and financial analysis into a feasibility report. Computer orientation. Prerequisites: CON 389; ECN 112; REA 251 or equivalent. *General studies: L2.*

477 Residential Construction. (3) F

Study of design concerns, construction material, and contract administration problems related to residential construction. Owner and contractor relationship. Field trips. Prerequisite: CON 252 or instructor approval.

482 Cost Engineering. (3) F, S

Application of engineering principals to project costs. System analysis of estimating design-construction and operating functions to optimize the life-cycle cost. Prerequisites: CON 389, 483 (or 486).

483 Advanced Building Estimating. (3) F, S

Concepts of pricing and markup, development of historic costs, life cycle costing, change order and conceptual estimating, and emphasizing microcomputer methods. Prerequisite: CON 383.

486 Heavy Construction Estimating. (3) F

Methods analysis and cost estimation for construction of highways, bridges, tunnels, dams, and other engineering works. Field trips. Prerequisite: CON 383. Pre- or corequisite: CON 344.

495 Construction Planning and Scheduling. (3) F, S

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. Prerequisites: CON 383; STP 226. Pre- or corequisite: CON 389 or instructor approval. *General studies: N3.*

496 Construction Contract Administration. (3) F, S

Review construction contracts. Survey the administrative procedures of the general and subcontractors. Study documentation, claims, arbitration, litigation, bonding, insurance, and indemnification. Discuss ethical practice, licensing, and codes. Lecture, field trips. Prerequisites: CON 371 and senior standing; Pre- or corequisite: ETC 400.

531 Economics of the Construction Industries. (3) F

The economic environment of construction, with emphasis on unique aspects; critical review of economic literature dealing with the construction industries. Prerequisite: CON 496 or instructor approval.

533 Strategies of Estimating and Bidding. (3) F

Course will explore advanced concepts of the estimating process, such as modeling and statistical analysis, to improve bid accuracies. Prerequisite: CON 483 or 486, or instructor approval.

540 Construction Productivity. (3) F

Productivity concepts. Data collection. Analysis of productivity data and factors affecting productivity. Means for improving production and study of productivity improvement programs. Pre- or corequisite: CON 495.

545 Construction Project Management. (3) F, S, SS

Theory and practice of construction project management. Roles of designer, owner, general contractor, and construction manager. Lecture, field trips. Pre- or corequisite: CON 495.

548 Managing the Construction Enterprise for Survival. (3) F

Provides a thorough understanding of the business risks in the construction industry, and processes for avoiding them.

551 Facilities Management. (3) S

Analysis of the facilities management organization and implementation of human resources, business management, building design and construction, work management, and physical plant operations.

577 Construction Systems Engineering. (3) F

Systems theory as applied to the construction process. Alternates for structuring information flows and the control of projects. Prerequisite: IEE 476 or equivalent.

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